OCEAN EXPLORATION 2024

NOAA Ocean Exploration is dedicated to exploring the unknown ocean, unlocking its potential through scientific discovery, technological advancements, partnerships, and data delivery. We are leading national efforts to fill gaps in our basic understanding of the marine environment, providing critical ocean data, information, and awareness needed to strengthen the economy, health, and security of the United States and the world.

ANNUAL REPORT: A Year In Review

NOAA Ocean Exploration explores the ocean for the benefit of the nation. We do so primarily through:

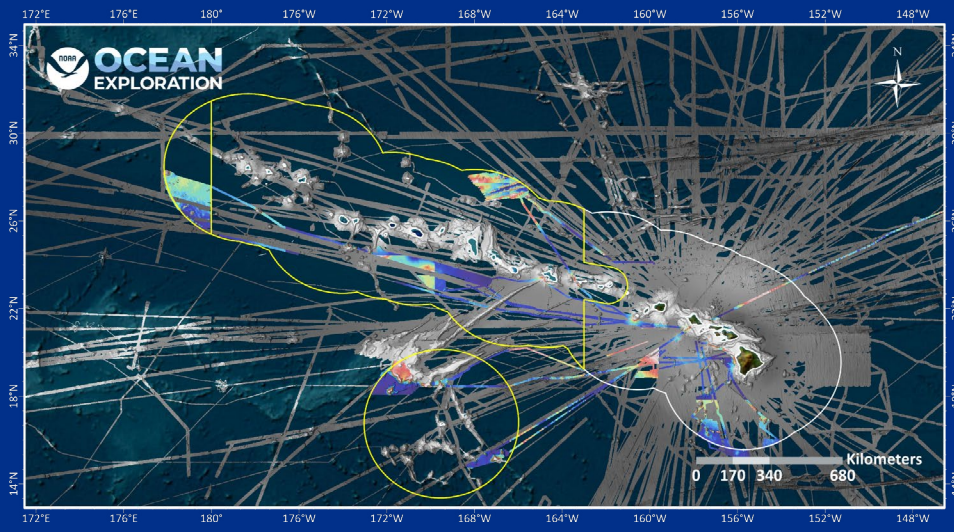
- Expeditions on NOAA Ship *Okeanos Explorer*
- The NOAA Ocean Exploration Cooperative Institute (OECI)
- An annual competitive grant program

DEEP-OCEAN EXPLORATION: *OKEANOS EXPLORER* AND THE OECI

NOAA Ocean Exploration and the OECI contributed to U.S. and international efforts to map the seafloor, mapping 443,304 square kilometers (171,161 square miles) of unmapped or poorly mapped seafloor, 302,921 (116,958) in the U.S. Exclusive Economic Zone. These data were collected during the field season on *Okeanos Explorer* and during OECI expeditions on Ocean Exploration Trust's Exploration Vessel (E/V) *Nautilus* and Research Vessel *Connecticut* and field deployments of uncrewed surface vehicle (USV) DriX in the Gulf of Maine and off American Samoa.

NOAA Ship *Okeanos Explorer*

NOAA Ocean Exploration kicked off Beyond the Blue: Illuminating the Pacific with seven mapping expeditions on *Okeanos Explorer* over 180 days at sea around Hawai'i and Johnston Atoll. The Beyond the Blue campaign is designed to raise collective knowledge, understanding, and appreciation of ocean waters in the Pacific Islands region through coordinated mapping and exploration expeditions, data management and sharing, strategic partnerships, and outreach and engagement.



During the 2024 field season on NOAA Ship *Okeanos Explorer*, NOAA Ocean Exploration filled mapping gaps in Papahānaumokuākea Marine National Monument, mapping ~9% of the monument's total area, and the Johnston Atoll Unit of the Pacific Islands Heritage Marine National Monument, mapping ~10% of the unit's total area (in total an area 6.5 times the size of the state of Hawai'i). Data collected will inform future exploration, research, and management activities. Yellow boundaries represent the monuments. Newly collected data are in color; preexisting data are gray.

Exploration Vessel *Nautilus*

Also in the Pacific, NOAA Ocean Exploration supported eight expeditions on E/V *Nautilus* over 123 days at sea through the OECI. These expeditions focused on mapping, remotely operated vehicle, and multivehicle operations around American Samoa, Howland and Baker Islands, and Palau, including parts of the Pacific Islands Heritage Marine National Monument and sister sanctuaries National Marine Sanctuary of American Samoa and the Palau National Marine Sanctuary. In particular, they continued efforts to expand the amount and type of exploration possible by teaming up remotely operated vehicle *Hercules* and autonomous underwater vehicle *Sentry*, fully implementing other OECI-affiliate technologies (after years of testing), demonstrating the ability to launch and control USV DriX from shore, and integrating new tools onto *Hercules*.

Highlights:

- While helping meet the U.S. commitment to map and explore habitats of Palau National Marine Sanctuary, the Corps of Exploration on E/V *Nautilus* saw the first nautiloids (*Nautilus belauensis*) ever seen during *Nautilus* operations.
- On E/V *Nautilus*, a variety of technologies were used to explore the seafloor and water column of Vailulu'u Seamount, including mapping systems, remotely operated vehicles, autonomous underwater vehicles, an uncrewed surface vehicle, and a seafloor lander and water column profiler. Vailulu'u is the only active underwater volcano in the Samoan archipelago and hosts an active hydrothermal system.

Learn more in Adventures Across the Pacific: 2024 Field Season Summary, OET's Top 10 WOW Moments of 2024, and E/V *Nautilus* 2024 Season Highlights.

OCEAN EXPLORATION GRANTS

NOAA Ocean Exploration conducts an annual ocean exploration competitive grant program. Through the Fiscal Year 2024 competition, we awarded over $2.1 million in grants to explore mesophotic coral ecosystems off Puerto Rico, study the biodiversity of crustaceans from deep waters off Southern California, explore nationally significant shipwrecks in Lake Michigan's Wisconsin Shipwreck Coast National Marine Sanctuary, and more.

Previous grant recipients explored deepwater habitats around Puerto Rico for biotechnology potential; investigated the Gulf of Alaska's pelagic diversity; mapped the water column and seafloor along the eastern Aleutian margin; surveyed the underwater battlefield of Attu, Alaska; continued testing an approach to autonomously map and characterize seeps over wide areas; tested an algorithm to enable autonomous underwater vehicles to locate hydrothermal vents and seeps; and demonstrated the first ever autonomous, near real-time, directional acoustic profiling float powered by marine renewable energy.

Images courtesy of (left to right): Exploration of Deepwater Habitats off Puerto Rico and the U.S. Virgin Islands for Biotechnology Potential; Allen Collins, NOAA Fisheries National Systematic Laboratory and Smithsonian National Museum of Natural History; Exploring Attu's Underwater Battlefield and Offshore Environment/ ThayerMahan, Inc.

OCEAN EXPLORATION 2024

OUTREACH AND EDUCATION

NOAA Ocean Exploration's outreach and education activities focus on providing educators with the information and tools they need to generate interest in the ocean among their students, training the next generation of ocean explorers, and providing access to information about our work, ocean exploration, and the ocean in general.

19
Educator Professional Development Workshops

413
Educators Trained

23
NOAA Ocean Exploration Interns

5.5 Million
NOAA Ocean Exploration Website Views

72,625
Deep Ocean Education Project Website Views

706,000
NOAA Ocean Exploration Social Media Followers

Outreach and education highlights included:

- Relaunching full-day, in-person professional development workshops for educators.
- Providing in-person and virtual internship opportunities in mapping, communications, maritime heritage, policy, data analysis, and environmental DNA.
- Co-hosting Pilina Kai Lipo: Connecting to the Deep Ocean, a multiday community outreach event in Hilo, Hawai'i, that included classes on how to paint a deep-sea creature, ship tours, and other activities for local students and partners.
- Supporting youth robotics teams involved in the FIRST Lego League Challenge.

The OECI also hosted interns and, on E/V *Nautilus*, conducted a robust ship-to-shore interaction program and offered ship tours in Pago Pago, American Samoa, and Koror, Palau.

Image courtesy of Ocean Exploration Trust.

To enhance ocean science education and career development in American Samoa, NOAA Ocean Exploration, Ocean Exploration Trust, National Marine Sanctuary of American Samoa, and the American Samoa Department of Education partnered to deliver a first-of-its kind professional development workshop for educators in American Samoa, which included a tour of E/V *Nautilus*.

NOAA Ocean Exploration hosted local Hawaiian community liaisons on all three expeditions in Papahānaumokuākea Marine National Monument. These liaisons shared knowledge and practices that highlighted the value of the monument.

OCEAN EXPLORATION 2024

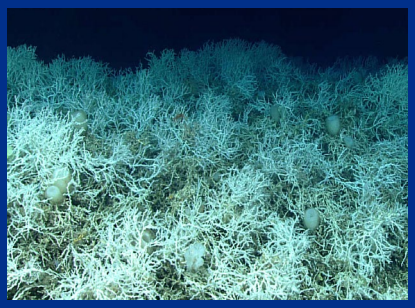
OTHER HIGHLIGHTS

To achieve our mission, NOAA Ocean Exploration works closely with other organizations to conduct and support ocean exploration expeditions, produce innovations in ocean exploration tools and capabilities, and maximize data collection. By working with organizations with a wide range of experience, expertise, and creativity, we are able to enhance the potential for significant new advances in discovery, understanding, action, and inspiration. In 2024, NOAA Ocean Exploration:

- Renewed relationships with the OECI and the National Marine Sanctuary Foundation, which furthers the office's education priorities.
- Addressed other NOAA priorities by surveying the Makapu'u precious coral bed to inform management decisions and deploying an acoustic mooring off American Samoa to assess whale and dolphin populations during expeditions on E/V *Nautilus*.
- Addressed priorities of the Bureau of Ocean Energy Management, U.S. Geological Survey, and NASA during expeditions in the Pacific on *Okeanos Explorer* and E/V *Nautilus*.
- Co-led development of the National Aquatic Environmental DNA Strategy and contributed to the federal Standard Ocean Mapping Protocol.
- Led development of formal partnership agreements between NOAA and the Defense POW/MIA Accounting Agency and the Ocean Discovery League and helped facilitate a new, expanded agreement with the Smithsonian Institution.
- Sponsored the 2024 National Ocean Exploration Forum, hosted by the OECI and focused on telepresence and transitioning to more remote operations.

Image courtesy of Schmidt Ocean Institute.

Through its partnership with the NOAA Pacific Marine Environmental Laboratory, NOAA Ocean Exploration supported NOAA international and philanthropic partner expeditions: exploring hydrothermal vents on the Central Indian Ridge with the Korea Institute of Ocean Science and Technology, studying the cause of the 2022 Hunga Tonga-Hunga Ha'apai volcano eruption with New Zealand's GNS Science and the National Institute of Water and Atmospheric Research, and searching for methane seeps off Chile on Schmidt Ocean Institute's Research Vessel *Falkor (too)*.



A 2024 journal article reported on the mapping of the largest deep-sea coral reef habitat revealed to date. Large coral mounds, mostly *Desmophyllum pertusum* (previously called *Lophelia pertusa*), on the Blake Plateau off the Southeast United States were found covering over 6.4 million acres — an area larger than Vermont. Much of the mapping data were collected during NOAA Ocean Exploration and partner expeditions, including several on *Okeanos Explorer*.

This report is a high-level summary of NOAA Ocean Exploration's accomplishments for 2024.

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