

The University of Hawai'i Sea Grant College Program



Science Serving Hawai'i's Coastal Communities

SEA GRANT COLLEGE PROGRAM OF THE UNIVERSITY OF HAWAI‘I AT MĀNOA

The Sea Grant College Program of the University of Hawai‘i at Mānoa (UH Sea Grant) has served our state since 1968. The program connects the research and human resources of the university with a national network of 33 other university-based Sea Grant programs to foster the development of **resilient, economically and socially vibrant, and inclusive communities** that function sustainably within the capacity of their coastal habitats and ecosystems.

UH Sea Grant is a unit of the prestigious School of Ocean and Earth Science and Technology with core funding support from both the university and the National Oceanic and Atmospheric Administration. The program supports research and education and links them comprehensively with public outreach to build the sustained well-being of our coastal ecosystems and economies.



UH Sea Grant Centers of Excellence

UH Sea Grant is organized into Centers of Excellence, a unique structure within the Sea Grant network. The three centers focus on **Smart Building and Community Design, Sustainable Coastal Tourism, and Marine Science Education**.

By partnering with diverse schools and colleges through joint faculty positions and other synergistic relationships, UH Sea Grant brings the full force of the university’s knowledge and human resources to serve Hawai‘i’s citizens and decision-makers to a far greater degree than our federal funding alone can support. The centers are interdisciplinary and are vehicles that build links throughout the university and engage the best and brightest minds to address

the critical issues facing our state and region. The centers also play a central role in defining the UH Sea Grant research agenda by identifying knowledge gaps that directly impact the coastal community’s well-being. Conversely, the centers are highly effective at linking research results to community needs, challenges, and opportunities.

Commitment to Educating Tomorrow’s Workforce

The UH Sea Grant graduate trainee program supports the research and extension training of graduate students who enter scientific, outreach, and policy careers at the local and federal levels. Graduate trainees are required to participate in outreach and teacher training, present their research findings to the public, author an article in UH Sea Grant’s quarterly magazine, and provide 40 hours per year of outreach to the community.

The following information is not a comprehensive listing of the positive changes we are making throughout the state, but instead seeks to provide a snapshot of UH Sea Grant’s contributions to the coastal communities we serve.



Rosie Alegado
Assistant Professor,
Department of Oceanography
and Center for Microbial
Oceanography: Research and
Education



Oceana Francis
Assistant Professor,
Department of Civil and
Environmental Engineering



Wendy Meguro
Assistant Professor,
School of Architecture



Craig Nelson
Assistant Professor,
Department of
Oceanography and Center
for Microbial Oceanography:
Research and Education



Michael Roberts
Associate Professor,
Department of Economics



Daniele Spirandelli
Assistant Professor,
Department of Urban
Regional Planning



Mehana Vaughan
Assistant Professor,
Department of Natural
Resources and Environmental
Management

Sustainability Initiative

The University of Hawai'i recognized the excellence of Sea Grant and its longstanding commitment to coastal sustainability by awarding it seven new general-funded faculty positions in a competition with 11 other departmental proposals. Over the next 30 years, this will represent ~\$50 million investment in Sea Grant's outreach and research program. We believe that this is likely an unprecedented commitment on the part of a university to Sea Grant and its NOAA partner. This initiative greatly increases our ability to address diverse challenges, needs, and opportunities in a multifaceted fashion.

These talented new faculty members will conduct research, education, and outreach while building on the existing partnerships already established to integrate science, economics, planning, and design into decisions on public policy and sustainability.





Increasing Availability of Fresh Food with Backyard Aquaponics Systems

UH Sea Grant extension faculty trained families, schools, and businesses across Maui to set up and maintain low-cost, small-scale, integrated backyard aquaponics systems. These efforts have increased ease and affordability of access to healthful foods within the community and continue to expand on the island.

Restoring Sand Dunes in South Maui

UH Sea Grant teamed with Maui County and local volunteers to facilitate large-scale sand dune restoration projects on South Maui beaches. Healthy sand dunes help protect shorelines from seasonal erosion and provide habitat for plants and animals.

Publishing Planning Recommendations for Sea-Level Rise

UH Sea Grant worked with Maui and Hawai'i Island planners to design county-level policy recommendations for regulating shoreline development in anticipation of the effects of sea-level rise. The recommendations were published in a report provided to both counties, and are intended to support adaptive planning for sea-level rise in coming years. They can also be used as a model for other areas in the state.

Establishing Erosion Rate-Based Setback Rules

With support from UH Sea Grant, the County of Maui was the first in the state of Hawai'i to adopt shoreline development setback rules based upon erosion rates. The rules provide a regulatory structure for managing the competing demands of development and natural resources, and for minimizing impacts from coastal hazards.

Conducting Coastal Management Outreach

UH Sea Grant extension faculty continue to provide technical and strategic support to Maui County's shoreline planners in support of permitting and policy tasks, including serving as the primary point of contact to various public stakeholders. Sea Grant also educates community members and government agency representatives on coastal management issues on Maui through presentations and site visits.

Promoting Sustainable Shoreline Development

UH Sea Grant and Maui County partnered to produce the Beach Management Plan for Maui, which offers specific recommendations and mechanisms for shoreline management to promote beach preservation and sustainable development. Such efforts will help ensure the health and accessibility of shoreline resources in the future.

Supporting a Renewable Energy Future

UH Sea Grant faculty assisted in Maui County efforts to reduce dependency on foreign oil and investigate clean energy alternatives by providing recommendations for related post-secondary curriculum development. Sea Grant also supported the evaluation and cultivation of crops for potential use in local biodiesel production.

Conducting an Energy Science Professional Development Course

UH Sea Grant collaborated with the County of Maui Economic Development Board to educate Maui teachers on the emerging field of energy science, which is highly relevant for Hawai'i's students. Within the broader statewide effort, 65 teachers attended professional development workshops on energy efficiency and alternative sources of energy.





Facilitating Coastal Disaster Preparedness

The Maui County Civil Defense Agency and UH Sea Grant facilitated a symposium for 120 public and private sector attendees from Maui regarding improving tsunami evacuation and sheltering plans. This helped inspire an initiative to develop post-disaster reconstruction protocols for Maui, funded by the NOAA Coastal Storms Program.

Supporting an Advanced Energy Distribution Pilot on Maui

UH Sea Grant faculty supported UH Mānoa engineering students on a project that will facilitate initial analysis for The Maui Smart Grid Project, which is evaluating home-based smart grid technologies. Maui results will be compared with those from other projects throughout the U.S. and used for decision-making on future local and national smart grid initiatives.

UH Sea Grant Maui Extension Faculty:

Dr. Robert Howerton, Aquaculture Extension Specialist

Howerton holds a PhD in aquaculture and fisheries science from Auburn University. His current projects relate to small scale, integrated agriculture-aquaculture production, feasibility of bivalve culture, small scale biodiesel production, and aquaculture/sustainability education.

Tara Miller Owens, Coastal Processes Extension Agent

Owens earned a master of science in coastal geology from the University of Hawai'i. Currently she works with county, state, and federal entities to integrate science with planning and permitting by providing technical guidance, consultations, site visits, and public outreach related to climate, shoreline change, and coastal hazards.

Establishing Shoreline Setback Rules for Kaua'i County

With assistance from UH Sea Grant, the County of Kaua'i adopted the first shoreline development ordinance in Hawai'i that utilizes coastal management principles and science-based standards, and is among the most progressive in the nation.

Assessing Sea-Level Rise Risk

UH Sea Grant is conducting a Kaua'i Climate Change and Coastal Hazards Assessment (KCHA) for Kaua'i County, using sea-level rise inundation maps generated by the UH Coastal Geology Group. The findings are intended to inform decision-makers in the updating of the County's General Plan.

Exploring Options for Renewable Energy

To help foster a secure energy future for Kaua'i, UH Sea Grant successfully worked with an ethanol fuel plant to alter its plans from burning coal to biomass for its energy source, and is looking to adopt the first large-scale renewable energy project: a biomass gasification facility that will generate ten percent of the island's electrical needs.

Supporting Sustainable Wetlands Farming

On Kaua'i, the Waipā Foundation manages one of the few remaining integrated watershed-ocean systems (ahupua'a). With assistance from UH Sea Grant, the foundation and others seeking to return to sustainable wetlands farming based on ahupua'a resource management principles have been able to proceed with reduced regulatory burden.



Monitoring Kaua‘i’s Water Resources

UH Sea Grant deployed five weather stations and four water sensors to monitor water and nutrient fluxes throughout targeted ahupua‘a on Kaua‘i. These data are being collected to support development of management strategies designed to mitigate human-induced impacts on Hawai‘i’s water resources.

Assisting with Coastal Hazards Mitigation

UH Sea Grant broadly supports efforts related to coastal hazards on Kaua‘i, including end-to-end management of beach and dune restoration projects, strategic advisory on seawall replacement, and leadership of Kaua‘i County’s Tsunamis Observation Team, which provides data to improve prediction of tsunami inundation areas.

Supporting Aquatic Science Education

UH Sea Grant supports aquatic science education for Kaua‘i’s students on multiple levels, including conducting presentations and field trips highlighting landforms and coastal processes for both high school and post-secondary groups. Through the ‘Teaching Science as Inquiry: Aquatic Science’ program, UH Sea Grant has provided teacher workshops to facilitate coastal science and conservation curricula in Kaua‘i schools.

UH Sea Grant Kaua‘i Extension Faculty:

Dr. Adam Asquith, Extension Specialist

Asquith earned a PhD in entomology from the University of Oregon. His current work is focused around sustainable agriculture, traditional Hawaiian aquaculture, reforestation, conservation, stream research, and water management.

Ruby Pap, Coastal Land Use Extension Agent

Pap has a master of science in resource policy and behavior from the University of Michigan. She serves as a liaison between university and private researchers, local and national government agencies, and the public, to ensure that the most current scientific information is available to decision-makers and the Kaua‘i community.



Establishing a New Aquaculture Industry in Hawai‘i

Hawai‘i imports more than 80 percent of its seafood, including about 400,000 oysters monthly. To help lessen local dependence on imports, UH Sea Grant supported development of a new commercial bivalve industry; and to date bivalves have been grown to market size in one-third the time it takes mainland sites to grow oysters.

Assisting the Washington Oyster Industry

The shellfish hatchery at University of Hawai‘i at Hilo (UH Hilo) Pacific Aquaculture and Coastal Resources Center, with support from UH Sea Grant, supplied over 2.5 billion oyster larvae and 3 million set oyster spat to help farmers in Washington State whose stock has dwindled due to ocean acidification. Oyster larvae cannot build their shells if the water is too acidic, and sub-ideal conditions discourage wild settlement which reduces the local supply of young oysters.

Encouraging Stewardship of Marine Resources

UH Sea Grant established the ReefTalk, ReefTeach, and ReefWatch programs on the island of Hawai‘i to promote conservation and stewardship of marine and coastal resources. These programs have been ongoing for 15 to 20 years, and engage the community in public lectures, volunteer training, and coral reef education and monitoring.

Developing New Programs in East Hawai‘i

In association with its ReefTeach program, UH Sea Grant developed similar outreach and education programs for groups in East Hawai‘i. New initiatives include biological monitoring projects with fishers in Ka‘u, and a series of science- and Hawaiian culture-

based lesson plans for use in elementary schools to assist children in understanding how terrestrial factors influence the coastal ecosystem.

Supporting the West Hawai‘i Fisheries Council

UH Sea Grant has worked continuously with the West Hawai‘i Fisheries Council (WHFC) to support community-based resource management. The WHFC has been successful in establishing a strong network of public sector organizations supporting nearshore West Hawai‘i ecosystems.

Generating Community Involvement in Hawai‘i County Policy

UH Sea Grant worked with Hawai‘i County to engage South Kohala communities on Hawai‘i Island in a county-wide Community Development Program (CDP) review process of the district’s General Plan. Community members collaborated to integrate future development guidelines based on smart growth principles, and the CDP plan was approved.

Ocean Day at the University of Hawai‘i at Hilo

UH Sea Grant is a major sponsor of Ocean Day: Mālama Kanaloa, a festival organized by UH Hilo. Thousands of attendees each year gain awareness of ocean and coastal issues including human impact on the ocean environment and managing coastal resources in a sustainable and culturally sensitive way.

Raising Awareness of Sustainable Living and Business Practices

UH Sea Grant collaborates with community organizations on Hawai‘i Island to provide opportunities for individuals, businesses, and community leaders to support marine conservation efforts and to raise awareness for sustainable living and business practices. Events like the Earth and Ocean Festival, which UH Sea

Grant helped to organize, helps engage the public on environmental issues through fun, educational, and cultural activities.

Supporting Strategic Hiring Initiatives for Coastal Communities

UH Sea Grant works with partner organizations statewide, including The Pacific Aquaculture and Coastal Resources Center at UH Hilo, to create extension positions focused on providing outreach and education programs that connect resources available at UH with the needs of local communities. Extension faculty build programs that center around issues important to the health and vitality of Hawai‘i’s coastal resources and people.

UH Sea Grant Hawai‘i Island Extension Faculty and Staff:

Pelika Bertelmann, Hawai‘i Island Extension Specialist

Bertelmann has a varied background in education, research, fishing, conservation, and business. She holds a bachelor’s degree in Hawaiian Studies, certificates in Marine Science, and Pacific Island Studies from UH Hilo and a master’s degree in Hawaiian Studies, with an emphasis on conservation and management, from the University of Hawai‘i at Mānoa.

Chantal Chung, Assistant to the Hawai‘i Island Extension Specialist

Chung served in an administrative capacity with UH Sea Grant for a number of years, and more recently took on the management of various UH Sea Grant extension activities on Hawai‘i Island.

Sierra Tobiason, South Kohala Action Plan Coordinator

Tobiason coordinates coastal and watershed management strategies promoting healthy mauka to makai ecosystems. She is a graduate of the University of Hawai‘i at Hilo where she earned a bachelor’s degree in agriculture and a master’s degree in tropical conservation biology and environmental sciences.





Restoring and Rebuilding Waikīkī Beach

UH Sea Grant partnered with the State of Hawai‘i Department of Land and Natural Resources and others to conduct a \$2.3 million beach replenishment project which added 27,000 cubic yards of sand to Waikīkī Beach. Given the project’s success, UH Sea Grant was asked to lead the development of a comprehensive beach management plan for Waikīkī to prioritize, guide, and coordinate beach management projects in the coming decades.

Waikīkī Aquarium Without Walls

UH Sea Grant is working to restore Waikīkī’s coral reefs by removing sand from the nearshore reef, and it is anticipated, once uncovered, the corals will repopulate the area. This would create the opportunity for visitors to swim in the Pacific Ocean “aquarium without walls” in Waikīkī, contributing to its longevity as a successful visitor destination.

Conducting Ocean Awareness Training

UH Sea Grant partnered with marine conservation organizations to offer a special Ocean Awareness Training in Waikīkī. The program was developed for those interested in learning more about Hawai‘i’s ocean environment, particularly those employed or volunteering in the fields of marine education or recreation, or looking to get involved. To date, the organizers and invited experts have shared their first-hand knowledge and experience with hundreds of eager participants.

Learning from the Voices of Yesterday

To better inform ecosystem management in the 21st century and increase capacity in Hawaiian language proficiency, UH Sea Grant collaborated with the Hawai‘inuiākea School of Hawaiian Knowledge and others to translate selected coastal resources-related articles published in Native Hawaiian language

newspapers between 1834 and 1948. In addition to training future Hawaiian language translators, these efforts have improved access to this important resource on historical Hawaiian coastal and fisheries management.

Incorporating Smart Growth Principles into New Developments

UH Sea Grant partnered with the University of Hawai‘i at Mānoa School of Architecture, the U.S. Environmental Protection Agency, and the City and County of Honolulu in an effort to find long-term solutions to the growing problems confronting Hawai‘i’s increasingly urbanized coastal communities. A team of nationally recognized smart growth experts focused on the development of 15,000 new housing units in Kapolei, a planned city in West O‘ahu. These efforts led to state-approved designs for a multi-billion dollar, live-work-play coastal community that possesses many elements that greatly reduce its environmental impact, compared with business as usual.

On July 10, 2013, the Honolulu City Council voted unanimously to approve the revised ‘Ewa Development Plan [Bill 65 (2012), CD1], which was then signed by the Mayor of the City and County of Honolulu on July 23, 2013. The adoption of this plan marked an important milestone for the future of ‘Ewa and its residents, and was a critical step in the work started by UH Sea Grant nearly a decade ago. UH Sea Grant’s leadership and facilitation encouraged various public and private entities to interact and explore the possibilities of building livable, vibrant communities through smart growth. Through these efforts, the City and County of Honolulu is advancing sustainable building practices and encouraging development that is beneficial to the economy, the community, and the environment.

Forest City Military Communities

UH Sea Grant’s Center for Smart Building and Community Design, the UH Mānoa School of Architecture, and the Hawai‘i Natural Energy Institute are collaborating to conduct energy audits on military housing managed by Forest City Military Communities Hawai‘i. The project seeks to identify and quantify the end-uses of energy consumed by the homes and to provide data to consultants for building simulation studies. The assessments and resulting improvements are expected to provide an aggregate savings of hundreds of thousands of dollars per year on energy costs in the



homes. The multidisciplinary approach to this project brings expanded research and educational opportunities to the students while reducing energy demand and increasing comfort for military families. In addition, private sector housing improvements will be realized as the results of the work are more broadly distributed.

Researching Seawater Air Conditioning

UH Sea Grant is working with partners at UH Mānoa and the largest hotel operator in Waikīkī to analyze the value of implementing a district-wide seawater air conditioning (SWAC) system, as well as to educate stakeholders on the implications of SWAC and to provide them an opportunity to participate in the decision-making process. Invented by a UH Sea Grant researcher in 1983, SWAC uses cold, deep ocean water to cool buildings. The high building density in Waikīkī makes it an ideal place to pilot a SWAC system in Hawai‘i.

Campus Spatial Survey and Integrated Planning

UH Sea Grant and the School of Architecture’s Environmental Research and Design Laboratory collaborated to inventory and virtually model facility space on the university’s flagship Mānoa campus. A campus-wide Building Information Model was developed for 51 buildings, and has proven valuable in assessing space usage and optimization on campus; it is also expected to help reduce energy use.

Creating Sustainable, Hazard Resilient Coastal Communities

UH Sea Grant hosted an issue-based training service conducted by the NOAA Coastal Service Center. The courses were geared toward enabling participants to understand, plan, and guide efforts to implement

alternative growth and development approaches in their communities. The courses also introduced the importance of building resilience to natural hazards. Participants included members of community, non-profit, and government entities.

Supporting Research in Sustainable Coastal Tourism

Hawai‘i’s tourism industry is uniquely impacted by the challenges associated with preserving coastal and marine resources. UH Sea Grant developed a Sustainable Coastal Tourism Fellowship program which provides fellows with research funding and exposure to the needs and issues of Hawai‘i’s tourism industry with the goal of producing scholarship that addresses these challenges.

Partner with Chancellor of UH Mānoa on Energy Savings

In December 2011, Professor Stephen Meder, director of the UH Sea Grant Center for Smart Building and Community Design, and former UH Mānoa Chancellor Virginia Hinshaw, were invited to participate in a White House Better Buildings Challenge for their leadership in setting and achieving energy goals for the campus and the state. In particular, they were recognized for the proposed renovations to Kuykendall Hall on the UH Mānoa campus, which after construction will be the first high-performance, net-zero energy (non-fossil fuel dependent) retrofitted building in the state.

Promoting Education and Stewardship at the Hanauma Bay Nature Preserve

UH Sea Grant administers and conducts the award-winning Hanauma Bay Education Program which reaches over 750,000 residents and visitors annually. Its



weekly lecture series is key to educating the community on Hawai‘i’s unique marine and coastal resources, and promoting strategies that encourage conservation and stewardship.

Engage Community and Local Students through Hands-On Marine Science Education

Hosted by the UH School of Ocean and Earth Science and Technology (SOEST), UH Sea Grant and a range of marine scientists, students, professionals, and organizations provide interactive marine science learning activities and exhibits during the SOEST Open House. The event draws over 6,000 Hawai‘i students and community members every other October.



Kailua Beach and Dune Management Plan Touted as First Site-Specific Climate Adaptation Plan in Hawai‘i

The Kailua Beach and Dune Management Plan is one of the first site-specific climate adaptation plans in Hawai‘i, and was developed jointly by UH Sea Grant and the State of Hawai‘i Department of Land and Natural Resources. Kailua, O‘ahu was selected for this innovative planning effort because of its large and intact beach and dune systems. The plan was developed to proactively identify land use and coastal management planning options for the long-term conservation of the Kailua coastal ecosystem, and provides recommended, science-based options for decision-makers to consider for long-term conservation of the beach and dune system. Since the policies, practices, and specific measures can be reproduced elsewhere, the intention is that this information will be integrated into regional beach management plans.

Evaluating University of Hawai‘i Mānoa (UHM) Campus Lighting

In early 2010, the Mānoa Energy and Performance

Assessment team of students led by UH Sea Grant extension faculty finished lighting audits of 800,000 square feet of building space on the UHM campus. Since then, UHM Facilities Management has moved forward with plans to retrofit the inefficient lighting in several buildings on the Mānoa campus.

Zero-Carbon Design Options for the Wai‘anae Coast Community Mental Health Center

The Wai‘anae Coast Community Mental Health Center provides mental health services to a largely Native Hawaiian population in West O‘ahu. UH Sea Grant assisted the center conduct an energy analysis and develop zero-carbon design options for proposed renovations to its facility.

University Energy Savings

UH Sea Grant’s Center for Smart Building and Community Design provides core support to UH Mānoa to advance energy efficiency, renewable energy, water conservation, and other sustainability efforts on campus. Rising energy costs have hit UH Mānoa’s 300-acre campus especially hard. As of 2011, UH Mānoa was paying more than \$30 million annually for electricity to light and cool these buildings. In 2006, at the Chancellor’s Energy Summit organized by UH Sea Grant, the campus adopted the ambitious goal of cutting energy use 30 percent within six years.

Climate Change Impacts to Hawai‘i Tourism

UH Sea Grant’s Center for Sustainable Coastal Tourism developed an analytical method to derive the impacts of global climate change on Hawai‘i’s tourism industry. This analysis facilitates the development of targeted strategies for adapting the various tourism sectors to environmental changes. An economic analysis of the



value of tourism resources potentially affected by climate change has also been conducted, and clearly shows the economic value of managing our natural resources sustainably. The results of this research were published in a report for the Hawai‘i Tourism Authority in 2012.

Energy Star Dorm Project

UH Sea Grant, together with the UH Student Housing Services, the Strategic Industries Division of the Department of Business, Economic Development and Tourism, and Strategic Energy Innovations, implemented the Energy Star Dorm Project in 2006. The project provided the UH Student Housing Office with energy efficiency products for one residential apartment at UH Mānoa. Energy consumption of four students living in the apartment was monitored and compared with figures from standard campus apartments. Project results demonstrated potential savings of approximately \$160,000 per year with increased use of energy efficient fixtures, and motivated UH Mānoa to join the Energy Star for Higher Education Partnership Program. The project also influenced the design of a new dormitory built on campus in 2008.

Hawai‘i Institute of Marine Biology Power Purchase Agreement

UH Sea Grant’s Center for Smart Building and Community Design led the creation of a renewable energy power purchase agreement (PPA) for the Hawai‘i Institute of Marine Biology, the first PPA for the University of Hawai‘i. Under the PPA, photovoltaic panels will provide a minimum of 25 percent of the institute’s energy needs, and reduce its carbon footprint significantly. The PPA will also ease the university’s budgeting uncertainties from fluctuating electricity rates by locking in a below-market electricity rate. Savings to UH Mānoa over the life of the contract are expected to be at least \$2.3 million.

Kapi‘olani Community College Culinary Institute

Kapi‘olani Community College envisioned developing a suite of new buildings incorporating sustainable design elements to house its Culinary Institute of the Pacific, the foremost local culinary institution in Hawai‘i. Recognizing a unique building opportunity with myriad benefits, Trenton Lum, a UH Sea Grant-supported architecture graduate student, focused his dissertation on proposing an overall design for the facility. He analyzed



the actual site and surveyed user concerns, presenting a multitude of sustainable strategies such as green roofs, on-site wastewater treatment, and photovoltaic and solar absorption cooling strategies. The \$32 million facility, when built, will establish a prestigious culinary program in Hawai‘i with a significant impact on Hawai‘i’s tourism industry and serve as a model of sustainability.

UH Sea Grant O‘ahu Extension Faculty, Staff, and Administration:

Andrew Bohlander, Shoreline Specialist

Bohlander has a master of arts in marine affairs from the University of Washington. He has a background in geographic information systems (GIS) and emergency management, with an emphasis on hazard and vulnerability analysis, and hazard-mitigation planning.

John Carey, Sustainability Coordinator

Carey has a master of arts in political science from Ohio State University, Columbus, and is a graduate of the Senior Executive Program at Harvard University, Kennedy School of Government. He has been involved in a broad range of activities directed at encouraging acceptance of sustainability principles in coastal communities, including serving as a member of the National Sea Grant Focus Team, which addresses sustainable coastal development. Carey is retired from the National Oceanic and Atmospheric Administration (NOAA), where he served as Comptroller, Deputy and Assistant Administrator for Ocean.

Dr. Mary Donohue, Program Specialist

Donohue has a PhD in organismal and population biology from the University of California, Santa Cruz. She conducts senior level extension activities and serves in various strategic roles within UH Sea Grant. She is a nationally recognized expert in the problem of marine debris. More recently she has focused on activities related to achieving sustainable communities in Hawai'i and beyond.

Heather Dudock, Assistant Communications Leader

Dudock earned degrees in physical anthropology/archaeology and visual arts/printmaking from Oregon State University. She manages various graphic design and multimedia projects including *Ka Pili Kai*, UH Sea Grant's quarterly magazine.

Dolan Eversole, NOAA Sea Grant Coastal Storms Program Coordinator, Pacific Region

Eversole has a master of science in geology from the University of Hawai'i at Mānoa. His master's work specialized in coastal geology, and his thesis was focused on historical shoreline mapping and sediment transport numerical modeling at Ka'anapali Beach, Maui, with Dr. Charles (Chip) Fletcher.

Matthew Gonser, Community Planning and Design Extension Agent

Gonser holds master's degrees in regional planning and landscape architecture from Cornell University. He supports projects related to sustainable coastal development and smart growth, with foci in ocean renewable energy and water resource management, specifically

public opinions of and attitudes toward seawater air conditioning (SWAC) in Waikiki.

Dr. E. Gordon Grau, Director, UH Sea Grant College Program

Grau has a PhD in biology from the University of Delaware, and completed postdoctoral studies at the University of California Berkeley. In addition to his position with UH Sea Grant, he is a professor and a faculty member of the Hawai'i Institute of Marine Biology where he maintains a laboratory. He is the author of over 150 papers in peer-refereed journals, and continues to mentor graduate and undergraduate students and postdoctoral associates.

Dennis Hwang, Coastal Hazard Mitigation Specialist

Hwang has a master of science in geology and geophysics from the University of Hawai'i at Mānoa, and JD from the University of Houston. He is a member of NOAA National Focus Team for Hazard Resilient Communities, and authored the Hawai'i Coastal Hazard Mitigation Guidebook. Hwang is also an attorney and his clients include government agencies and planning departments dealing with coastal, hazard, and land use issues.

Cindy Knapman, Communications Leader

Knapman earned a master of marine affairs from the University of Rhode Island. She writes and edits communications materials and other publications including the quarterly magazine, *Ka Pili Kai*. One of her favorite projects to date was the production of an interactive kiosk for the Smithsonian National Museum of Natural



History Sant Ocean Hall, which focuses on traditional Marshallese navigation.

Dr. Denise Konan, Director, Center for Sustainable Coastal Tourism

Konan has a PhD in economics from the University of Colorado at Boulder. She currently serves as the University of Hawai'i at Mānoa Dean of the College of Social Sciences. Konan has served as a consultant to the World Bank, and is known for her research on economic integration, foreign investment, trade in services, and intellectual property rights. Her current research agenda involves the economics of energy and climate change in Hawai'i.

Dr. Darren Lerner, Associate Director

Lerner has a PhD in organismic and evolutionary biology from the University of Massachusetts, Amherst. He manages all aspects of the UH Sea Grant program including extension, communication, and education, and serves as the research coordinator. Lerner also is an affiliate research faculty at the Hawai'i Institute of Marine Biology where he conducts a research program focused on environmental physiology of fishes.

Elizabeth Kumabe Maynard, Regional Environmental Education Specialist

Maynard has a master of education in curriculum and instruction from the University of Hawai'i at Mānoa. Her work is geared toward developing learning avenues of ocean literacy for O'ahu students and communities, and she leads the UH Sea Grant Hanauma Bay Education Program, which focuses on education and outreach for Hanauma Bay



Nature Preserve visitors and the community.

Dr. Stephen Meder, Director, Center for Smart Building and Community Design

Meder has a doctoral degree in architecture from the University of Hawai'i at Mānoa. His work focuses around exploring and mitigating the built environment's impacts on our marine and coastal resources. He is also the Interim Assistant Vice Chancellor for Physical, Environmental, and Long-Range Planning. His research on sustainable development, particularly solar design and high performance buildings has been widely recognized, and he has received numerous awards for his innovative designs and work.

Dr. Darren Okimoto, Extension Leader

Okimoto earned a PhD in biology from the University of Delaware. He is responsible for the programmatic management of UH Sea Grant extension faculty and staff and their activities, and also participates in state and regional collaborative projects that focus on Sea Grant focus areas associated with outreach and education.

Eileen Peppard, Sustainability Specialist

Peppard earned a master of science in fisheries and aquaculture from Louisiana State University. She is a sustainability specialist working on energy conservation issues for the University of Hawai'i's Mānoa campus and in the local community. She has managed a team of students conducting energy audits of lighting systems on campus, demonstration of LED lighting retrofits, and collecting data on campus buildings for input into a building information management system.



Dr. Bradley Romine, Coastal Management Specialist

Romine has a PhD in geology and geophysics from the University of Hawai'i at Mānoa. He is the manager of the Coastal Lands Program at the Hawai'i Department of Land and Natural Resources' Office of Conservation and Coastal Lands. He works with county, state, and federal entities to integrate science with planning and permitting by providing technical guidance, consultations, site visits, and public outreach related to climate, shoreline change, and coastal hazards.

Dr. Kanesa Seraphin, Director, Center for Marine Science Education

Seraphin has a PhD in zoology from the University of Hawai'i at Mānoa. She is currently conducting research in Accessible Professional Development for Teaching Aquatic Science Inquiry (TSAI Aquatic), and is a co-principal investigator on Hawai'i's collaborative project with the National Science Foundation-funded Center for Ocean Science Education Excellence (COSEE) California and an active member of the local and national marine science education community.

UH Sea Grant Hanauma Bay Nature Preserve Education Program Staff:

Shawn Carrier, Outreach Education Coordinator

Carrier has a master of science in natural resource and environmental management from the University of Hawai'i at Mānoa. He has conducted research on the decline of Steller sea lion populations in the North Pacific, and has worked with a variety of marine mammals, including whales, dolphins, sea otters, and seals.

Cassidy Lum, Volunteer Assistant Coordinator

Lum has a bachelor's degree in environmental studies from the University of Hawai'i at Mānoa. She assists with coordinating volunteer activities,

including training and enrichment events for the Hanauma Bay Volunteer Program.

Morgan Mamizuka, Volunteer Program Coordinator

Mamizuka has a bachelor's degree in agriculture from the University of Hawai'i at Hilo. She is responsible for recruiting, educating, and maintaining a large group of volunteer docents who support the Hanauma Bay Education Program's mission of enhancing appreciation and promoting understanding and stewardship of Hawai'i's marine environment through public education.

Gavin Iwai, Education Assistant/Service-Learning Coordinator

Iwai has a master's degree in zoology from the University of Hawai'i at Mānoa. He is responsible for the E Mālama Hanauma Service-Learning Program and also assists other Hanauma Bay educators with their programs.

Anne Rosa, Marine Education Specialist

Rosa has a bachelor's degree in environmental and evolutionary biology from Dartmouth College. She is responsible for coordinating and conducting education programs for schools and visiting groups at Hanauma Bay, and she also conducts the education program for visiting members of the public.

Coastal Sustainability Faculty

Rosie Alegado, Assistant Professor, Department of Oceanography and Center for Microbial Oceanography: Research and Education

Alegado holds a PhD from Stanford University, and conducted a postdoctoral fellowship at University of California, Berkeley. The focus of her research is to understand how bacteria have influenced the evolution of animals and how these interactions impact their ecosystem. Ultimately, she hopes to translate her findings from modeling microbial community dynamics to understanding the

impact of land use in fragile Hawaiian estuarine and marine wetland ecosystems.

**Oceana Francis, Assistant Professor,
Department of Civil and Environmental
Engineering**

Francis holds a PhD in atmospheric science from the University of Alaska, Fairbanks and a master of science in civil engineering from the University of Alaska, Anchorage. She has extensive academic and professional experience in the areas of civil engineering and atmospheric research with an emphasis on coastal engineering and sustainability, as well as green alternatives to water and wastewater management.

**Wendy Meguro, Assistant Professor,
School of Architecture**

Meguro obtained a master's degree in architecture studies in building technology from the Massachusetts Institute of Technology, and was the UH Mānoa School of Architecture valedictorian. Her research focuses on high-performance building design and policy, including enabling coastal communities to adapt to the effects of climate change. Her research, teaching, and outreach are motivated by the desire to make Hawai'i's coastal communities exemplars in energy and water efficiency, resiliency, economic success, and social well-being.

**Craig Nelson, Assistant Professor,
Department of Oceanography and Center
for Microbial Oceanography: Research
and Education**

Nelson earned his PhD in ecology, evolution, and marine biology from University of California, Santa Barbara and a BA in integrative biology and English from University of California, Berkeley. His research lies at the interface of microbial ecology and ecosystem science, specializing in the structure and function of natural microbial communities in aquatic habitats such as coral reefs, lakes, streams, and the open ocean.

**Michael Roberts, Associate Professor,
Department of Economics**

Roberts holds a PhD agricultural and resource

economics from the University of California at Berkeley, an MA in statistics from the University of California at Berkeley, and an MS in applied economics from Montana State University. His research focuses on the intersection of agricultural and environmental economics. Increasingly, he has focused on the potential effects of climate change on production, world commodity prices and price volatility of staple food grains, especially through increased exposure to extreme heat.

**Daniele Spirandelli, Assistant Professor,
Department of Urban Regional Planning**

Prior to joining UH faculty, Spirandelli was part of a multi-disciplinary team in the Urban Ecology Research Laboratory at the University of Washington while pursuing a PhD in urban design and planning and a master's degree in landscape architecture. Her research follows two related paths: the relationship between urban development patterns and environmental conditions, and human's response to environmental change, whether through individual behavior, community restoration efforts or through formal institutional arrangements.

**Mehana Vaughan, Assistant Professor,
Department of Natural Resources and
Environmental Management**

Vaughan holds a PhD in natural resource policy and environmental studies from the Emmett Interdisciplinary Program for Environment and Research at Stanford University. Her research interests include community efforts to care for natural resources at the local level, collaborative resource management partnerships, contemporary management based on indigenous systems, participatory research methods, watershed ecology, and place based education. She collaborates with a consortium of scholars who work with Hawai'i communities to develop solutions to natural and cultural resource management, food security and sustainability issues.

STATEWIDE



Statewide Coastal Hazard Preparedness Workshops

UH Sea Grant partnered with multiple agencies to spearhead a statewide series of free public workshops to assist communities plan and prepare for natural hazards. This series was developed from years of similar community outreach on emergency preparedness organized by UH Sea Grant in support of the Homeowner's Handbook to Prepare for Natural Hazards.

Tsunami Inundation Maps

A UH Sea Grant researcher and graduate trainee developed a state of the science two-dimensional tsunami model which simulates tsunami inundation in coastal areas. Since 2004, this researcher has led the Hawai'i Tsunami Mapping Project that updated Hawai'i's tsunami inundation maps. New tsunami evacuation maps for O'ahu and Hawai'i Island were released to the public in 2010; maps for the islands of Maui and Kaua'i are now being finalized.

Three-dimensional NEOWAVE Model

UH Sea Grant researchers developed a three-dimensional tsunami model named NEOWAVE (Non-hydrostatic Evolution of Ocean WAVE). After winning the 2009 Benchmark Challenge at Oregon State University, the tsunami model NEOWAVE received worldwide attention. Currently, NEOWAVE provides a new standard for tsunami inundation mapping and is being used nationally and internationally for tsunami research and hazard mitigation. It extends the 100-year event models to predict 500-year events to help prevent the loss of lives in the U.S. and abroad.

Mapping Coastal Erosion Hazards on O'ahu, Maui, and Kaua'i

UH Sea Grant research revealed that many of Hawai'i's coastal assets and famous beaches are vulnerable to coastal erosion and coastal inundation, posing severe threats to the economy and public safety. To understand and minimize these threats, the historical pattern of shoreline change on the islands of Maui, O'ahu, and Kaua'i were mapped, and a rigorous coastal erosion online database for coastal managers was developed. These data formed the foundation for new coastal construction setback policies, beach-specific management plans, tools to manage erosion problems, and beach conservation policies to be considered at the community planning level.

Designing Hawai'i's K-12 Portable Classrooms

Nearly 10 percent of all children enrolled in Hawai'i's public schools are educated in portable classroom facilities where conditions are often oppressively hot. To improve the quality of the learning environment, UH Sea Grant led a team of experts from the Department of Education, the Center for Better Communities, local engineers, the State Energy Office, and the U.S. Department of Energy to find solutions. A variety of design options were evaluated using computational modeling and the team successfully designed replacement units that are more conducive to learning.



NATIONAL/INTERNATIONAL

NOAA Sea Grant Coastal Storms Program

The National Oceanic and Atmospheric Administration developed a Coastal Storms Program (CSP) in which local, state, and federal organizations collaborate to provide a suite of tools and services to enhance community resilience to coastal storms. In the Pacific, UH Sea Grant is spearheading this program and is designing and implementing programs in Hawai‘i, American Samoa, Guam, Commonwealth of the Northern Mariana Islands, Republic of Palau, Republic of the Marshall Islands, and the Federated States of Micronesia. The ~\$2 million invested in the region through the CSP will improve protection, preparedness, and mitigation for literally billions of dollars in infrastructure and reduce loss of life through improved forecasts, training, awareness, and education.

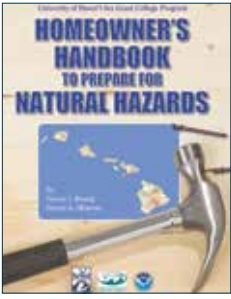
UH Sea Grant featured in the Smithsonian Museum of Natural History’s Sant Ocean Hall

UH Sea Grant developed an interactive kiosk for the Ocean Today Kiosk at the Smithsonian

Museum of Natural History’s Sant Ocean Hall. The kiosk, which focuses on traditional Marshallese navigation and the revival of indigenous canoe building and sailing, was selected as one of just 20 videos featured during the Sant Ocean Hall’s opening three months. In addition to reaching visitors of the Sant Ocean Hall, UH Sea Grant’s contribution is shared with other museums and aquaria across the U.S. and Mexico and is available on the museum’s website. The video now appears on a rotating basis at one of the Ocean Hall’s interactive kiosks.



SELECTED PUBLICATIONS



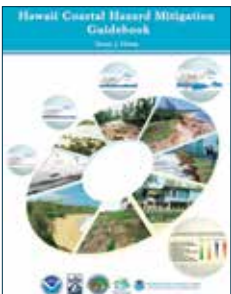
Homeowner's Handbook to Prepare for Natural Hazards

This 116-page free handbook was specifically developed for the homeowner, and outlines effective ways to significantly lower risks to lives and property. Over 65,000 handbooks have been distributed to stakeholders throughout the state, and UH Sea Grant has also assisted several Sea Grant programs develop their own state-specific versions.



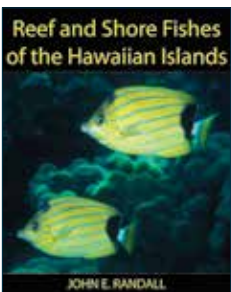
The 3 'Io Brothers and THE BIG BAD HURRICANE

Partnering with NOAA's National Weather Service in Honolulu, UH Sea Grant published a children's hurricane preparedness book titled "The 3 'Io Brothers and THE BIG HURRICANE." Books were provided to over 300 public elementary school libraries and throughout the State of Hawai'i public library system. The book was also featured at the 2011 Hurricane season press conference hosted at the Central Pacific Hurricane Center.



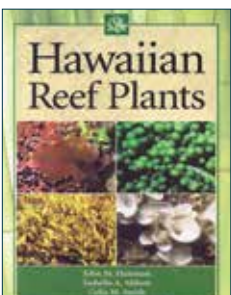
Hawai'i Coastal Hazard Mitigation Guidebook

UH Sea Grant authored and published the Hawai'i Coastal Hazard Mitigation Guidebook for audiences ranging from developers and architects to homeowners and government officials. The book describes how to reduce risks to coastal development by proactively planning for hazards such as erosion, flooding, tsunamis, and hurricanes. The Federal Emergency Management Agency used the guidebook extensively in its rebuilding efforts after the devastating 2005 Atlantic hurricane season, and the author also worked with the Louisiana and Mississippi Sea Grant programs to write a derivative Gulf Coast guidebook.



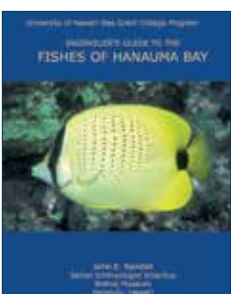
Reef and Shore Fishes of the Hawaiian Islands

Authored by esteemed ichthyologist, Dr. John E. Randall, UH Sea Grant produced a comprehensive, scholarly guidebook titled Reef and Shore Fishes of the Hawaiian Islands. The 560-page volume covers the 612 species of fish found in the Hawaiian Archipelago to 200 meters depth. In 2008, the book won the Award of Excellence in Natural Science at the Ka Palapala Po'okela awards which honor the finest books published Hawai'i.



Hawaiian Reef Plants

UH Sea Grant produced a comprehensive guidebook to marine plants titled Hawaiian Reef Plants. The book was written by John M. Huisman, Isabella A. Abbott, and Celia M. Smith, three of the world's leading botanists. UH Sea Grant produced this guidebook in recognition of the lack of a scholarly book on Hawaiian marine plants. In 2008, Hawaiian Reef Plants was awarded the Honorable Mention in Natural Science at the Ka Palapala Po'okela awards.



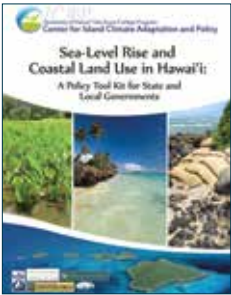
Snorkeler's Guide to the Fishes of Hanauma Bay

UH Sea Grant produced a popular book titled Snorkeler's Guide to the Fishes of Hanauma Bay authored by Dr. John E. Randall. This 65-page waterproof guide provides color photographs, names, and descriptions of the fishes commonly viewed by snorkelers and swimmers at Hanauma Bay. As a result, visitors to the Hanauma Bay Nature Preserve have a resource that enriches their visitor experience and encourages protection and conservation of Hawai'i's unique natural resources.



Climate Change and Regulatory Takings in Coastal Hawai'i

The UH Sea Grant Center for Island Climate Adaptation and Policy (ICAP) prepared a report titled Climate Change and Regulatory Takings in Coastal Hawai'i to examine the interactions among climate change, the regulation of shoreline development in Hawai'i, and constitutional law regarding unpermitted takings of private property for public benefit. This document will assist government officials, private landowners, and members of the public assess and evaluate the viability of potential takings claims.



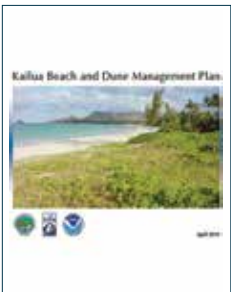
Sea-Level Rise and Coastal Land Use in Hawai'i: A Policy Tool Kit for State and Local Governments

This publication identifies and explains key land use policy tools for state and local government agencies and officials to facilitate action in support of sea-level rise adaptation in Hawai'i.



Shoreline Impacts, Setback Policy & Sea-Level Rise

At the request of Hawai'i State Senator Shan Tsutsui, ICAP developed a report titled Shoreline Impacts, Setback Policy & Sea-Level Rise. It determined that Senate Bill 468, 2009, was an effective vehicle for long-range coastal climate change adaptation. The bill represented the first step to developing statewide shoreline setbacks that account for coastal erosion and sea-level rise.



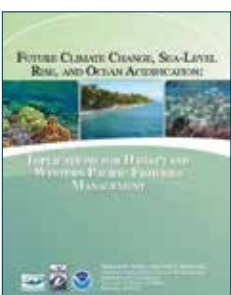
Kailua Beach and Dune Management Plan

The Kailua Beach and Dune Management Plan is one of the first site-specific climate adaptation plans in Hawai'i and was developed jointly by UH Sea Grant and the State of Hawai'i Department of Land and Natural Resources. The plan was developed to proactively identify land use and coastal management planning options for the long-term conservation of the Kailua coastal ecosystem.



2011 Environmental Product Guide

The 2011 Environmental Product Guide identifies sustainable materials currently available for the design and construction market in Hawai'i. The guide is being used to raise awareness in consumers and builders alike, and serve as a platform for catalyzing the use of more environmentally-supportive building materials in Hawai'i.



Sustainability Case Studies

UH Sea Grant coordinated the development of four case studies on the sustainability of water resources, energy sustainability, nearshore coastal ecosystems, and fishery resources. The case studies facilitate the teaching and understanding of scientific concepts fundamental to developing a well-rounded understanding of sustainability issues.



This paper is funded by a grant/cooperative agreement from the National Oceanic and Atmospheric Administration, Project C/CC-1, which is sponsored by the University of Hawaii Sea Grant College Program, SOEST, under Institutional Grant No. NA09OAR4170060 from NOAA Office of Sea Grant, Department of Commerce. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its subagencies. UNIHI-SEAGRANT-QQ-13-01.