# SOEST

# HIGHLIGHTS 2024







*Inset:* Chip Fletcher, *Interim* Dean of SOEST. Credit: Kellen Garcia. Kalo growing in a lo'i on O'ahu. Credit: Marcie Grabowski.

#### Dear friends of SOEST,

As we present the 2024 SOEST Highlights Report, I am proud to share another year of remarkable achievements in research, teaching, and service. Our faculty, staff, and students continue to push boundaries in atmospheric, Earth, and space science; oceanography; ocean engineering; human health; marine biology; and renewable energy, tackling some of the most pressing global challenges.

SOEST is committed to fostering a rooted, resilient, and responsive community that advances UH Mānoa as a Native Hawaiian Place of Learning—grounded in aloha 'āina—so that the sustainable practices deeply rooted in Hawai'i endure for generations to come. We are dedicated to increasing the diversity of our workplace, recognizing that a broad range of perspectives strengthens our mission and impact.

Through innovative research, community engagement, and interdisciplinary collaboration, we strive to create sustainable solutions for our world. I invite you to explore our achievements and join us in shaping a resilient future.

As we look to the future, we remain optimistic. The challenges ahead are significant, but so too are the opportunities for discovery and impact. With our talented faculty, dedicated staff, and passionate students, I am confident that SOEST will continue to thrive and lead in the pursuit of sustainable solutions for our world.

Thank you for your support and engagement with our mission. I invite you to explore the highlights of our achievements in this short report and to join us in our journey forward.

Warm regards,

#### Chip Fletcher

Interim Dean, School of Ocean and Earth Science and Technology (SOEST)



### Konter Ridge

Seamount named in honor of Earth Sciences professor Jasper Konter

A large seamount southeast of Hawai'i was named Konter Ridge (0°N, 135°W) in honor of Jasper Konter (1977–2022), who was a professor of Earth Sciences. He is recognized globally for his research on oceanic volcanism and isotope geochemistry. "This is a beautiful tribute and an especially fitting way to honor Jasper and his love for marine geology," said Bridget Smith-Konter, SOEST Earth Sciences professor and Konter's wife.

"He loved sea-going research and nearly all of his research studies were focused on investigating the origins of seamounts, their geochemical fingerprints, and how these relate to tectonic plate motions and mantle plumes."

Read more about it in this SOEST News article.



Jasper Konter aboard SOEST's R/V Moana Wave. Credit: Ben Duncan.



Hawaiian Islands

Baja California

Konter Ridge est. 2024 (0°N, 135°W)

> -4000 -3500 -3000 -2500 -2000 -1500 neters below sea leve

Bathymetric map of Konter Ridge. Inset shows its location (yellow box) in the Pacific Basin. Credit: Bridget Smith-Konter

134°30'W

### Loko i'a

Could drone technology and fishpond restoration help Hawai'i's food sustainablity?

Revitalization of loko i'a, or fishponds, has the potential to significantly increase locally available seafood. Research from the **Hawai'i Institute of Marine Biology** (HIMB) determined that these Indigenous aquaculture systems in Hawai'i can increase the amount of fish and fisheries harvested both inside and outside of the pond.

Researchers in the **Department of Earth Sciences** and kia'i loko (fishpond practitioners) discovered that **drone technology can aid their efforts** to restore and ensure the resilience of Native Hawaiian fishponds. The use of uncrewed aerial vehicles can support integrated coastal zone management, including at cultural heritage sites.

Inset: An aerial view of Honokea loko i'a in Keaukaha, Hilo during low tide. Credit: Kainalu Steward.

An aerial view of the He'eia fishpond in Kāne'ohe Bay. Credit: Keli'i Kotubetey, courtesy of Paepae o He'eia.



### Coral reefs

#### Innovations in monitoring and conservation

Researchers in the Pacific Biosciences Research Center (PBRC), the Marine Biology Graduate Program (MBIO), and the Center for Microbial Oceanograpy: Research and Education (C-MORE) discovered that each type of coral and algae from a coral reef in Waimea Bay produced a unique suite of hundreds of chemical compounds (metabolites). These compounds represent a repository of potentially valuable indicators of the health of these reef organisms.

Another effort led by the Hawai'i Institute of Marine Biology (HIMB) resulted in a new tool for forecasting coral disease that could help conservationists step in at the right times with key interventions. Using ecological and marine environmental conditions, the new product predicts the risk of two diseases, providing a critical tool for conserving and managing marine ecosystems near-real-time.







NOAA coral reef watch daily 5km bleaching alert area 7-day maximum (v3.1) for SW Pacific for 02-12-25. Credit: NOAA.

### Human health

#### *Two centers focus on microbiomes and nutrition*

The **Pacific Biosciences Research Center** (PBRC) hosts two Centers of Biomedical Research Excellence (COBRE) funded by the National Institutes of Health.

The Integrative Center for Environmental Microbiomes and Human Health explores the link between microbial environments and human health, addressing environmental deterioration and insect-borne diseases. The Integrative Center for Precision Nutrition and Human Health aims to train future leaders in personalized nutrition, with an emphasis on sustainable practices and locally sourced foods to enhance human, environmental and economic health, benefiting both Hawai'i and globally.

Four new assistant researchers joined the centers in 2024: Andrea Jani, Lenore Pipes, Lucia Seale, and Mengting (Maggie) Yuan.



*Inset:* Researchers study the connections between microbial environments and human health.

State-of-the-art facilities enable impactful research, education and training activities.



Natalia Gauer Pasqualon talked with elementary students about Hawaiian volcanoes. Credit: Rose Gallo.

Hawaiian Eruptions

Blake Stoner-Osborne (far right) offered hands-on activities during a visit to an O'ahu high school. Credit: Sonia Rowley.

#### Connections

Graduate students share knowledge, passion with Hawaiʻi's communites

SOEST graduate students engage in vital conversations and outreach opportunities with our community and K–12 students and teachers. Graduate students shared their knowledge, curiosity, and passion for **deep-sea zooplankton**, **fishes**, **and ecology**, **volcanoes and Hawaiian geology**, and a **wide variety of topics** with hundreds of elementary, middle, high school, undergraduate students, and community members.

They offered workshops, hands-on activities, and presentations at the UH Mānoa campus, Hawai'i STEM Conference, K–12 schools, public events such as Waikīkī Aquarium's "Mauka to Makai," and public libraries.

*Inset:* Carla Baizeau shared a Lego-based sea level rise activity with high school students. Credit: Courtesy of Carla Baizeau.



### Kīlauea

Insights from a century of stress and deformation

After assessing an unprecedented 120 years of data from Kīlauea volcano on Hawai'i Island, **Earth Sciences** researchers **uncovered**, for the first time, centuryspanning patterns of deformation and stress changes. They focused on the 1975 magnitude 7.7 Kalapana earthquake, which resulted in a 20-foot high tsunami.

"Deciphering Kīlauea's history...offers critical insights into how stress evolves in volcanic systems, guiding our ability to anticipate and interpret future earthquakes and magmatic events," said lead author **Lauren Ward Yong**, who conducted this study as part of her doctoral dissertation in Earth and Planetary Sciences.





A humpback whale sings in Hawaiian waters. Credit: Lyman/Hawaiian Islands Humpback Whale National Marine Sanctuary (NOAA permit 782-1719).

#### Pacific whales Insights into their lives

Led by the Marine Mammal Research Program (MMRP) at the Hawai'i Institute of Marine Biology (HIMB), researchers and students in the Marine Biology Graduate Program (MBIO) gained new insights into the lives of whales in Hawai'i and across the Pacific Ocean.

A study conducted in partnership with NOAA's Hawaiian Islands Humpback Whale National Marine Sanctuary **revealed a daily pattern as humpback whales** off Maui move their singing away from shore throughout the day, returning to nearshore in the evening. MMRP scientists used drone imagery to **understand how nursing humpback whale mothers and their calves fare** and quantified the **energetic cost for pregnant humpback whales** to pull off the extreme physical feat of the annual migration between Hawai'i and Alaska, crossing the Pacific Ocean.

HIMB and Pacific Whale Foundation utilized cuttingedge non-invasive suction-cup tags to track endangered false killer whales and short-finned pilot whales, shedding light on impacts of human activities and threats they could pose to Hawai'i's endangered false killer whale population.





From left: Josephine Briones, a UH Mānoa climate adaptation specialist, and Wendy Meguro, director of the School of Architecture Environmental Research and Design Laboratory and the Hawai'i Sea Grant Center for Smart Building and Community Design, with the AIA Award of Merit. Credit: AIA Honolulu (American Institute of Architects, Honolulu Chapter).



#### Resilience

Waikīkī sea-level rise adaptation project earns national recognition

Highlighting the importance of climate resilience for Hawai'i's coastal communities, a University of Hawai'i at Mānoa-led **project creating architectural renderings** to illustrate adaptation strategies in Waikīkī earned several awards.

A collaboration between the Climate Resilience Collaborative, Hawai'i Sea Grant, and the UH Mānoa School of Architecture, the project earned the distinguished Award of Merit from the American Institute of Architects Honolulu (photo top left). Additionally, the project earned a design award from the Society of American Registered Architects in New York City.

Flood adaptation strategy icons are shown superimposed on a generic site that represents a location adjacent to the canal in Waikīkī. Credit: D. Malabed.



#### Giant viruses

Encoding a key piece of protein-making machinery of cellular life

SOEST oceanographers made an exciting discovery: a virus found in the ocean called FloV-SA2 carries the genetic instructions for making part of a ribosome a crucial component in cells that turns genetic information into proteins.

This is the first time a virus that infects eukaryotic organisms (such as plants, animals, and fungi) has been found to have this capability. "Our working hypothesis is that by inserting one of its own proteins into the ribosome, the virus alters this key piece of machinery to favor the production of virus proteins, over the usual cell proteins," said **Julie Thomy**, lead author and postdoctoral research in the **Center for Microbial Oceanograpy: Research and Education** (C-MORE) and the **MarVEL Lab**.

Read more about it in this SOEST News article.





*Inset:* Transmission electron micrograph of negatively stained FloV-SA2 virus particles. Credit: Julie Thomy.

CTD (conductivity, temperature, and depth) water sampler being deployed from SOEST's R/V *Moana Wave*. Credit: Kelsey Maloney.

### Titan

Saturn's largest moon has insulating methane-rich crust up to six miles thick

Saturn's largest moon **Titan** is the only place other than Earth known to have an atmosphere and liquids in the form of rivers, lakes, and seas on its surface. Because of its extremely cold temperature, the liquids on Titan are made of hydrocarbons like methane and ethane, and the surface is made of solid water ice.

A new study, led by planetary scientists at the Hawai'i Institute of Geophysics and Planetology (HIGP) in SOEST, revealed that methane gas may also be trapped within the ice, forming a distinct crust up to six miles thick, which warms the underlying ice shell, and may also explain Titan's methane-rich atmosphere.

Read more about it in this SOEST News article.

NASA image of Titan using the Cassini VIMS (visual and infrared mapping spectrometer) instrument. Credit: NASA.





'Wave of Consumption" by Hilton Alves.

Jocelyn Ng, featured artist in monthlong exhibit.



"Wisdom From Wisdom: Innovation Takes Flight" (detail) by the Voyager Pacific Charter School.

#### Science+Art

Hawai'i Sea Grant's annual exhibit explored the impact of marine debris

At the third annual sci-art exhibition "Refuse REFUSE," local artists shined a spotlight on the profound impact of marine debris on Hawai'i's coastlines and ecosystems at The ARTS at Marks Garage in Honolulu's historic Chinatown district. Organized by the **University of Hawai'i Sea Grant College Program**, in partnership with the Papahānaumokuākea Marine Debris Project and Hawai'i Pacific University's Center for Marine Debris Research, it featured a dynamic collection of art by local artists and students. In addition, every Monday night during the exhibition the Science and Stories seminar series was held featuring inspiring talks from Sea Grant and PI-CASC graduate scholars.



### Clean energy

#### Battery storage boosts solar photovoltaic integration

Hawai'i is experiencing rapid growth in solar energy, most recently in the form of utility-scale solar combined with battery energy storage, prompting concern about the impact of these changes on power grid reliability. **The Hawai'i Natural Energy Institute** (HNEI) is developing new analytic tools to inform various stakeholders, including the State Legislature, Public Utilities Commission, and Hawaiian Electric Company.

HNEI has shown that grids in Hawai'i can operate with very high inputs of solar or wind energy without compromising reliability. HNEI's analysis also indicates that with proper "backup" power generation, up to 70% or even more of the islands' energy could be derived from these variable renewable sources. This work supports progress toward Hawaii's 2045 100% renewable goals.



Solar energy is an important component of achieving Hawai'i's clean energy goals. Credit: John Cole.



El Niño Southern Oscillation can cause droughts, floods, crop failures, and food shortages. Credit: Tomasz Filipek vis Unsplash.

#### **El Niño**

#### Forecasts 18 months out? UH researchers have a new tool

The El Niño Southern Oscillation (ENSO) brings variations in winds, weather, and ocean temperatures that can cause droughts, floods, and crop failures. By developing an innovative modeling approach researchers in Oceanography, Atmospheric Sciences and the International Pacific Research Center (IPRC) are now able to forecast ENSO events up to 18 months ahead of time significantly improving conventional climate model forecasting.

"Our model effectively incorporates the fundamental physics of ENSO and ENSO's interactions with other climate patterns in the global oceans that vary from season to season," said **Sen Zhao**, lead author and assistant researcher in Atmospheric Sciences.



#### Experience

#### Undergraduate student research highlights

Engaging in research efforts first-hand is a cornerstone of the undergraduate experience at SOEST. Students in Atmospheric Sciences, Earth Sciences, and Global Environmental Science (GES) focused their projects on supporting Hawai'i's renewable energy goal of 100% clean energy by the year 2045; gaining invaluable experience with the Hadal Water Column Profiler, a unique scientific instrument designed to study deep ocean trenches; building an ionosonde, essentially a giant antenna, to investigate one of the highest layers of the Earth's atmosphere; understanding how atmospheric and oceanic systems affect tropical cyclone creation and progression; determining how artificial lights might affect the behavior of the most culturally important and highly valued deep-water bottomfish species in Hawai'i; and studying water quality in the ahupua'a of He'eia.

Inset: GES student Tyra Arends stands next to the CTD sensor package on the back deck on the R/V Kilo Moana.



GES student Malia Martin created an artificial light to aid deep sea underwater camera surveys.

Atmospheric Sciences associate professor Giuseppe Torri (left) with the four Aeronauts investigating the highest layers of Earth's atmosphere.

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#### ESTACION CIENTIFICA CHARLES DARWIN Charles Darwin Research Station

Environmental Earth Science student Aaliyah Thomas conducted water quality research in the Galapagos Islands and the ahupua'a of He'eia.



Water testing sensors deployed in the near shore water off Lahaina, Maui. Credit: SOEST, UH Manoa.

### Lahaina

*Monitoring the effects of the fires on Maui coral reefs* 

In addition to destroying land, homes, businesses, and other significant spaces, the devastating Lahaina wildfire in August 2023 affected water quality in nearby coastal areas. UH Mānoa researchers including oceanographers, Earth scientists, and ecologists have been monitoring the impact on water quality of the nearshore waters off Lahaina. Oceanographer Andrea Kealoha leads the team assessing carbonate chemistry, nutrients, organic contaminants, microorganisms, and metals. High levels of some metals were measured, particularly near the harbor, but those concentrations have been declining. Teams of researchers continue to monitor conditions and share the results with partners and community members to support healthy coastal areas to ensure community, culture, and economy can thrive.



### **SMART Cables**

Contract signed for world's first SMART subsea cable to connect Vanuatu and New Calidonia

Efforts to install the world's first Science Monitoring And Reliable Telecommunications (SMART) seafloor cable cleared a major hurdle in 2024. A supply and construction contract was signed for the cable system, named Tamtam, to connect Vanuatu and New Caledonia in the Pacific Ocean. France is providing much of the funding for the project.

The SMART concept is being advanced by the SMART Cables Joint Task Force, which has been led since 2016 by Bruce Howe, SOEST professor of Ocean and Resources Engineering (ORE). The submarine cables integrate environmental sensors to monitor climate change and provide early warning for earthquakes and tsunamis.





## Deep learning

#### Illuminating atmospheric blocking events of the past and future

Atmospheric blocking events occur when large-scale high-pressure systems become stationary and divert the jet stream, which creates weather patterns that can be associated with record-breaking flooding or heat waves. In a new **study**, SOEST atmospheric scientist **Christina Karamperidou** used a deep learning model to infer the frequency of blocking events over the past 1,000 years and shed light on how future climate change may impact these significant phenomena.

"This is a unique study and the first attempt to reconstruct a long record of blocking frequencies based on their relationship with surface temperature, which is complex and unknown," she said.



