2023 Annual Report

ADVANCING THE FRONTIERS OF KNOWLEDGE

ACCELERATING THE SEARCH FOR SOLUTIONS

WOODS HOLE OCEANOGRAPHIC INSTITUTION®

ON THE COVER
Not far from the busy ports and densely populated cities of the U.S. East Coast, the deep-sea canyons of the Mid-Atlantic Ocean are home to a remarkable abundance and diversity of corals, sponges, anemones, and fishes. These 90-plus canyons and their deep-water habitats are some of the most productive on the planet. Their resources include unique habitats, yet undiscovered species, and potential biomedical and pharmaceutical products. Deep-water coral ecosystems also help support valuable commercial fisheries. Image courtesy of deep-sea biologist Tim Shank

BELOW
A Deep-sea Discovery: Scientists onboard research vessel Falkor (too) using the 4,500-meter robot, ROV *SuBastian*, discovered two pristine cold-water coral reefs in the waters surrounding the Galápagos Islands, including the one in this photograph. These newly identified reefs reside 370 to 420 meters (~1,200 to 1,400 feet) down. The discovery expands understanding of deep reefs within the Galápagos Islands Marine Reserve and included the participation of WHOI deep-sea experts Tim Shank and Dan Fornari. (Photo courtesy of Schmidt Ocean Institute)

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A Message from the President and Director

In 2023, our planet experienced extreme heat during what was reported as the hottest year on record. The news underscored the importance of WHOI's mission to understand the ocean, which absorbs vast amounts of excess heat on our planet. It also validated that WHOI's Vision 2030 roadmap is highly relevant, as we work to turn the tide on climate change and ocean pollution, to protect ocean life and health, and to harness technology and innovation in search of more and better solutions to these and other pressing problems.

Over the year, we pushed the limits of both basic and applied science, continued to groom the next generation of ocean leaders, and elevated the singular engineering and marine operations that enable WHOI's groundbreaking at-sea research, exploration, and ocean monitoring.

WHOI also led partnerships and communications campaigns created to promote awareness of ocean importance. A powerful example of this is the COP28 Ocean Pavilion in Dubai—a joint project with Scripps Institution of Oceanography and other ocean-forward organizations to educate world leaders on the ocean's role in climate. This was WHOI's second year co-leading the Ocean Pavilion, which featured more than 100 live events, including 72 panel discussions in the Main Theater, 42 screenings in the Immersive Theater, and various receptions.

WHOI's burgeoning impact is thanks largely to our closest supporters and I am happy to report that we raised $90.6 million during another blockbuster fundraising year. Our dedicated Trustees, Life Trustees, and Corporation Members continued to give generously, both as financial supporters and as connectors willing to introduce others to WHOI and its mission. I am especially grateful to Paul Salem for a stellar first year as WHOI board chair. He has created many efficiencies within the Board of Trustees and demonstrated real leadership with his personal support and willingness to engage his friends with WHOI. Paul is one of three trustees, including Sarah Johnson and an anonymous donor, who gave eight-figure gifts this year.

In the pages that follow, you'll find 2023 research, education, and other highlights and meet some of the extraordinary supporters whose funding is enabling WHOI to move the needle during a time of urgent need. These vignettes represent just a fraction of the year's accomplishments.

I am thankful to the WHOI community writ large for the successes of 2023. Vision 2030 is resonating, with its overarching goal to leverage WHOI's unique capabilities to advance ocean science for the global good at a pace commensurate with the urgency of the grand challenges we face. The momentum we continue to gain compels us to forge ahead with courage and commitment and to lead with determination and passion. Together, we are building a future where the ocean is understood, protected, and sustainably managed for generations to come.

For our ocean, our planet, our future,

Peter de Menocal

"Together, we are building a future where the ocean is understood, protected, and sustainably managed for generations to come."

Research Highlights

In 2023, WHOI researchers, engineers, technologists, and scholars collaborated on more than 800 projects worldwide to advance the frontiers of scientific knowledge and accelerate the search for solutions to urgent global challenges. Here are some of their findings.

A GROUNDBREAKING STUDY OF THE HUMAN AND OCEAN HEALTH IMPACTS OF OCEAN PLASTICS

For the first time, leading researchers from the fields of healthcare, ocean science, and social science, including WHOI scientists, collaborated to quantify plastic's considerable risks to all life on Earth. The Minderoo-Monaco Commission on Plastics and Human Health report, released in March 2023, presented a comprehensive analysis showing plastics as a hazard at every stage of their life cycle.

EXPLORING OCEAN-BASED CLIMATE SOLUTIONS

Thanks in large part to private foundations and philanthropists like board chair Paul Salem, WHOI has significantly advanced its portfolio of potential ocean-based climate solutions. This risk capital has been leveraged to attract agency funding. As a result, WHOI scientists have been carefully evaluating the risks—and benefits—of several options for harnessing the ocean's power to sequester carbon, including:

- Protecting coastal ecosystems, including seagrass beds, mangroves, and salt marshes that store an immense amount of atmospheric carbon. With many of these environments in global decline, protecting those that still exist and restoring others is essential.
- Iron fertilization, a marine carbon dioxide (mCDR) removal technique that could increase the ocean's ability to store carbon.
- Alkalinity enhancement, an mCDR technique involving adding alkalinity to the ocean, which may counteract ocean acidification and help the ocean store more carbon.
- Cultivating seaweed, which draws substantial amounts of carbon dioxide out of the atmosphere.

Funders: WHOI and its collaborators received federal support for mCDR research, including $8.5 million from the U.S. Department of Energy, as well as additional funding from NOAA's Ocean Acidification Program on behalf of the National Oceanographic Partnership Program.

Photo by Dr. Tom Burns

OCEAN'S TOP PREDATORS COULD FACE DRASTIC HABITAT LOSS

Some marine predators could lose more than 70% of their habitat by the year 2100 due to climate-driven changes in the ocean, according to research by WHOI, San Diego State University, and NOAA Fisheries. Research on 12 species of highly migratory fish predators—including sharks, tuna, and billfish—found that most will encounter widespread suitable habitat losses by the end of the century due to shifting availability in prey. The research identified the Northwest Atlantic Ocean and the Gulf of Mexico, which are among the fastest-warming ocean regions, as hotspots of habitat loss. The findings reinforce the need for ecosystem conservation, but also for the broad adoption of adaptation practices across coastal fisheries and communities in these regions.

Funders: NASA Ecological Conservation program grant, NOAA Integrated Ecosystem Assessment Program, the Postdoctoral Scholar Program at WHOI, and the Dr. George D. Grice Postdoctoral Scholarship Fund at WHOI.

SCIENTISTS PROVIDE CLEAR EVIDENCE OF HUMAN-CAUSED CLIMATE CHANGE SIGNAL ASSOCIATED WITH CO_2 INCREASES

Atmospheric research provided clear evidence of a human "fingerprint" on climate change and showed that specific signals from human activities have altered the temperature structure of Earth's atmosphere. Differences between tropospheric and lower-stratospheric temperature trends have long been recognized as a fingerprint of human effects on climate. This fingerprint, however, neglected information from the mid- to upper-stratosphere, 25 to 50 kilometers above the Earth's surface. "Including this information improves the detectability of a human fingerprint by a factor of five. Enhanced detectability occurs because the mid- to upper-stratosphere has a large cooling signal from human-caused CO_2 increases, small noise levels of natural internal variability, and differing signal and noise patterns," according to the scientific findings. "This research undercuts and rebuts claims that climate change is natural, whether due to the Sun or due to internal cycles in the climate system. A natural explanation is virtually impossible in terms of what we are looking at here: changes in the temperature structure of the atmosphere," said lead author, adjunct scientist Benjamin Santer. Santer is WHOI's first Francis E. Fowler IV Distinguished Scholar in Residence.

Funders: National Science Foundation, National Oceanic and Atmospheric Administration, U.S. Department of Energy, and the Francis E. Fowler IV Center for Ocean and Climate at Woods Hole Oceanographic Institution.

STUDY CONFIRMS "CLIMATICALLY RELEVANT" GULF STREAM WEAKENING

A 2023 study provided definitive evidence that the Gulf Stream, a major current off the U.S. East Coast, is weakening, slowing by 4% since 1982, with 99% certainty that this weakening is more than expected from random chance. This is the strongest, most definitive evidence we have of the weakening of this climatically relevant ocean current," said the study's lead author, physical oceanographer Chris Piecuch. Although the study didn't conclude whether the Gulf Stream weakening is due to climate change or to natural factors, it stated that future studies should try to identify the cause.

PAST CLIMATE DATA HELPS PREDICT THAT LAND MAY WARM MORE THAN SEA

Ongoing climate change driven by greenhouse gas emissions is often discussed in terms of global average warming. For example, the landmark Paris Agreement seeks to limit global warming to 1.5°C (34.7°F), relative to pre-industrial levels. However, the extent of future warming will not be the same throughout the planet. One of the clearest regional differences in climate change is the faster warming over land than sea. This "terrestrial amplification" of future warming has real-world implications for understanding and dealing with climate change. A paper published about terrestrial amplification described that amplification focuses on how geochemical records of past climate on land and at the sea surface allow scientists to better predict the extent to which land will warm more than oceans—and will also get drier—due to current and future greenhouse gas emissions. "The core idea of our study was to look to the past to better predict how future warming will unfold differently over land and sea," said WHOI's Alan Seltzer, an assistant scientist in the Marine Chemistry and Geochemistry Department and the paper's lead author. Ultimately, understanding land versus sea temperatures may improve climate models.

©NASA

BOTTLENOSE DOLPHINS COMMUNICATE IN "MOTHERESE" WITH THEIR OFFSPRING

WHOI scientist Laela Sayigh co-led a study with the Chicago Zoological Society's Sarasota Dolphin Research Program that showed that humans are not the only mammals to use baby talk with their offspring. The study documented that bottlenose dolphins also modify their communication with their calves. The research was based on analysis of recordings made during brief catch-and-release health assessments of wild bottlenose dolphins (*Tursiops truncatus*) in waters near Sarasota Bay, Florida.

WHOI LEADS MAJOR OCEAN MONITORING PROGRAMS

In 2023, the National Science Foundation renewed WHOI's contract to operate and maintain the Ocean Observatories Initiative (OOI). This science-driven ocean observing network delivers real-time data to answer critical science questions about the world's oceans. The data, which is shared publicly online, is collected from more than 900 autonomous instruments on the seafloor and on moored and free-swimming platforms that are serviced during regular, ship-based expeditions to the array sites. WHOI has led operations and management aspects of the OOI since 2018. Other OOI leaders include University of Washington and Oregon State University.

WHOI also assumed management of the National Science Foundation-funded Oleander Project, a 30-year effort to monitor circulation in the Northwest Atlantic Ocean using data gathered from sensors mounted on or launched from a cargo ship that makes regular crossings of the Gulf Stream. Magdalena Andres, an associate scientist in WHOI's Department of Physical Oceanography, is heading the effort, which began in 1992 under the leadership of the University of Rhode Island Graduate School of Oceanography and Stony Brook University School of Marine and Atmospheric Sciences.

Funders: National Science Foundation and NASA.

MAKING WAVES FOR THE OCEAN AT COP28

Top ocean scientific, philanthropic, and other stakeholder organizations, led by WHOI and Scripps Institution of Oceanography, came together to highlight the global ocean at the 28th Conference of the Parties (COP28) in Dubai, United Arab Emirates. The ocean leaders gathered in the Ocean Pavilion for a second year to underscore the integral role of our ocean in climate and to exchange ideas for leveraging ocean science and solutions to help with the climate crisis. A major highlight was the unveiling of the $250 million ORCA Fund to super-charge ocean-based climate solutions. Private donor partners including Bloomberg Philanthropies, Builders Vision, Oceankind, and others were among the fund's supporters. Another highlight was the release of the Dubai Ocean Declaration emphasizing the need for ocean science and observations as critical for understanding ongoing global climate changes. More than 45 international ocean science, policy, and philanthropic organizations signed the declaration.

WHAT DRIVES THE GREAT ATLANTIC SARGASSUM BELT?

Floating *Sargassum* in the Sargasso Sea provides habitat for hundreds of types of organisms, including fishes, birds, and turtles. But, since 2011, the Great Atlantic *Sargassum* Belt (GASB) has exploded in size across the

central Atlantic Ocean, inundating Caribbean coastlines with seaweed, harming ecosystems, challenging coastal communities, and threatening human health.

Researchers from WHOI, Texas A&M University, Florida Atlantic University, University of South Florida, and University of Alaska Fairbanks analyzed *Sargassum* tissue to learn the cause of the boom. High nitrogen and phosphorous found in the tissue revealed "a smoking gun that GASB inundations are nutrient driven," according to WHOI scientist and project lead, Dennis McGillicuddy. Arsenic, a highly toxic chemical, was also found in *Sargassum* tissue, indicating the washed-up seaweed should be handled with caution. For now, scientists suspect rivers are a possible source for these nutrients, although further research is needed to identify which rivers could be driving the GASB.

Funders: National Science Foundation, WHOI, the Isham Family Charitable Fund, the State of Florida, and NASA Beta.

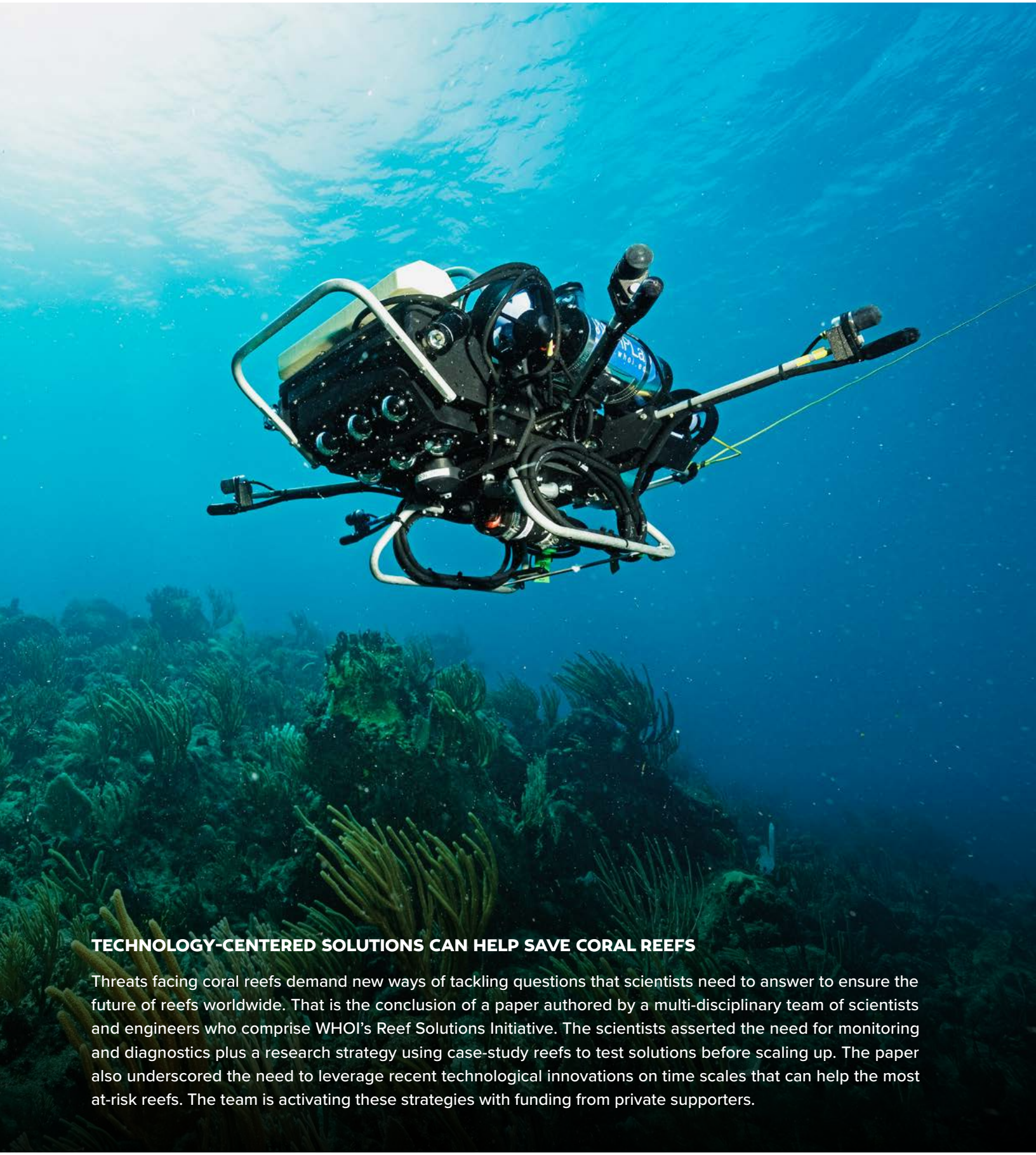
OCEAN TWILIGHT ZONE IS ECOLOGICALLY IMPORTANT TO LARGE MARINE FISHES

Electronic tags, shipboard acoustics data, Earth-observing satellites, and data-assimilating ocean models provided by multiple scientific sources showed that the ocean's mesopelagic zone, also called the ocean twilight zone (OTZ), is ecologically significant to large marine fishes that are considered surface dwellers. The research, led by WHOI assistant scientist Camrin Braun, demonstrated that large predatory fishes like sharks, tunas, and billfish make a surprising number of visits to the deep ocean—particularly the OTZ, which lies between 200 and 1,000 meters (656 and 3,280 feet) below the surface. The data also revealed that OTZ has been overlooked as critical habitat for large predator species.

Funders: The Coastal Research Fund in Support of Scientific Staff and the Investment in Science Fund at the Woods Hole Oceanographic Institution, the WHOI President's Innovation Fund and Postdoctoral Scholar Program at Woods Hole Oceanographic Institution with funding provided by the Dr. George D. Grice Postdoctoral Scholarship Fund, UK Natural Environment Research Council, the European Research Council, a Marine Biological Association Senior Research Fellowship, and the King Abdullah University of Science and Technology, and IslandShark (PTDC/BIA-BMA/32204/2017), AEROS-Az (ACORES-01-0145-FEDER-000131), MEESO (EU H2020-LC-BG-03-2018), and Mission Atlantic (H2020-LC-BG-08-2018-862428). This work was part of the Woods Hole Oceanographic Institution's Ocean Twilight Zone Project, funded as part of the Audacious Project housed at TED.

Austin Greene © Woods Hole Oceanographic Institution

WHOI's autonomous robot CUREE monitors coral reefs in St. John, U.S. Virgin Islands. Photo by Austin Greene © Woods Hole Oceanographic Institution



TECHNOLOGY-CENTERED SOLUTIONS CAN HELP SAVE CORAL REEFS

Threats facing coral reefs demand new ways of tackling questions that scientists need to answer to ensure the future of reefs worldwide. That is the conclusion of a paper authored by a multi-disciplinary team of scientists and engineers who comprise WHOI's Reef Solutions Initiative. The scientists asserted the need for monitoring and diagnostics plus a research strategy using case-study reefs to test solutions before scaling up. The paper also underscored the need to leverage recent technological innovations on time scales that can help the most at-risk reefs. The team is activating these strategies with funding from private supporters.

Education Highlights

In 2023, Dean Meg Tivey retired from the Academic Programs Office (APO) after six years of outstanding service. Senior Scientist Rob Evans stepped in as interim dean, while a search is underway for a permanent replacement.

Educational activities were central to WHOI's mission, with postdocs and students contributing to campus vibrancy and research innovation. K-12 activities engaged some 2,500 students on-site during 88 separate events, with the George and Wendy David Center for Ocean Innovation serving as a key classroom visit attraction.

The education program continued to improve diversity, equity, and inclusion at WHOI, with a strong incoming Joint Program cohort, as well as Summer Student Fellows and Partnership in Education Program students on campus. WHOI also hosted a weeklong program with members of the Black Girls Dive organization, the first of a partnership we hope will grow into a regular series of internships and engagements.

APO also oversaw the second year of the Blue Economy Program, a partnership between WHOI, Cape Cod Community College (4Cs) and UMass Dartmouth. WHOI also hosted summer interns from 4Cs who participated in the CC-Crew program, established in 2015. These programs provide research and training opportunities to underserved local students and are an important WHOI staffing recruitment vehicle.

Blue Economy students on a tour of Woods Hole, January, 2023 (Photo: Kama Thieler).

SUMMER STUDENT FELLOWSHIP PROGRAM

Academic Programs received 330 complete applications for the 2023 Summer Student Fellowship. Of those, 91 were international students, and 68 were U.S. citizens or permanent residents from groups underrepresented in the ocean sciences. A cohort of 24 students spent 12 weeks at WHOI. Of the group, 10 participants were funded by a grant from the National Science Foundation, the rest were funded through endowed funds and gifts.

Many of the students presented their work at national meetings, including Society for Advancement of Chicanos/Hispanics & Native Americans in Science, the fall American Geophysical Union meeting, and the meeting of the American Meteorological Society. Nash Ward, from the University of Utah, worked with scientists Alan Condron and Claudia Cenedese on tank experiments exploring how sediment layers trapped within ice accelerate iceberg melting and breakup, a newly identified mechanism of deterioration. Their work was presented at the 76th Annual Meeting of the American Physical Society Division of Fluid Dynamics, in Washington, DC.

BLUE ECONOMY PROGRAM

This was the second year of the Blue Economy Internship Program, a partnership with the University of Massachusetts Dartmouth and Cape Cod Community College. This internship program introduces undergraduate students, typically a cohort of about 10 per year, from local (and frequently underserved) communities to different types of lab-based training, provides them with paid research experiences as they pursue their STEM degrees, and engages them with the local ocean and engineering Blue Economy in their own backyard. The program begins with a two-week WHOI onsite short course in early January. All participants in the short course then carry out a research or lab skills training internship from January through April with a placement in a WHOI laboratory or engineering group. Several Blue Economy participants have returned to WHOI as guest students, interns, or lab workers.

Students on a field trip in St. Croix, USVI. Photo by JP Student Ciara Willis.

MIT-WHOI JOINT GRADUATE PROGRAM

This was the second year running, select MIT-WHOI Joint Program (JP) students were official members of the WHOI Delegation to the annual UN climate conference, traveling to Dubai, UAE in December 2023 to attend COP28. Split into Week 1 and Week 2 cohorts, eight students joined WHOI faculty mentors Chris Piecuch and Sarah Das in this transformative experiential learning opportunity. Students shared their expertise speaking on panels at the Ocean Pavilion, met with policymakers and stakeholders from around the world, and engaged with a wide variety of finance, technology, and non-profit organizations, all working on addressing ocean and climate-related problems and solutions. As part of their Observer status, they also attended international negotiation sessions, hearing firsthand from a diverse set of delegates, including those from the Global South, Global Youth, and Small Island Developing States (SIDS), hammering out global agreements to advance climate action.

The 2023 geodynamics course "Coral Reef Sensing and Solutions" included a weeklong field trip to St. Croix, USVI to introduce students to coral reefs and reef restoration. The group also attended meetings with local government, NGO, scientists, and community stakeholders and were immersed in the priorities, challenges, realities, and successes of conserving and restoring coral reefs. This year's class was the largest geodynamics class in WHOI history with the broadest-ever disciplinary span of students.

JP students continued to lead many of WHOI's scientific publications. Danielle Haas Freeman and others published a 2023 paper detailing how sunlight and changes in temperature impact the solubility of oil in seawater, with the properties of crude oil greatly changed by interaction with sunlight. Their results have changed how the community thinks about approaching mitigation and cleanup of these catastrophic events.

While a number of JP students are supported by external federal grants, contracts, and fellowship awards, many rely on internal support. WHOI's internal fellowships allow flexibility of study and guarantee financial support through the duration of each student's study. The fellowships are supported by endowment gifts and are highly valuable to WHOI, at any level.

U.S. Senator Ed Markey (D-Mass.) shoots a video for his social media channels at the Ocean Pavilion in Dubai with MIT-WHOI Joint Program students (L to R): Iulia Șteangă, Michael Dotzel, Kate Lane, Lina Taenzer. (Photo by Katherine Spencer Joyce, © Woods Hole Oceanographic Institution).

POSTDOCTORAL PROGRAM

There were six members of the incoming cohort of Postdoctoral Scholars, supported through WHOI endowed funds this year and the overall postdoc population grew to 136, the largest since at least 2010. This growth was spurred by internal WHOI support from donor gifts.

The postdocs spanned all WHOI science disciplines and come from more than 20 countries. Highlights of work from this group included Jia-Rui Shi's published papers on the effects of anthropogenic aerosols and other greenhouse gases on ocean warming and postdoc Hannah Mark serving as lead editor for a new community-led, all-volunteer open access scientific journal, *Seismica*. This new breed of journal not only addresses the high costs of publishing, but also breaks down the knowledge barriers to publishing that some scientists might face. Hannah was also lead author on a paper describing the philosophy and methods behind the *Seismica* model.

A postdoc position is a critical period of training and professional development. To help postdocs succeed, WHOI's Academic Programs Office and the Postdoctoral Association ran career development activities throughout the year, including one on preparing a job application, a proposal writing course, and a non-academic career workshop. Postdocs also had the opportunity to meet with federal program managers during the annual Ocean Carbon and Biogeochemistry (OCB) meeting in Woods Hole.

Other Highlights

WHOI RELEASES RARE VIDEO FOOTAGE FROM THE FIRST SUBMERSIBLE DIVES TO RMS *TITANIC*

In February 2023, WHOI released largely never-before-seen footage taken by DSV *Alvin* and ROV *Jason Jr.* on a deep-sea expedition. The video they captured in 1986 of the wreckage of the RMS *Titanic* marked the first time humans set eyes on the ill-fated ship since 1912. WHOI released the *Titanic* footage to the media and premiered it on WHOI's YouTube Channel, timed to coincide with the 25th anniversary of the premiere of James Cameron's film, "Titanic." The footage drew coverage by major news outlets generating more than 3,700 media mentions with an addressable audience or "reach" of 10 billion. In addition, the YouTube video went viral (2.3 million views and 166,000 watch hours), driving notable increases in WHOI's social media followers, reach, and engagements, as well as web traffic on WHOI.edu.

CELEBRATING 50 YEARS OF COMMUNITY LEADERSHIP AND EDUCATION

WHOI Sea Grant, a NOAA-funded program established at WHOI in 1973, celebrated 50 years of impact this year. Through research, outreach, and education, the program leverages marine science to build sustainable economies and environments for Massachusetts' diverse communities. WHOI Sea Grant has been a leader on pressing ocean topics, including water quality, coastal resilience, aquaculture, and marine debris. The program seeded research that led to the creation of the U.S. National Office for Harmful Algal Blooms and helped develop the Ocean Literacy principles used in marine education programs. One of 34 Sea Grant programs across the nation, WHOI Sea Grant is jointly supported by WHOI, NOAA, and Barnstable County.

ANNOUNCING WHOI'S FIRST CHILDREN'S BOOK

In 2023, WHOI offered up its first-ever children's book: *Where the Weird Things Are: An Ocean Twilight Zone Adventure* written by Zoleka Filander and illustrated by Patricia Hooning (Earth Aware Editions. ISBN 9781647225889). The book was inspired by the groundbreaking work of the Ocean Twilight Zone Project, and *Mesobot*, an innovative hybrid robot WHOI designed specifically to study life in this fascinating ocean realm.

In Memoriam

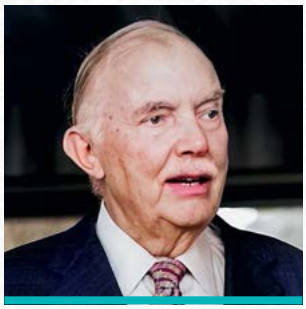
Sadly, Woods Hole Oceanographic Institution lost seven beloved friends and supporters in 2023. Join us in remembering them and their dedication to WHOI and the ocean.

PETER ARON
Trustee,
Corporation Member

PHILANTHROPIC FOCUS
Ocean exploration, President's Fund for Innovation

"Peter was a strong believer in ocean science and exploration. His enthusiasm and passion for understanding how the ocean worked was so prevalent in our conversations whenever I visited him in his office in New York. His support for WHOI was unwavering for many years exemplifying a true commitment to the importance of the ocean for the health of the planet and humanity."

—Bob Gagosian, WHOI President Emeritus



PROFESSOR LEWIS BRANSCOMB
Trustee, Life Trustee

PHILANTHROPIC FOCUS
Unrestricted support and postdoctoral scholarships

"I met Dr. Branscomb in the early 1990s at a WHOI meeting. He was then the director of the Science, Technology and Public Policy Program at Harvard's Kennedy School. As a somewhat nervous early career scientist, I found him very approachable, sharing with me his experience in research and travel. He was very much interested in what I was doing at the Marine Policy Center and emphasizing the importance of understanding the science-policy interface. He was passionate about helping early career scientists to grow at WHOI."

—Di Jin, WHOI Marine Policy Scientist

MARVIN DAVIDSON
Corporation Member

PHILANTHROPIC FOCUS
Unrestricted support

"My father loved the ocean. He said many times he was happiest when out at sea and he enjoyed exploring remote places up and around Nova Scotia. He supported WHOI as he felt the Institution's work helped protect the oceans so future generations would be able to continue to enjoy time out on and around the sea. He was also focused on the world's increased love for consuming seafood and remarked that a gatekeeper like WHOI would be needed to protect the finite supply of the oceans."

—Scott Davidson, Marvin's son

ROBERT A. DAY, JR.
Trustee,
Corporation Member

PHILANTHROPIC FOCUS
President's Fund for Innovation, ROV Jason II, Keck Foundation

"Robert was a wonderful example of the importance of national scientific leadership. Beyond his deep dedication to WHOI as a Trustee and Life Trustee, he led the Keck Foundation's important work to expand our nation's science funding."

—Peter de Menocal, WHOI President and Director

WILLIAM C. MORRIS

Trustee, Corporation Member

PHILANTHROPIC FOCUS

Unrestricted support, red tide control, corals as archive of mercury contamination

"Bill was a devoted WHOI leader who was committed to supporting environmental research. We are grateful for his generosity over the years."

—Court Clayton, WHOI Chief Development Officer

CECILY CANNAN SELBY, PHD

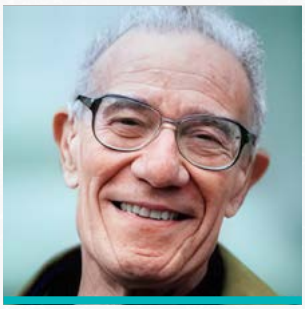
Trustee, Life Trustee

PHILANTHROPIC FOCUS

Education, endowed chairs, unrestricted giving

"Cecily Cannan Selby was in the vanguard of women scientists, earning a PhD in Biophysics from MIT in 1950. She had a pathbreaking career as a researcher, educator, executive, corporate, and non-profit board member. Cecily was a passionate and generous WHOI trustee and supporter, and we miss her."

—Jamie Clark, WHOI Corporation Chair



PROFESSOR ROBERT SOLOW

"One thing that attracted my dad to WHOI was the emphasis on basic science. Irrespective of the undeniable tangible benefits that basic science provides, he believed that, by itself, the free pursuit of knowledge elevates society. And as an economist, he greatly admired WHOI's entrepreneurial spirit. Also, he thought the ships were cool."

—Andrew Solow, WHOI Scientist Emeritus, former Marine Policy Center Director, and Robert's son

Danniel Hentz ©Woods Hole Oceanographic Institution

“We’re spending $48 billion to go to the moon, and just a tiny fraction of that on the ocean. But it’s on our planet and we can’t survive without it.”

—WHOI Board Chair Paul Salem

The Power of Giving in 2023

Private philanthropy from generous individuals and foundations keeps WHOI at the forefront of ocean science and advances knowledge and solutions at a time of urgent need. Meet some of the year's visionary supporters.

BOARD CHAIR PAUL SALEM JUMPSTARTS OCEAN-BASED CLIMATE SOLUTIONS

About six months into his time as WHOI's board chair, Paul Salem had the opportunity to dive in *Alvin*, WHOI's famous human-occupied submersible, and visit the watery universe beneath the waves.

Describing the experience of sinking towards the ocean floor, Salem said, "All of a sudden it gets black after 150 meters, and you see these alien lifeforms that look like they're from "Men in Black." When you get to the bottom, they turned a light on and all you see are starfish."

"It was like going into space. We're spending $48 billion to go to the moon, and just a tiny fraction of that on the ocean. But it's on our planet and we can't survive without it."

Luckily, as board chair and the donor of a recent $25 million gift to WHOI, Salem is working to ensure that both the ocean and the rest of us survive on our planet.

After retiring from private equity, Salem spent the last few years learning about climate change and the oceans—particularly how the ocean might offer some solutions in the fight against human-induced climate change.

Salem's gift will be used to help jumpstart climate solutions and projects. In particular, it will be used as "seed funding" for projects focused on environmental measurement reporting and verification (eMRV) and field trials for ocean-based carbon capture solutions, which could play an important role in helping to draw down carbon dioxide from atmosphere.

"It's really important that we have the best, independent scientists figuring out if this really works, if it is safe. WHOI can help write the rule book by providing the foundational scientific understanding and real-time measurement capabilities to demonstrate how carbon flows through the ocean and how human interventions might affect that flow.

"There are really great solutions here, we've just got to figure them out," Salem says. "Why the U.S. government isn't throwing bazillions of dollars at this is beyond my belief, but people haven't figured it out yet," adding, "sometimes the easiest solutions are the simplest."

Leveraging the power and genius inherent in the ocean is exactly the kind of simple-but-elegant work that scientists at WHOI are uniquely able to do, providing world-class research as well as leadership on exploring and protecting the ocean, without which, as Salem says, we can't survive.

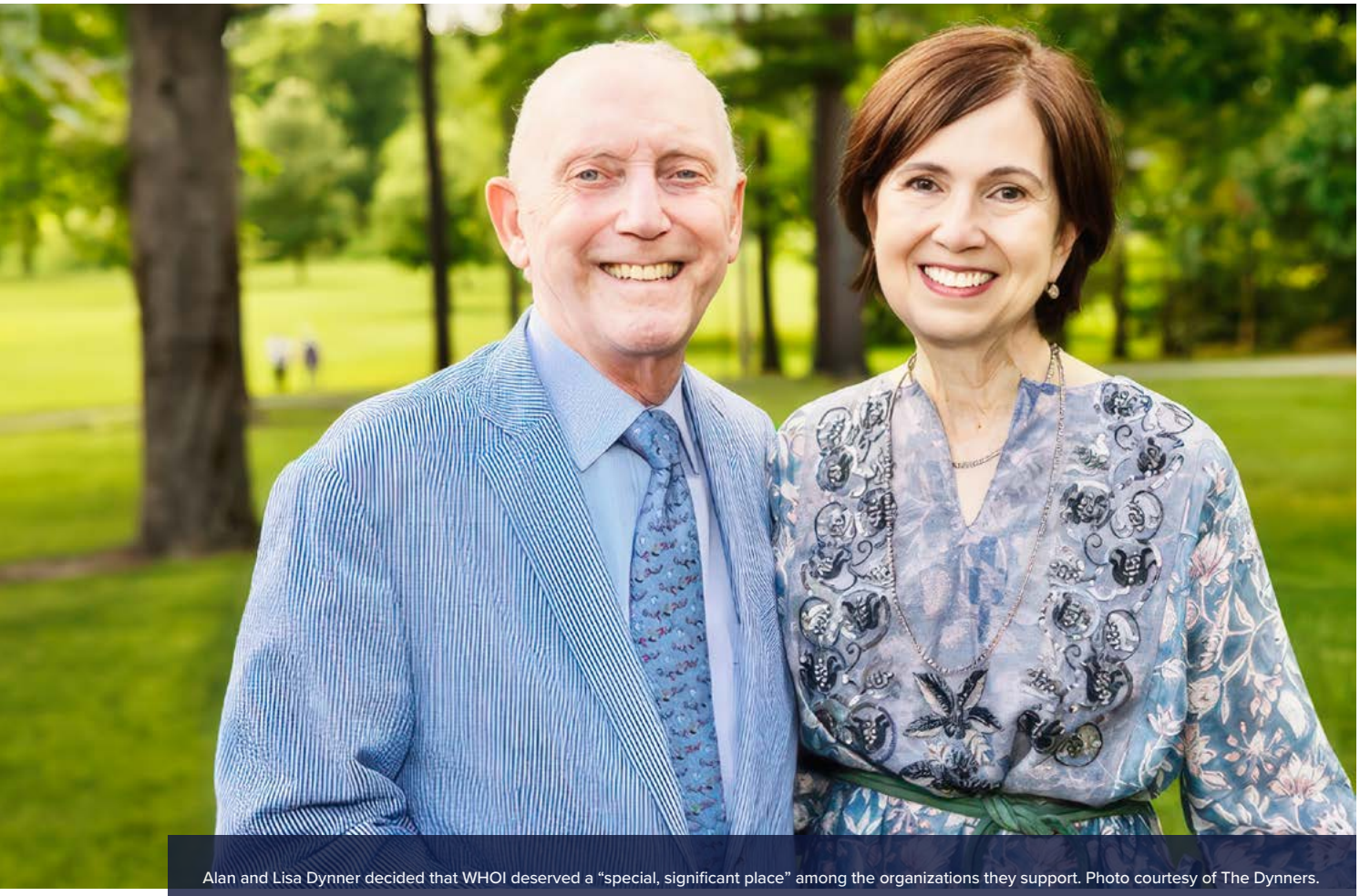
THE G. UNGER VETLESEN FOUNDATION IS AN OCEAN SCIENCE CHAMPION

At WHOI, the G. Unger Vetlesen Foundation carries an ocean of respect and gratitude for a funder that, for 37 years, has consistently provided more than $24 million in funding—much of it discretionary.

"Vetlesen's commitment to discretionary giving has been game-changing, not only for WHOI but for the entire oceanographic community," says WHOI President and Director Peter de Menocal. "Discretionary gifts like theirs provide flexibility to allocate funds where they can be most effective, stability in the form of a financial cushion when needed, and they can often leverage additional funding or provide matching funds that traditional funders sometimes require. Discretionary funding is also key to innovation, since it provides freedom from strict requirements associated with restricted grants."

The Vetlesen Foundation is known for its "long-term commitment to voluntarily aiding and contributing to scientific, cultural, educational, and other charitable initiatives."

Over nearly four decades, the Foundation has enabled WHOI to deploy funding where it can make the most impact, enabling its leadership to nimbly advance ocean



Alan and Lisa Dynner decided that WHOI deserved a "special, significant place" among the organizations they support. Photo courtesy of The Dynners.

knowledge and solutions to pressing ocean-related problems. Vetlesen has also supported numerous other ocean science leaders, including Columbia University's Lamont-Doherty Earth Observatory, Scripps Institution of Oceanography at the University of San Diego, and the University of Rhode Island Graduate School of Oceanography.

"Ocean science and WHOI would not be where they are today without the Vetlesen Foundation," says de Menocal. "We are tremendously thankful to George Unger Vetlesen for his foresight in creating the foundation in 1955 and to Ambrose K. Monell and his team for sustaining the foundation and its ongoing commitment to oceanography."

"The Vetlesen Foundation is proud of its longstanding affiliation with WHOI and many other leading ocean science research and academic institutions," says Monell. "Over the decades, the collaboration between their scientists have contributed in innumerable ways to scientific discovery, shedding light on some of the ocean's most intriguing mysteries and secrets. We look forward to a continued and productive partnership with WHOI and the ocean science community."

The Vetlesen Foundation is a private philanthropic organization established in 1955 by the Norwegian-American shipbuilder George Unger Vetlesen. The foundation provides support in the Earth sciences for institutions of excellence.

ALAN AND LISA DYNNER: A GIFT TO HELP PRESERVE CORAL REEFS

Corporation Members Alan and Lisa Dynner, retired from successful careers in law and finance, have a deep passion for supporting marine conservation through their philanthropy and volunteer work.

Alan has personally observed the decline of coral reefs from their once pristine status. "My family moved to South Florida in 1956 and after reading Cousteau's *The Silent World*, I couldn't wait to go underwater and see that world for myself," says Alan. He learned to SCUBA

dive while in high school and spent many weekends diving in the Keys, "marveling at the gorgeous reefs and abundance of fish." In the 60 years that followed, Alan explored coral reefs throughout the Caribbean and the Pacific. "I have been thrilled to see them, and over time, disappointed to witness the degradation of reefs and marine life," he says. "It's what has made me so determined to support ocean research and conservation." Lisa shares Alan's love of coral reefs and the ocean and, while not a diver, she has explored coral reefs through snorkeling, reading, watching films, and participating in ocean conservation non-profits.

The Dynners had known about WHOI for many years "by its reputation" before getting more involved. And the more they learned, the more interested they became. "We were especially intrigued by the depth and breadth of scholarship and the marriage of science and engineering that are the hallmarks of WHOI," says Alan. "We were excited to join WHOI and learn more about the ocean and its future."

By late 2023, Alan and Lisa decided that WHOI deserved "a special, significant place" among the organizations they support, and the Reef Solutions Initiative's scientists and engineers inspired the couple to make a significant gift to the project.

Lead Reef Solutions Scientist Amy Apprill says the Dynners' gift is accelerating the project just in time. "Taking immediate action may help keep reefs from being destroyed by 2050," she adds. Apprill and the Reef Solutions Team are working as quickly as possible to deploy new technologies for assessing reef health and devising treatments and toolkits for treating declining reefs.

Alan and Lisa are optimistic but realistic about what might be done at this stage. According to Alan, "While coral reefs as we know them may not survive extreme global warming, we felt it important to do everything possible to preserve them to the extent feasible."

THE GRAYCE B. KERR FUND: GIVING A LEG UP TO EARLY CAREER SCIENTISTS

Life as an early career scientist is not for the faint of heart. It is a complex juggling act wherein new scientists must establish themselves by building key collaborations and growing their body of work, while also seeking funding to support their salaries and their research.

One funder sympathetic to these challenges is the Grayce B. Kerr Fund, who this year pledged $1.6 million to establish its second Early Career Scientist Endowed Chair at WHOI. The chairs assist scientists in launching their research at a critical juncture, while memorializing devoted WHOI Trustee and Corporation Member, the philanthropist Breene M. Kerr. "Breene was an avid sailor, passionate about the ocean and science, and profoundly committed to WHOI," says John Valliant, Grayce B. Kerr Fund president.

The first Breene M. Kerr Early Scientist Chair was established in 2017 and to date has supported four early career scientists. WHOI associate scientist Carolyn Tepolt (Biology) was chair holder from 2021 to 2023. "The Kerr Chair gave me the intellectual freedom to pursue new questions as I was getting started at WHOI—primarily pilot projects on marine parasites and how they influence host ecology and evolution," says Tepolt. "I'm fascinated by parasites as evolutionary drivers and am grateful to the Kerr Fund for helping me and other early career scientists to grow and expand our research programs at WHOI." Other Breene M. Kerr Chair awardees include Matthew Long (Applied Ocean Physics and Engineering); Tristan Horner (Marine Chemistry and Geochemistry), and Maria Pachiadaki (Biology).

Early career chairs provide a powerful leg up for new scientists just as they are establishing themselves and their labs. These and other chairs are a great way to attract and retain talent and are a powerful funding vehicle.

The Grayce B. Kerr Fund, Inc. is a Maryland-based independent philanthropy that supports educational achievement and cultural growth. The Grayce B. Kerr Fund, Inc. seeks opportunities for significant impact by strategically investing in the health and viability of organizations and innovative programs in the Fund's areas of interest.

> "Breene was an avid sailor, passionate about the ocean and science, and profoundly committed to WHOI."
>
> —Grayce B. Kerr Fund president John Valliant

Danniel Hentz ©Woods Hole Oceanographic Institution

WHOI TRUSTEE SARAH JOHNSON GENEROUSLY SUPPORTS OCEAN INNOVATION

Sarah Johnson hasn't always been interested in the ocean, but the last few years have changed that. She started living full time on the coast, splitting her time between a barrier beach in the winter and island life in the summer. As her exposure to the sea increased, so did her interest; but it really piqued when good friend, Peter de Menocal, left a tenured position in academia to helm WHOI as its president and director.

Johnson recalls asking Peter: "What would make you do that? His response was: 'You know, the oceans are what's going to save the planet.' And the more I learn about that, the more I realize it's true," says Johnson.

When de Menocal asked her to join WHOI's board, she said yes, even though it meant leaving a college board she had served on for more than two decades. "I'm a big proponent of academia and supporting academia, but this is just too important," Johnson says. So, in 2023 she named WHOI in her will and made a large, ongoing donation to the President's Fund for Innovation.

Sarah's gift is empowering her friend, Peter, and all future WHOI presidents and directors with monies to deploy for innovation. The President's Fund enables WHOI scientists and engineers to develop solutions to pressing problems as they arise, rather than having to wait for other funding sources to materialize. It supports initiatives to increase diversity in the sciences as well as opportunities to forge partnerships with other institutions. Given recent concerning developments in the ocean—extremely low levels of Antarctic sea ice, excessive water temperatures in the Caribbean and beyond, and changes in ocean currents—the need for innovation has never been more urgent.

"The last year or so has really proven that it's more critical than ever to be putting money towards ocean research," Johnson says, and she hopes her donation will encourage others to give. Her generous gift is structured to support the President's Fund annually, and also establishes a permanent endowment moving forward for strategic ocean research and efforts to find solutions to the climate crisis.

"There's no time to waste in funding ocean-based projects that could help curb climate change before it crosses a tipping point and goes completely beyond our control," says Johnson. "This is too important."

"There's no time to waste in funding ocean-based projects that could help curb climate change before it crosses a tipping point and goes completely beyond our control."

—WHOI Trustee Sarah Johnson

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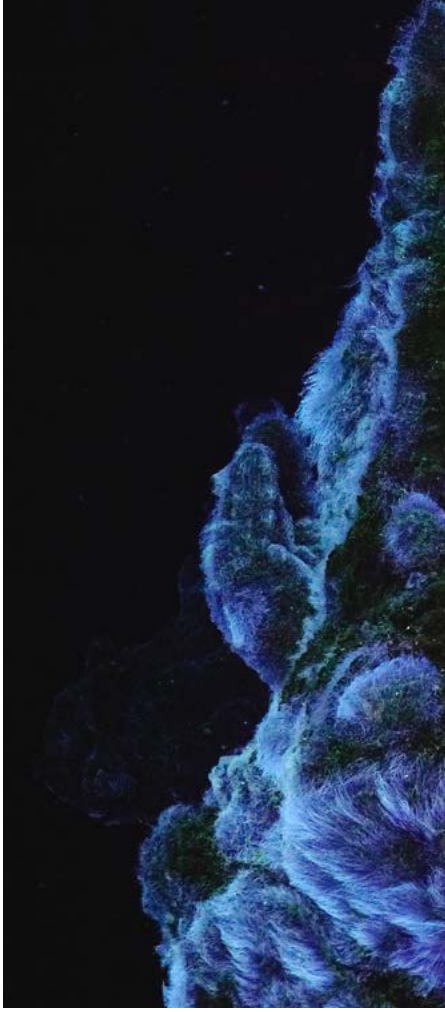
Human-occupied vehicle *Alvin* surfaces after exploring newly discovered coral reefs in the Galápagos Marine Reserve in April 2023, photographed by *Alvin* Group lead Bruce Strickrott. The extensive, ancient deep-sea coral reefs here are the first of their kind to be documented inside the marine protected area since it was established in 1998. WHOI emeritus Daniel Fornari co-led the expedition. In this photo *Alvin* engineer Matt Skorina and R/V *Atlantis* crewmember Mike Sessa are swimmers in the recovery process, talking to *Alvin* pilot Nick O'Sadcia inside the sub, and *Atlantis* chief mate Eric Piper is the small boat coxswain. Bruce Strickrott © WHOI



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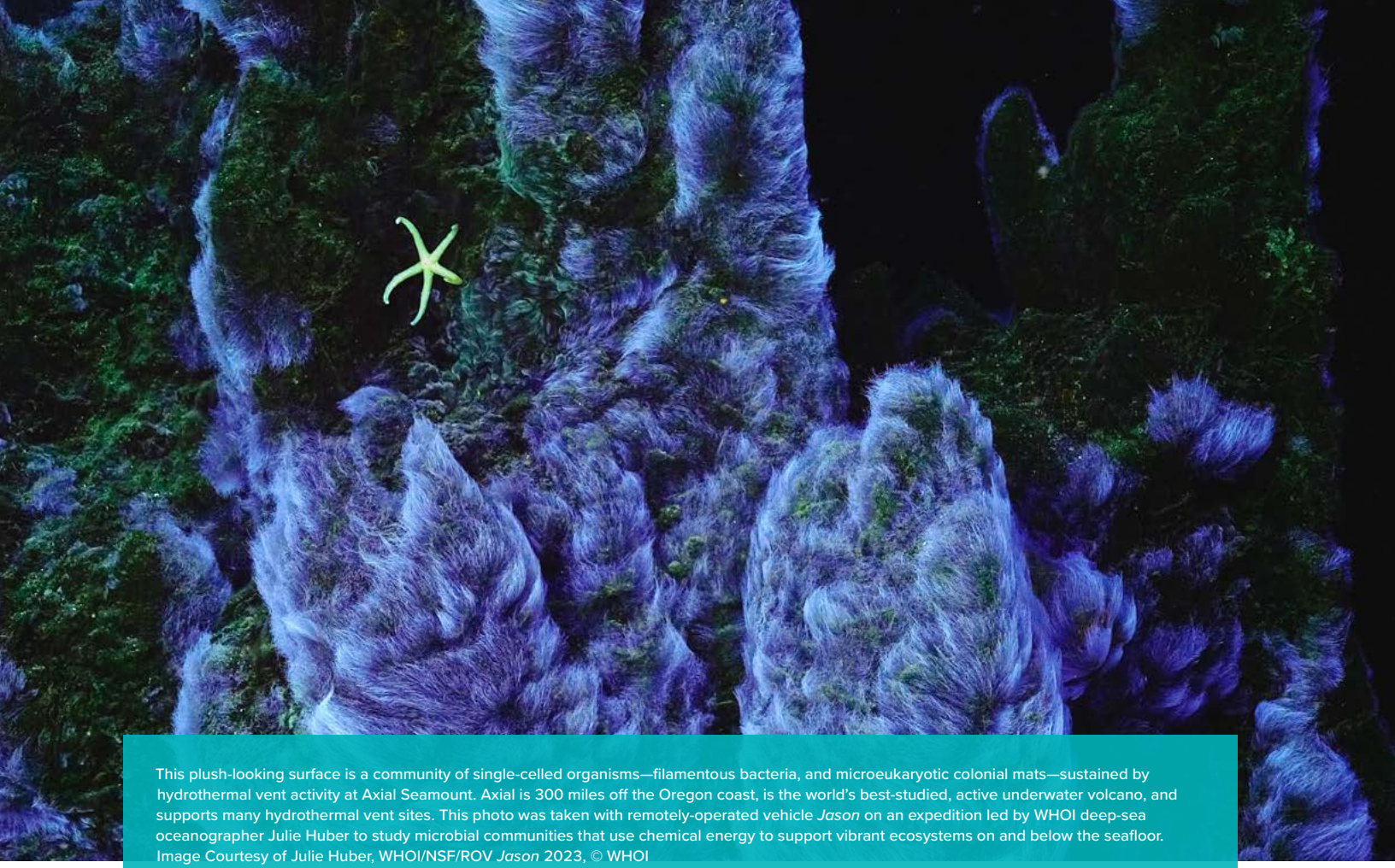

This plush-looking surface is a community of single-celled organisms—filamentous bacteria, and microeukaryotic colonial mats—sustained by hydrothermal vent activity at Axial Seamount. Axial is 300 miles off the Oregon coast, is the world's best-studied, active underwater volcano, and supports many hydrothermal vent sites. This photo was taken with remotely-operated vehicle *Jason* on an expedition led by WHOI deep-sea oceanographer Julie Huber to study microbial communities that use chemical energy to support vibrant ecosystems on and below the seafloor. Image Courtesy of Julie Huber, WHOI/NSF/ROV *Jason* 2023, © WHOI

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A black-browed albatross (*Thalassarche melanophris*) soaring through the mist near a breeding colony on New Island, Falkland Islands. During his graduate studies, WHOI postdoctoral scholar Francesco Ventura spent time collecting demographic and migration data on birds in the colony by monitoring around 400 nests and deploying GPS trackers on birds to understand their movements at sea during the breeding season. Francesco Ventura © WHOI

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These freckled hawkfish (*Paracirrhites forsteri*) were photographed by WHOI biologist Simon Thorrold while he was researching the abundance of corals and fishes in the Red Sea near Saudi Arabia. While the science team found some evidence of coral bleaching during the fieldwork, other reefs, like this one, were thriving. Hawkfish are approachable and frequently photographed, but it's rare to see two fish on one coral head. When Thorrold was taking this photo, he was focusing on a single fish and suddenly the second one appeared—just long enough to get this picture. Simon Thorrold © WHOI

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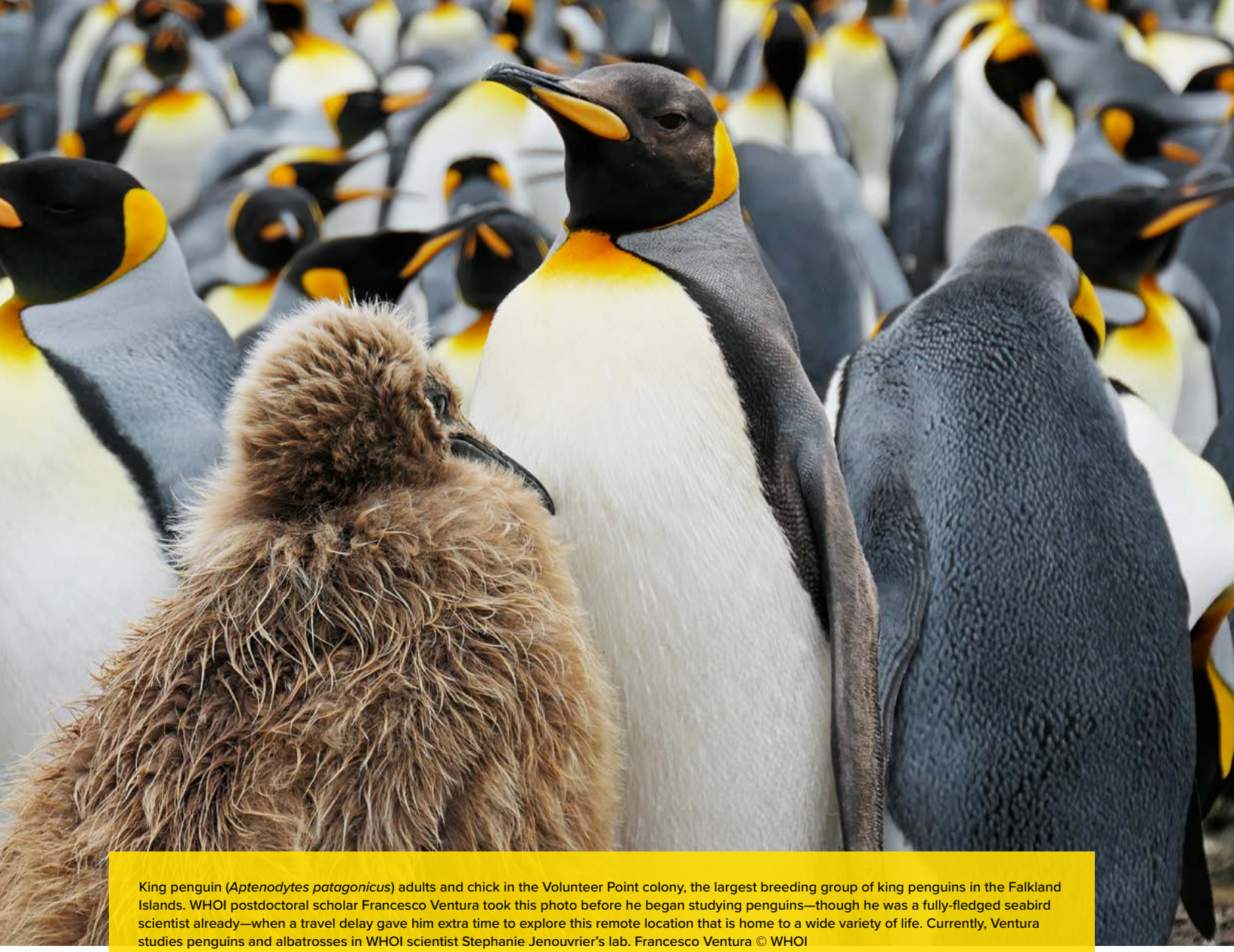

King penguin (*Aptenodytes patagonicus*) adults and chick in the Volunteer Point colony, the largest breeding group of king penguins in the Falkland Islands. WHOI postdoctoral scholar Francesco Ventura took this photo before he began studying penguins—though he was a fully-fledged seabird scientist already—when a travel delay gave him extra time to explore this remote location that is home to a wide variety of life. Currently, Ventura studies penguins and albatrosses in WHOI scientist Stephanie Jenouvrier's lab. Francesco Ventura © WHOI

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Corals and small fish at a reef near Apo Island, Dauin, Philippines. This area in the western Pacific Ocean is known as the Coral Triangle. Diverse corals and marine life here support more than 120 million people with food, work, and storm protection. MIT-WHOI Joint Program student Ciara Willis dove here after presenting her findings on tuna management strategies to the World Wildlife Fund Sustainable Tuna Partnership in Manila. Apo Island was established as a Marine Sanctuary in 1982 to protect local fish stocks and is now ranked in the top 100 dive sites in the world. Ciara Willis © WHOI

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2023 Institution Leadership

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Deputy Director and Vice President for Science and Engineering

Dr. Richard W. Murray

Interim Vice President for Academic Programs and Dean

Dr. Robert L. Evans

Vice President for Marine Facilities and Operations

Mr. Robert S.C. Munier

Vice President for Operations and Chief Financial Officer

Ms. Kathryn Link

Vice President for Advancement and Chief Marketing Officer

Mr. Samuel C. Harp

Chief Diversity Equity and Inclusion Officer

Ms. Natalie Nevarez

Vice President for Business and Legal Affairs, General Counsel

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Dr. Young-Oh Kwon

Marine Policy Center

Dr. Kilaparti Ramakrishna

Brown skuas (*Stercorarius antarcticus*) perched on a rock at Biscoe Point on Anvers Island, off the Antarctic Peninsula. The glacier in the photo has receded quickly in recent decades, revealing that Biscoe Point is actually an island. This area is one of the most rapidly changing environments in the world and is designated as an Antarctic Specially Protected Area. WHOI researchers are part of a multi-institutional Long-Term Ecological Research program studying climate change, the flow of nutrients among plankton in coastal waters, and larger organisms that depend on plankton. Photo taken under ACA permit# 2021-002. Benjamin Van Mooy © WHOI

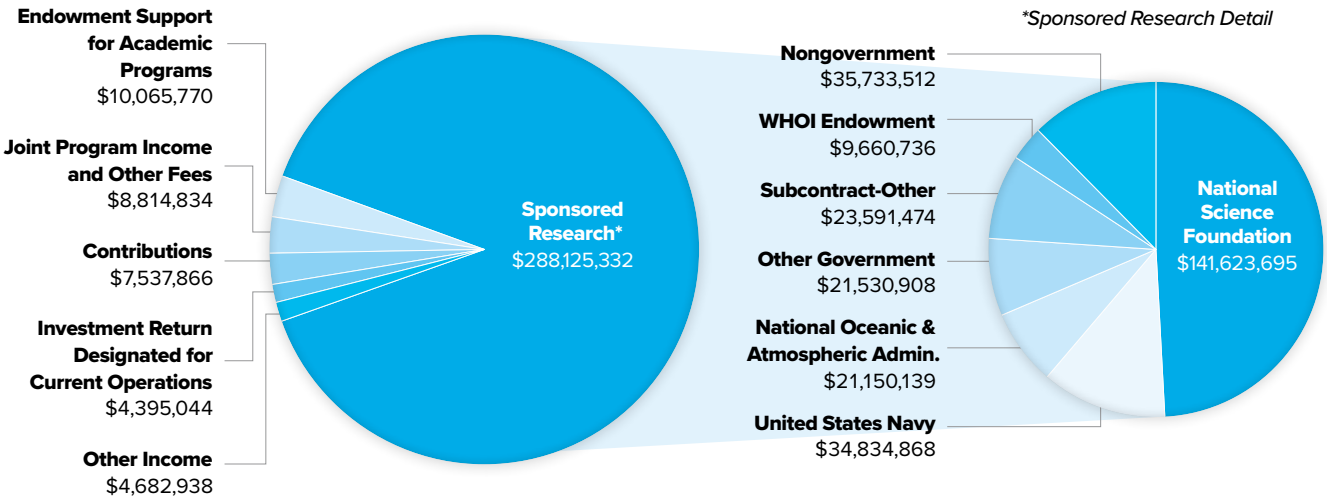
2023

Financial Statements

We are pleased to present the 2023 financial statements of the Woods Hole Oceanographic Institution (WHOI). We are grateful to our many funders, both private and public, for their support of WHOI's mission of ocean research, exploration, and education.

The Institution continued to deliver its mission in the face of ongoing political and economic turbulence due to climate change, post pandemic, and political conflict around the globe. Our scientists, engineers, and technical and support staff led our increase of 12 percent to our total funded sponsored research portfolio. Sponsored research funding increased across major funding agencies with the National Science Foundation leading the way. We continued to make significant investments in our fundraising activities and finished the year with record commitments. Ship operations increased by 3.5 percent as both vessels were fully operational in 2023. Our investment portfolio experienced positive returns in the face of inflationary pressures and interest rates remaining high, ending 2023 with a market value of $472.0 million, which includes $148.6M in Receivable for Investments Sold. With interest rates remaining consistent from 2022, the defined benefit obligations of the Institution decreased slightly $57.6 million to approximately $57.1 million. We are grateful to our trustees for their generosity and fiduciary guidance.

REVENUES: $323,621,784



STATEMENT OF FINANCIAL POSITION

As of December 31, 2023, WHOI's total assets were $775.0 million, total liabilities were $182.4 million, and total net assets were $592.6 million. Net assets represent the accumulated financial strength of a not-for-profit organization and are an important gauge of its ability to carry out its mission. The investment portfolio, including the Receivable for Investment Sold, of $472.0 million, represents 61 percent of the total assets as of December 31, 2023.

STATEMENT OF ACTIVITIES

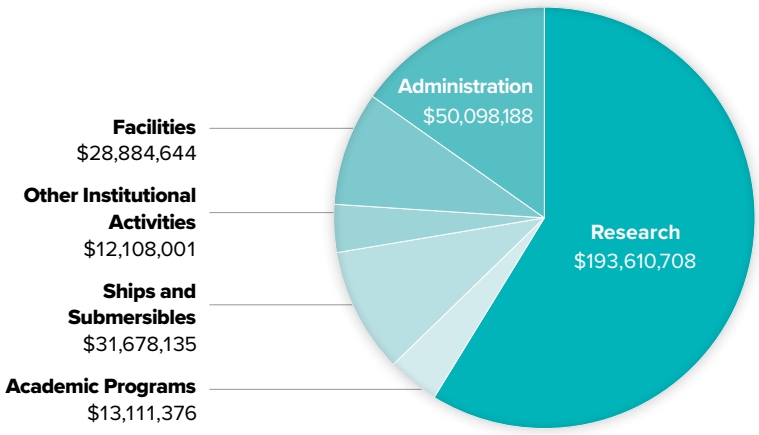
WHOI's total revenues without donor restrictions increased by $30.4 million; from $293.2 million in 2022 to $323.6 million in 2023; and the Institution's change in net assets from operating activities was a loss of over $5.9 million. Our $22.2 million of endowment income and appreciation was distributed to operations as follows:

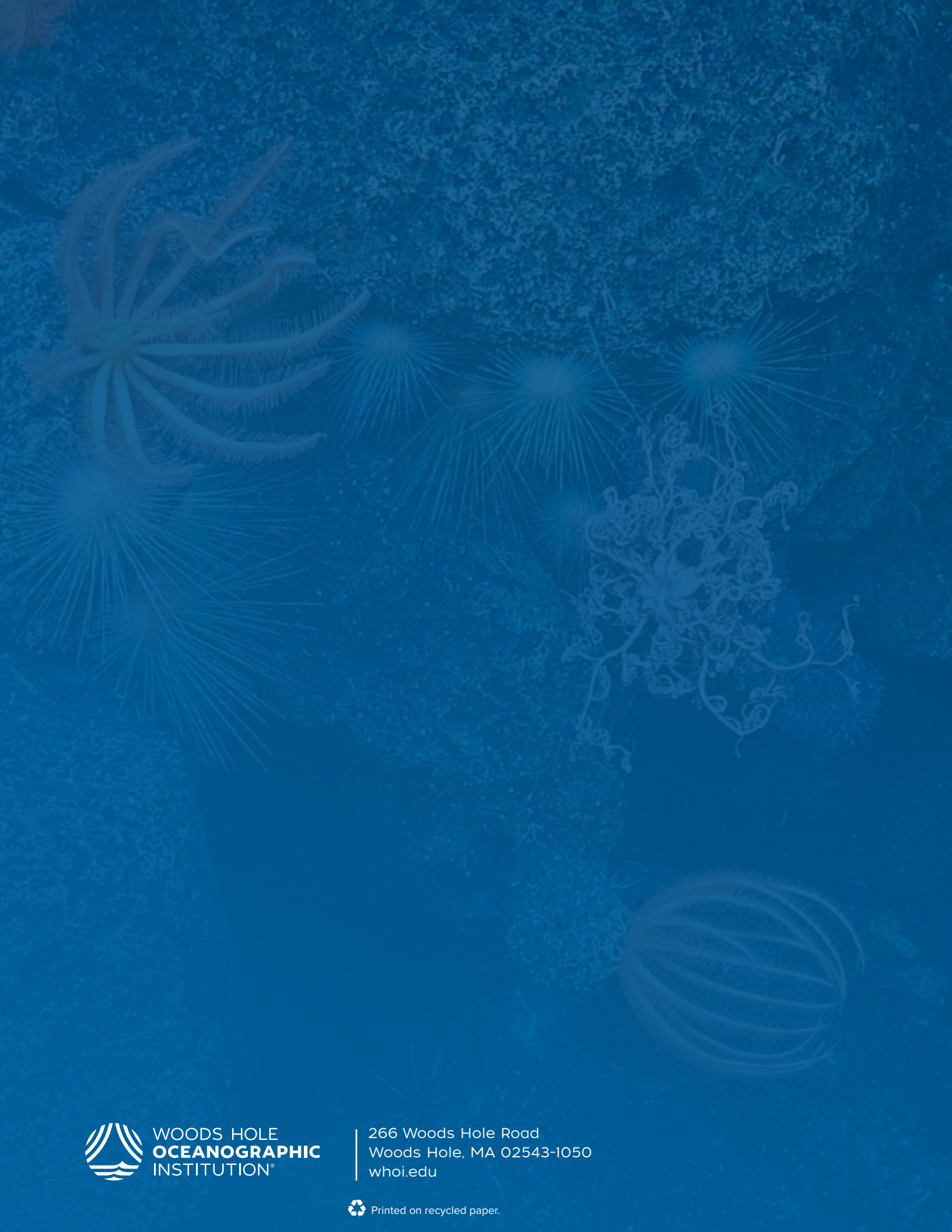
- Education: $9.7 million
- Research: $8.1 million
- Unrestricted: $4.4 million

The Institution had facilities and administration costs of $79.0 million, and approximately 83 percent of that amount, $65.3 million, was recovered from government and nongovernment research. This included $2.9 million of interest associated with the Series 2018 Bonds. The remainder was institutional expenses.

It was another exceptional year for fundraising, with philanthropy playing a crucial role in advancing our research and educational programming objectives. In 2023, current-use giving and endowment income comprised 19.9 percent of the Institution's revenue. A total of 7,431 supporters contributed $90.6 million in new commitments, including $19.2 million in bequest intentions. The ongoing generosity of WHOI's supporters continues to fuel the momentum for WHOI's Vision 2030 roadmap for advancing ocean science for the global good.

EXPENSES: $329,491,052





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