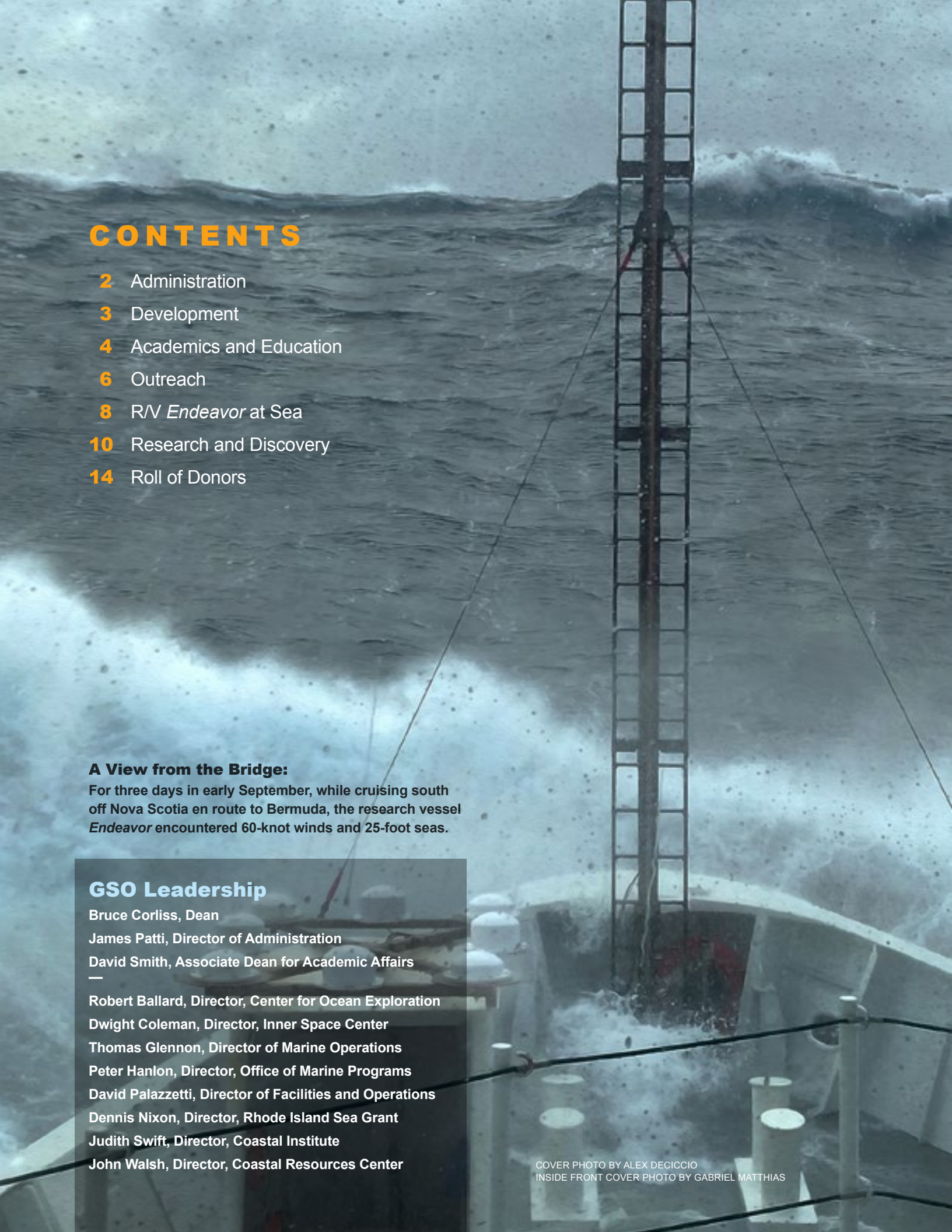
THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY

2019 ANNUAL REPORT



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A View from the Bridge:
For three days in early September, while cruising south off Nova Scotia en route to Bermuda, the research vessel *Endeavor* encountered 60-knot winds and 25-foot seas.

GSO Leadership

Bruce Corliss, Dean
James Patti, Director of Administration
David Smith, Associate Dean for Academic Affairs

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Robert Ballard, Director, Center for Ocean Exploration
Dwight Coleman, Director, Inner Space Center
Thomas Glennon, Director of Marine Operations
Peter Hanlon, Director, Office of Marine Programs
David Palazzetti, Director of Facilities and Operations
Dennis Nixon, Director, Rhode Island Sea Grant
Judith Swift, Director, Coastal Institute
John Walsh, Director, Coastal Resources Center

COVER PHOTO BY ALEX DECICCIO
INSIDE FRONT COVER PHOTO BY GABRIEL MATTHIAS

FROM THE DEAN

I am pleased to provide you with the "Graduate School of Oceanography 2019 Annual Report" that summarizes activities and accomplishments from across the GSO community. Over the years, GSO has demonstrated a commitment to advancing exciting and innovative initiatives and 2019 continued that trajectory. A few examples include:

- The keel laying and start of construction of the new regional class research vessel *Resolution* on May 7, 2019, in Houma, La., with Governor Gina Raimondo as sponsor of the new vessel. Gov. Raimondo will christen the vessel in 2023 when R/V *Resolution* arrives at the Narragansett Bay Campus;
- The start of planning for the first stage of the Narragansett Bay Campus Master Plan supported by $45 million provided in a 2018 Rhode Island bond that will include a new pier and a marine operations building for *Resolution,* and an ocean technology and robotics building to be completed in 2022;
- The inauguration of the East Coast Oceanographic Consortium (ECOC) consisting of URI, Woods Hole Oceanographic Institution (WHOI) and the University of New Hampshire as primary members involved with operation of *Resolution* and 13 additional East Coast institutions that will promote science, education and outreach collaborations;
- GSO selected as the lead institution of a National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute for Ocean Exploration with funding of $94 million over the next five years, and joining the NOAA Cooperative Institute for the North Atlantic Region (CINAR) led by WHOI with $8 million in funding over five years;
- Faculty searches for an assistant professor of ecosystem modeling and a professor of ocean exploration;
- Robust outreach and educational programs through Rhode Island Sea Grant, Coastal Resources Center, Inner Space Center and Office of Marine Programs; and
- 104 peer-reviewed articles published, $35 million in research funding, and nearly 1,400 undergraduates taught, quadrupling the 2012 teaching number.

These accomplishments build on the exciting progress that GSO has made as a community over the last eight years, including:

- The development of a Narragansett Bay Campus Master Plan;
- $45 million state bond funding;
- Selection as the operator of a National Science Foundation $125 million regional class research vessel;
- Recruitment of 11 new faculty members representing approximately 40% of the faculty; and
- A revised professional Master of Oceanography degree.

Our continued tradition of excellence in oceanographic research, education and outreach has been made possible by the energy, hard work and dedication of GSO scientists, staff and graduate students. Critical support has come from Senators Jack Reed and Sheldon Whitehouse, Congressmen Jim Langevin and David Cicilline, Governor Raimondo, and leaders and staff of Rhode Island state agencies. The GSO Dean's Advisory Council, URI President David Dooley and Provost Donald DeHayes, URI administrators and staff, Rhode Island taxpayers and friends from across the country were all vital supporters.

I am proud of the team effort and inclusive environment that we have created over the last eight years, and the resulting accomplishments that will continue to move GSO forward in the years to come. It was a privilege for me to return to Rhode Island as the fifth dean of GSO, and I thank everyone for their support of this extraordinary school during my tenure.

Best wishes,

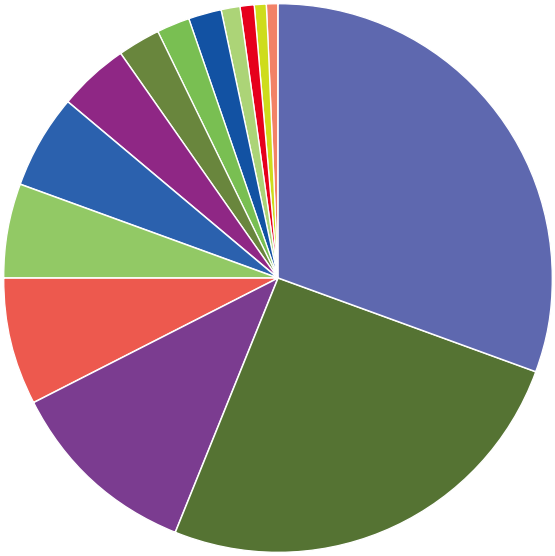
Bruce H. Corliss
Dean

2019

ADMINISTRATION

The year was marked by unprecedented levels of funding for research projects, outreach programs and campus renewal.

Sponsored-Project Awards by Source



$ (millions)	Source
10.752	National Science Foundation
8.954	U.S. Agency for International Development
3.949	National Oceanic and Atmospheric Administration
2.658	Nonprofit Organizations
1.963	University of Rhode Island Sub-Awards
1.930	U.S. Department of Defense
1.518	Other Federal Agencies
0.807	National Institutes of Health
0.731	Private For-Profits
0.642	National Aeronautics and Space Administration
0.384	U.S. Department of the Interior
0.320	State of Rhode Island
0.221	U.S. Department of Agriculture
0.225	Miscellaneous

2019 was a banner year—financially and programmatically—for GSO. The school ended the year in excellent financial condition due to our highly productive faculty and staff, growing support from alumni and friends, and overall sound fiscal management. As a result, we are well positioned for the coming leadership transition as Dean Corliss retires after a transformative eight years of service. The accomplishments of Bruce's tenure are well known, and we are fortunate that he will remain involved with the school in the years ahead, most notably as the principal investigator on the research vessel *Resolution* project.

Total operating revenue for FY19 exceeded $45 million. As is customary at GSO, most of this amount is attributable to sponsored funding for research projects, outreach and education initiatives and ship operations. For the first time, awards for sponsored projects exceeded $35 million, an increase of more than 15% over the prior year. This is due primarily to the productivity of our faculty, expansion of the Coastal Resource Center's support to the Philippines, and the establishment of two cooperative institutes funded by the National Oceanic and Atmospheric Administration. State operating support was $9.5 million and the overhead returned to the school exceeded $1.8 million (another record). Gift revenue, including current-use funds and distributions from endowment, exceeded $1 million and provided support for student awards, faculty start-up packages, select staff positions and general operations.

To pursue its agenda for campus renewal, GSO now has access to $45 million in new capital due to passage of the 2018 Rhode Island bond referendum. Utilizing these funds, the school has hired an architect to begin detailed planning for the replacement of the pier, which will be necessary to accommodate R/V *Resolution*. (Vessel construction is slated for completion late in 2022. *Resolution* will then sail from Louisiana into Narragansett Bay.) Detailed architectural planning has also begun for a new ocean technology center and a marine operations building. Late in 2020, or early in 2021, the first visible changes to the Narragansett Bay Campus will become apparent as new construction begins.

Finally, we are proud to have built an excellent GSO communications function to tell the our story through a variety of channels. This has been essential to position the school competitively for resources, public and private. We look forward to keeping you abreast of important news and progress at GSO, including the campus renewal and *Resolution's* construction.

On behalf of the entire GSO administration, thank you for your support of the school.

—James Patti
Director of Administration

2019

DEVELOPMENT

Robust support for the Fund for GSO continued through fiscal year 2019, while several major gifts made in calendar year 2019 are also advancing the school's priorities.

Campus Renewal

In 2018, Rhode Islanders supported the URI GSO by voting "yes" on Question 2. The bond issue, which was supported by 60% of the voters, provided $45 million to begin a multi-phase renewal of URI's Narragansett Bay Campus. Detailed design of a new pier and two new buildings is underway, with construction expected to begin early in 2021.

To complement public funding, GSO secured a number of major private gifts in 2019. These gifts will be applied to construction-project costs in excess of the $45 million provided by the state. They also demonstrate to Rhode Island voters and political leaders that the school is viewed as an important asset by the private sector.

Building on the $1,000,000 gift that Stephen M. Greenlee (M.S. 1982) and Donna Church Greenlee made in late 2018, gifts received in 2019 include:

- **a $500,000 challenge gift*** from James Austin, senior research scientist at the University of Texas at Austin, Institute for Geophysics, and member of the GSO Dean's Advisory Council. Under the terms of this gift all cash donations in support of campus renewal at GSO will be matched dollar-for-dollar up to $500,000 over the next five years. This provides a powerful incentive for others to leverage the benefit of the matching contribution.
- **a $100,000 pledge** from Barclay Collins (M.S. 1974, Ph.D. 1978), chair of the GSO Dean's Advisory Council.
- **a $100,000 pledge** from Laura Harris, Rhode Island philanthropist and supporter of the school.
- **a $100,000 pledge** from Jeffrey Sobel '93 and Ali Mirian '93.
- **a $70,000 pledge** from David E. Adams '70 on the occasion of his 50th URI reunion.
- **an anonymous $50,000 bequest** from a longtime donor who passed away wishing to support GSO's activities.

Ocean Science Education

In September 2019, The Devereux Ocean Foundation, Inc. pledged $250,000 to create the Devereux Ocean Foundation Fund for the Graduate School of Oceanography.

The Devereux Ocean Foundation fosters ocean research, education and stewardship. The gift includes support for Rhode Island K-12 science teachers to collaborate with GSO experts to develop new ocean science education materials. This content will be supplemented with educational videos produced by GSO's Inner Space Center, which has an impressive content library of ocean video footage with extraordinary educational potential that will be unlocked with Devereux's support. Ultimately, GSO will distribute these educational materials in K-12 schools statewide to provide a baseline understanding of ocean science for all students in the Ocean State.

"We appreciate GSO's position as one of the world's premier oceanographic institutions and want to support the amazing work being accomplished by its faculty and students," said Mark Grosby, president of The Devereux Ocean Foundation. "Solving critical ocean issues requires not only outstanding research, but world class public outreach and education."

GSO's mission is essential to improving our understanding of the basic processes and health of the ocean, as well as the blue economy in Rhode Island. Critical to this primary objective are transformational research and teaching facilities. That is why I am issuing this challenge to all those who value ocean science. *—James Austin*

Fund for GSO

The annual-giving account, Fund for GSO, raised $125,000 in the fiscal year ended June 30, 2019. This came from 461 separate gifts resulting in an average gift of $477. Gift values ranged from $10 to $14,000, and their impact was often multiplied by corporate matching programs. These funds provide the dean with critical flexibility to support student travel, campus events like our open house and other critical needs of the research, teaching and outreach missions. Your support has a real impact at GSO!

** The Austin matching-gift challenge will continue until $500,000 in new cash is received by GSO. As many of the above gifts are multi-year pledges, prospective donors should be aware this is an ongoing opportunity to double the impact of philanthropy for GSO.*

2019

ACADEMICS AND EDUCATION

The next generation of scientists and oceanographers pursue their passions for new knowledge and career development.

The academic program continues to evolve at GSO while maintaining the same core mission–attract the brightest students from around the globe and help them address critical issues in oceanographic research.

In May 2019, 14 students received their graduate degrees in oceanography from GSO. Six students earned a Master of Oceanography degree (non-thesis). This group included two students who completed the "Blue MBA" program by earning a Master of Business Administration degree concurrently with an oceanography degree. The Master of Oceanography graduates included our first international student who was sponsored by the Indonesian government. Three more students from Indonesia joined our program in the fall semester to follow in her path. Two students turned the internships they completed for the degree into full-time jobs upon graduation. Another joined fellow GSO alumni at a company that conducts marine seismic surveys.

Four students earned a Master of Science in Oceanography (thesis-based) degree. This group included an active Lieutenant Commander in the United States Coast Guard. Another active Coast Guard officer will join our program next fall. The other graduates have moved into positions in local environmental firms.

Our four doctoral students that graduated last May have spread out to continue their research careers. This includes post-doctoral positions both here and abroad as well as research positions within government laboratories.

In 2019, 19 new students joined GSO to begin their pursuit of graduate degrees in oceanography. The non-thesis Master of Oceanography degree continues to attract new students. Ten of the incoming class are in this degree program, two of which came through the accelerated five-year masters program. These students began taking graduate courses at GSO during their senior year at URI.

The National Science Foundation (NSF)-sponsored Summer Undergraduate Research Fellowship in Oceanography (SURFO) was held for the 32nd consecutive summer at GSO. In 2019 we had 13 instead of the usual 12 students as we paired up with the Puerto Rico Louis Stokes Alliance for Minority Participation to co-fund two students from Puerto Rico. Some SURFO students were supported to present their research results at national scientific meetings.

GSO students continue to lead various functions on and off campus. The oceanbites blog (oceanbites.org) continues to expand with authors from well beyond the Bay Campus. Local efforts include the Bay Informed Discussion Series where graduate students present current topics in oceanography to an enthusiastic audience from the local community.

Two new faculty members joined GSO in 2019. Dr. Veronique Oldham as an assistant professor. Her research is focused on redox chemistry of trace metals in the ocean. Dr. Martha McConnell is a new lecturer at GSO. She is focused on teaching undergraduate oceanography courses.

GSO students will continue to push our current understanding of the ocean and make new discoveries, and we will continue to actively recruit the next generation of ocean leaders.

PHOTO: NPP/CYNTHIA GARCIA

Left: GSO scientists collect ice cores during the Inner Space Center's Northwest Passage Project, an expedition into the Canadian Arctic Archipelago funded by the NSF and led by GSO professor Brice Loose. Back on board the icebreaker *Oden,* GSO Ph.D. candidate Jacob Strock, center, and post doc Alessandra D'Angelo conducted initial analyses of the cores. Strock and D'Angelo found an abundance of microplastics embedded in the ice—an unexpected discovery. The microplastics are further evidence regarding the scope of humanity's adverse impacts on the Arctic environment. In 2019, Strock was awarded a National Aeronautics and Space Administration fellowship through the Rhode Island Space Grant Consortium.

Below: the 2019 class of SURFO. Seated, from left to right are Angela Dougal, Sommer Meyer, Sandra Rech, Jamillez Olmo Classen; standing from left to right are Nicole Hammond, Nick Gershfeld, Brianna Villalon, Benjamin Watzak, Kamal James, Paul Ernst, Mac Diare, Gage Pilone and Lydia Nuñuz

PHOTO: LUCIE MARANDA

2019

OUTREACH

From promoting the value of ocean science, to influencing policy and increasing public and private support, GSO engages audiences in Rhode Island and throughout the world.

GSO continued to build upon its extensive outreach portfolio of programs designed to educate marine scientists, students, policymakers, business leaders and the public. Highlights of this past year include:

Lectures

The Narragansett Bay Campus hosts leading scientists, journalists and ocean practitioners from around the globe throughout the year. Some of the more prominent lectures included the Coastal Institute's 7th Annual Scott W. Nixon Lecture, featuring Dr.Pál Weihe from the University of the Faroe Islands and a co-lead of the NIEHS-sponsored STEEP Superfund Research Program, who discussed PFASs and their effects on human health.

Dr. George Lauder of Harvard University was the featured speaker of the annual Charles and Marie Fish Lecture, where he spoke about his work to develop robotic fish models and how they can help scientists better understand fish locomotor dynamics. Rhode Island Sea Grant's Coastal State Discussion series brought a number of participants to campus to discuss issues facing the Ocean State, including the impacts of the Block Island Wind Farm on tourism, harmful algal blooms in Narragansett Bay, and how oysters alter the environment.

Rhode Island Sea Grant also sponsored the annual Coastweeks series of events, which give the public hands-on, interactive opportunities to learn more about ocean and coastal environments and issues. Events in 2019 included, among others, a walking tour of the Providence waterfront featuring a discussion of coastal resilience, and a documentary film showing about the Hurricane of '38 followed by a discussion of hurricane preparedness.

K-12 Programs

Numerous outreach programs led by GSO focus on K-12 students, the next generation of ocean stewards. The Office of Marine Programs' Narragansett Bay Classroom presented 93 programs to over 1,400 students. The programs were presented by 20 outreach scientists, 19 of whom are GSO graduate students. The Rhode Island Teachers at Sea program saw eight educators experience science at sea aboard the research vessel *Endeavor.*

The Inner Space Center (ISC) conducted programs that reached thousands of students and teachers across the U.S. Over 450 students toured the ISC and participated in on-campus education programs. Over 3,000 K-12 students were reached through the ISC's virtual programs. The ISC's largest reach was to over 10,000 U.S. middle school teachers and students who participated in the team's 2019 Hurricane Awareness webinars, conducted in partnership with the National Hurricane Center. The ISC team also partnered with the College of Engineering to conduct a Navy Science and Engineering Camp for 11 R.I. high school students and conducted its annual Oceanography Exploration Camp for 21 R.I. middle school students.

Rhode Island educators and URI faculty and students on board R/V *Endeavor* during the RITAS cruise in August, 2019.

U.S. and International Stakeholder Engagement

The Coastal Resources Center (CRC) continues to bring science to bear on coastal and ocean issues that are important to stakeholders in Rhode Island, the U.S. and around the world, with a variety of activities that support coastal communities. Domestically, the center's U.S. Team spearheaded a GSO-funded project to engage dozens of R.I. leaders in the creation of "The Value of Rhode Island's Blue Economy," a report describing key sectors and offering strategies to enhance it further. Other domestic work focused on strengthening relationships between marine farms and their host communities, and helping cities and towns apply tools and policies from the Rhode Island Shoreline Change Special Area Management Plan (Beach SAMP) to meet the challenges of sea level rise and hurricanes. For each of its efforts in coastal and ocean planning, coastal resiliency, and sustainable fisheries and aquaculture, the U.S. Team provided technical support to government, private sector, academic and community partners. In addition, the domestic program continued to provide targeted assistance, guidance and lessons learned from Rhode Island's pioneering experience with offshore renewable energy resources and windfarms to decision-makers, practitioners and students worldwide.

Internationally, CRC is implementing several multi-partner international fisheries and marine biodiversity projects funded by the United States Agency for International Development (USAID). In the Philippines, the Fish Right Program is assisting the Bureau of Fisheries and Aquatic Resources and local government units to establish functioning new fisheries management areas. In Ghana, CRC supports the implementation of national fisheries co-management as well as several applied fisheries management initiatives. CRC in collaboration with the URI College of the Environment and Life Sciences serves on the Management Entity of the USAID Feed the Future Fish Innovation Lab, which selected its first round of competitively awarded aquaculture and fisheries research grants. CRC also supports biodiversity projects

Left: Dr. George Lauder delivers the Fish Lecture about developing better locomotion for underwater robots by learning from fishes. Far left: before embarking for Thule, Greenland, the Northwest Passage Project's science team expresses its enthusiasm.

in Malawi, Madagascar and Central America, where the team is leading studies and providing technical assistance on many topics such as fisheries biomass assessments, payment for ecosystem services, database development and gender analysis. Additionally, CRC is partnering on a U.S. Department of Agriculture project to provide monitoring, evaluation and knowledge management services for USAID West Africa's portfolio.

In November, the ISC team conducted the fourth Global Ocean Science Education Workshop with 66 delegates from 14 nations, representing the ocean science research, education, business and policy sectors. Delegates focused on preparing for the United Nations Decade of Ocean Science for Sustainable Development, while discussing the workshop themes of ocean observation, seabed mapping and the engagement of business and industry.

Telepresence

With over $3,000,000 provided by NSF and $700,000 from the Heising-Simons Foundation, a GSO team led an expedition in August and September aboard the Swedish Icebreaker *Oden* to study the Arctic's Northwest Passage. The collaborative effort between the ISC, the film company David Clark Inc., three informal science education institutions, and five U.S. Minority Serving Institutions saw a multidisciplinary group of 38 participants, including 18 undergraduates, set sail on an innovative expedition to investigate and communicate how waters and fauna of the Canadian Arctic Archipelago are changing as a consequence of rapid climatic warming. During the expedition, the ISC team conducted 40 live, interactive broadcasts from the Northwest Passage.

The ISC team also had funding from NSF to conduct the Antarctic Broadcasts: Broader Impacts Through Telepresence project, which allowed the team to test the ISC's telepresence technology in a new and challenging region—extreme southern latitudes. The team was able to successfully conduct live interactions from onboard the research vessel *Laurence M. Gould* as the ship transited across the Southern Ocean between Punta Arenas, Chile and Palmer Station, Antarctica. School, museum and general public audiences were able to ask questions of polar scientists in real time.

Online Presence

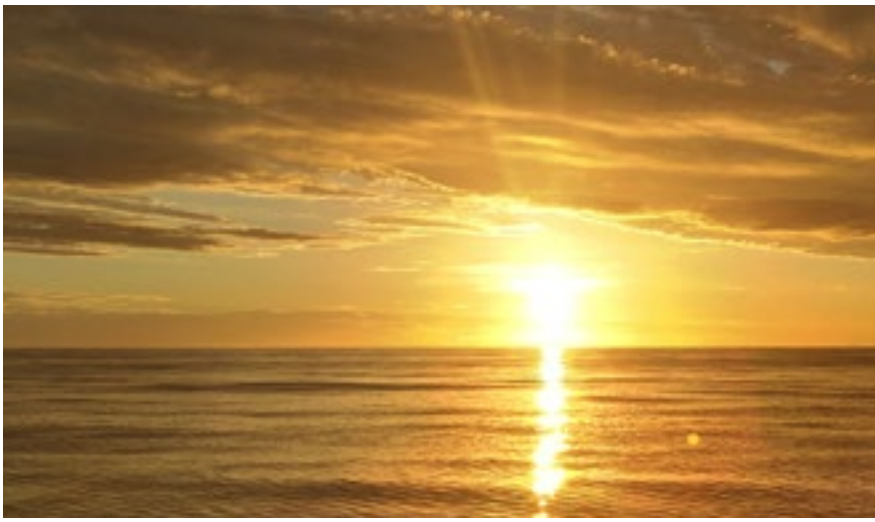
After a redesign in 2018, the GSO website continued to expand and refine content in 2019 to help numerous different audiences find the information they need. GSO's social media channels are increasing their reach by creating posts for a variety of audiences including prospective students, scientific colleagues, alumni, K-12 students and educators and the ocean-engaged public.

Publications

The Coastal Institute released "Narragansett Bay Watershed Economy: The ebb and flow of natural capital." The study provides a comprehensive overview of the watershed's economy and analyzes the value of 13 economically beneficial sectors that rely on the region's natural capital. The report can be accessed at nbweconomy.org. Rhode Island Sea Grant and the Coastal Institute published two issues of *41ºN* (41nmagazine.org), Rhode Island's ocean and coastal magazine. GSO published its alumni magazine, *Aboard GSO,* its 2018 annual report and numerous other materials to help the School reach diverse audiences.

2019

R/V *ENDEAVOR* AT SEA



***Endeavor's* science missions included food-web studies, deployment of novel monitors and sensors, collection of water and sediment samples, and tracking movement and impacts of water-borne nutrients.**

Endeavor began 2019 in drydock at Senesco Ship Repair Yard.

EN 627: Under the direction of Heidi Sosik of Woods Hole Oceanographic Institution (WHOI), the first mission of the new year was the third dedicated transect cruise for the Northeast U.S. Shelf (NES) Long-Term Ecological Research (LTER) project. The overarching goal of NES-LTER is to understand and predict the change of planktonic food webs through space and time in response to changes in the physical environment, and how those changes impact ecosystem productivity, particularly of higher trophic levels.

Transit mission *EN 628* to St George's, Bermuda began Feb. 11.

EN 629: Departed St. George's Feb. 16, to conduct Bermuda Atlantic Time Series (BATS) cruises. As R/V Atlantic Explorer was in drydock, *Endeavor* conducted two BATS missions, which typically require five days, multiple Conductivity, Temperature and Depth casts (CTDs), sediment trap drifters, and production array drifters. *Endeavor* returned to St. George's on Feb. 20.

EN 630: Departed St. George's Feb. 27 with GSO professor Jaime Palter as Chief Scientist on a cruise funded by the Rhode Island *Endeavor* Program (RIEP). *Endeavor* was to rendezvous with, then follow Saildrone—an autonomous vessel launched several weeks earlier from Newport, RI—in order to validate Saildrone's sensor readings. While crossing the Gulf Stream en route to Bermuda, Saildrone encountered heavy weather—12-meter seas and winds in excess of 60 knots. Damage to Saildrone caused loss of autonomous operation and function of two-thirds of its onboard instruments, curtailing EN 630. Saildrone was guided to Bermuda and recovered by a team from the Bermuda Institute for Ocean Science. After repairs, it resumed trans-Atlantic missions.

EN 631: *Endeavor* conducted the second of two BATS cruises out of St. George's, Bermuda. CTDs, trace metal CTDs, sediment traps and pumps were deployed.

Transit mission *EN 632* returned *Endeavor* to the GSO pier on Mar. 20.

EN 633: This cruise began on Mar. 26 and supported a project by URI seniors in Ocean Engineering. It was directed by Chief Scientist and URI professor Lora Van Uffelen (Ocean Engineering/GSO) and funded by the RIEP. Working with WHOI mooring technician John Kemp, the students designed two moorings with a surface buoy for passive monitoring of marine mammals in the vicinity of the Block Island Wind Farm (BIWF). The buoys received sound from a hydrophone and transmitted data via the cell network to an onshore server. Two moorings (MARIMBA-E and MARIMBA-W) and a geosled were deployed. The geosled was equipped with acoustic sensors and rested on the sea floor.

EN 634: On April 10, *Endeavor* returned to the vicinity of BIWF to retrieve the acoustical moorings deployed during *EN 633.* CTD casts and an acoustical survey were conducted while in the area. This cruise was also directed by Chief Scientist and URI professor Lora Van Uffelen (Ocean Engineering/GSO) and funded by the RIEP.

EN 635: Departed for waters south of New England on April 18 under the direction of Principle Investigator, Chief Scientist, and GSO professor Melissa Omand on a mission funded by the RIEP. This interdisciplinary educational cruise was the culmination of a URI undergraduate honors science class during which students examined linkages between marine mammal distribution, physical oceanography and prey distribution. Participating in all aspects of data collection, the students also deployed student-built underwater cameras and experimental, passive acoustic devices.

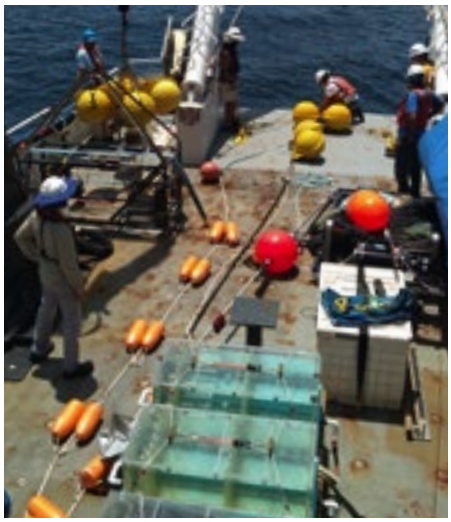
With assistance from GSO's Inner Space Center staff, the students also broadcast live discussions to Rhode Island classrooms about the science being conducted, its importance and their experiences aboard Endeavor. The broadcasts were focused primarily on Earth Day and included a Facebook live broadcast.

EN 636: Departed May 1 for an NSF-sponsored cruise under the direction of Principle Investigator John W. Toole of WHOI. For the project Development and Field Testing of a Lift Assisted Moored Profiler (LAMP), *Endeavor* recovered a tall (4000m) subsurface mooring deployed six months earlier and returned the gear to Woods Hole.

On May 10, began transit mission *EN 637* to Morehead City, N.C.

EN 638: This NSF-sponsored cruise began May 15, and was under the direction of Principle Investigator Carol Arnosti, University of North Carolina-Chapel Hill. For the project A Mechanistic Microbial Underpinning for the Size-Reactivity Continuum of Dissolved Organic Carbon Degradation, *Endeavor* sampled the North Atlantic water column at six depths and 12 stations to collect samples for incubation experiments involving microbial degradation of organic carbon.

EN 639: Departed Morehead City on June 3. During this transit to Bridgetown, Barbados, a dozen STEMSEAS students were aboard and directed by two mentors and Dr. Joseph Montoya of Georgia Tech. The students participated in CTD casts, ring net and MOCNESS tows, and on-deck incubation experiments.



EN 640: This NSF-sponsored cruise began on June 14. Titled Collaborative Research: Impact of the Amazon River Plume on Nitrogen Availability and Planktonic Food Web Dynamics in the Western Tropical North Atlantic, the project's Principle Investigator was Joseph Montoya. Samples from the northern reaches of the Amazon Plume were taken during the high-flow season. Regions of dense populations of N2-fixing organisms were targeted to explore factors that promote blooms and ways that fixed nitrogen moves into the food web. *Endeavor* worked on the northern side of the Amazon Plume off French Guyana and Suriname for two weeks.

Endeavor returned to Bridgetown to take on fuel and stores then began the second leg of *EN 640,* which concentrated on areas east of Barbados.

On July 10, *Endeavor* transited from Bridgetown to Gulfport, Miss. *EN 641* passed between the Windward Islands of St. Lucia and St. Vincent, through the Mona Passage between the Dominican Republic on the Island of Hispaniola and Puerto Rico, and through the Florida Straits into the Gulf of Mexico. It ended in Gulfport on July 19.

EN 642: Andrew Juhl and Ajit Subramaniam, both of Lamont-Doherty Earth Observatory, were the Principle and Co-principle Investigators of this NSF-funded mission. They conducted studies of the temporal change in nitrogen and phosphorous nutrients as a water mass moves offshore. An identified water mass was tracked for 13 days by following an Argos-Apex float drifting on the surface. Scientists deployed and recovered floating particle interceptor traps (PIT) every four days and continuously sampled the water mass using CTD and MOCNESS net casts, a snow cam, spectroradiometer, Ring nets, and micro profiler.

Endeavor departed Gulfport Aug. 6 on transit mission *EN 643* and arrived at GSO on Aug. 12.

EN 644: Principle Investigator Heidi Sosik of WHOI directed this NSF-sponsored cruise. In transects south of Martha's Vineyard out to the shelf break, CTD casts and towing of bongo nets and the ISIIS Sting Ray plankton-imaging remotely operated towed vehicle were performed. On departure day, Aug. 19, *Endeavor's* bridge UPS/clean power unit, which powers such critical equipment as the gyro compasses, throttle, and navigation computers, failed, forcing a return to GSO. Temporary repairs enabled *Endeavor* to go back out, and the clean power unit was replaced after *EN 644* was completed.

EN 645: This cruise was sponsored by the U.S. Naval Research Laboratory under the direction of Geoffrey F. Edelmann of NRL–D.C. The project, Reliable Acoustic Communications, seeks to enable new naval capabilities to support undersea networking via the continued development of a Navy-owned, software defined modem. The project will demonstrate directional reliable acoustic communications. *Endeavor* deployed up to 10 anchored arrays fitted with acoustic pressure vessels.

EN 646: In mid-September, *Endeavor* departed for the annual Rhode Island Teachers at Sea cruise under the direction of Principal Investigator and GSO Associate Dean David Smith. This year's cruise introduced eight R.I. educators to ship-based research and shipboard living. The crew stressed safety at sea as teachers took part in emergency drills, including a race for donning overboard survival suits. The Rhode Island Teachers at Sea cruise, sponsored by the RIEP, is a perennial highlight that earns rave reviews from participants. Teachers then share their experiences with their students.

EN 647: *Endeavor* departed Sep. 22, under the direction of Principal Investigator and GSO professor Roxanne Beinart. Corinna Breusing and Brennan Phillips, also professors at URI and GSO, were Co-Chief Scientists. The cruise was sponsored by the RIEP. The science team collected live organisms, cold seep mussels, to test the effect of nutrients—specifically phosphorous availability—on rates of productivity in symbiotic, chemosynthetic mussels from the Veatch Canyon Seep, a site located 242 kilometers from Narragansett, R.I. at 1,444 meters depth on the mid-continental slope. This work generated preliminary data to support future proposals targeted at understanding chemosynthetic production at deep-sea cold seeps. Deep-sea sampling technology that can eliminate the need for typical deep-sampling vehicles and may be utilized by many other URI researchers is being developed.

EN 648: The 2019 cruise season's final mission, which began on Oct. 18, was a mooring trip conducted under the direction of John Toole of WHOI.

On Dec. 12, *Endeavor* returned to Senesco for an inspection by the American Bureau of Shipping Hull and Machinery. This may be *Endeavor's* last haul-out while in the service of URI. Her 44th sailing season will begin in early 2020.

With a major refit in 1993, and many equipment upgrades performed since, *Endeavor* has remained a vital member of the UNOLS fleet of research vessels, embarking on missions never imagined when she was launched in 1976. *Endeavor's* assignments have taken her around the world. She has proven to be a rugged little ship—always getting the job done and keeping her crew and scientists safe. We at the Marine Office look forward to more successful seasons with *Endeavor* while her successor, *Resolution,* is under construction.

2019

RESEARCH AND DISCOVERY

New findings and new projects by GSO professors and scientists as published in scholarly journals and funded grant proposals:

Scientific Publications

Research results were presented in the following articles that were authored or co-authored by GSO faculty, researchers and students.These articles were published in peer-reviewed journals during 2019.

…Adelman, D., Vojta, Š.… Lohmann, R. Passive Sampling of Persistent Organic Pollutants in Four Coastal Aquatic Systems of Puerto Rico: A Pilot Study. *Bulletin of Environmental Contamination and Toxicology.*

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PHOTO BY ALEX DECICCIO

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Sponsored Research Awards

GSO's faculty and marine research scientists earned the following new awards in 2019:

$3,506,125 to Robert Ballard and Dwight Coleman from NOAA for "Ocean Exploration Cooperative Institute"

$180,000 to Roxanne Beinart from Simons Foundation for "Patterns of Specificity and Maintenance in Microbe-Microbe Partnerships"

$51,498 to Dwight Coleman from BBC for "BBC Blue Planet Live 2019—R/V *Atlantis*"

$33,725 to Teresa Crean from R.I. Coastal Resources Management Council for "Rhode Island Shoreline Adaptation for Resilience and Habitat Enhancement"

$30,832 to Teresa Crean from RI Coastal Resources Management Council for "Development and Maintenance of an Online Delivery System for STORMTOOLS Inundation and Risk Maps"

$84,271 to Azure Cygler from University of Connecticut for "Advancing Southern New England Shellfish Aquaculture through an Engaged Public and Next Generation Tools"

$14,999 to Brian Heikes from Brown University for "Quantifying Wet and Dry Deposition of Ammonium to Narragansett Bay"

$115,924 to Karen Kent and Elin Torell from U.S. Department of Agriculture for "Monitoring, Evaluation and Analytical Support Services"

$61,330 to Christopher Kincaid from R.I. Science and Technology Advisory Council for "Building Essential Bridges Between Ecosystem Data and Hydrodynamic-Ecosystem Models of Rhode Island Coastal Waters through CHN Analysis"

$50,000 to John King from R.I. Commerce Corporation for "MIKEL Submerged Acoustic Navigation System Generation 5 Beacon"

$75,000 to John King from U.S. Department of Interior for "Regional Scale Benthic Habitat Mapping at Northeast Region Coastal Parks Using CMECS"

$32,370 to John King from Stonington Historical Society for "1814 Battle of Stonington Battlefield Protection Project"

$37,543 to Dawn Kotowicz from R.I. Natural History Survey for "Climate Resilient Markets: Adapting to the Fisheries of the Future"

$28,848 to Dawn Kotowicz from University of Connecticut for "Nurturing the Successful Growth and Maturation of a Domestic Seaweed Aquaculture Industry: Identifying and Removing Barriers and Promoting Opportunities"

$85,940 to Rainer Lohmann from Harvard University for "Evaluating the Importance of Precursor Transport and Transformation for Groundwater Contamination with Poly- and Perfluoroalkyl Substances"

$80,000 to Rainer Lohmann from R.I. Science and Technology Advisory Council for "Testing Nanographene as Passive Samplers for Emerging Contaminants of Concern in Narragansett Bay"

$70,607 to Rainer Lohmann from General Dynamics Information Technology for "Analysis of the Strength of the Predictive Relationship Between Organism Bioaccumulation and Passive Sampler Uptake"

$522,171 to Rainer Lohmann and Robert Pockalny from National Science Foundation for "Concentrations and Source Assessment of Black Carbon Across Tropical Atlantic Air and Sediment"

$344,154 to Brice Loose from National Science Foundation for "How to Trace Glacial Meltwater in the Ocean by Shipboard Hydrographic Analysis of Dissolved Neon and Krypton"

$7,495 to Lucie Maranda from TelAztec for "Evaluation of TelAztec Materials Following Seawater Immersion"

$132,884 to Lucie Maranda and David Smith from National Science Foundation for "REU Summer Undergraduate Research Fellowships in Oceanography (SURFO)"

$42,866 to Lucie Maranda and David Smith from R.I. Commerce Corporation for "Testing Onvector High-Voltage Plasma for Ballast Water Management"

$30,000 to Jennifer McCann and Azure Cygler from NOAA Sea Grant for "Sea Grant Northeast Regional Lobster Extension Program: Rhode Island"

$32,000 to Susanne Menden-Deuer from R.I. Science and Technology Advisory Council for "Coupling Physical and Ecological Models to Understanding How Climate Drives Disease Outbreaks in Narragansett Bay"

$33,594 to Colleen Mouw from National Aeronautics and Space Administration for "Continued Mentoring of Junior Women in Physical Oceanography: Link to NASA labs"

$131,957 to Melissa Omand from National Aeronautics and Space Administration for "Ocean Submesoscale Currents and Vertical Transport"

$9,450 to Candace Oviatt from R.I. Department of Environmental Management for "Perform Analysis of Chlorophyll-A Concentrations from Water Quality Samples"

$281,999 to Glenn Ricci and Peter Freeman from International Union for Conservation of Nature for "Regional Coastal Biodiversity Project"

$390,670 to Rebecca Robinson and Kelton McMahon from National Science Foundation for "MRI: Acquisition of a Customized GC-IRMS for Isotopic Analysis of Nitrate and Nitrous Oxide at URI"

$95,413 to Christopher Roman from Dartmouth College for "RII Track-2 FEC: Computational Methods and Autonomous Robotics Systems for Modeling and Predicting Harmful Cyanobacterial Blooms"

$139,000 to Christopher Roman from Physical Science Inc. for "Enhanced Sonar Feature Reacquisition Using Simultaneous Localization and Mapping Techniques"

$350,000 to Gail Scowcroft from the Department of Defense, Office of Naval Research for "Discovery of Sound in the Sea 2018-2019"

$67,892 to Yang Shen from National Science Foundation for "An Open Access Experiment to Seismically Image Galapagos Plume-Ridge Interaction"

$253,253 to Yang Shen from National Science Foundation for "Gathering New Insights into the Magmatic and Tectonic Processes at Kilauea Volcano from Analysis of the 2018 RAPID OBS Array Data"

$33,770 to Jacob Strock from Brown University for "NASA R.I. Space Grant Fellowship"

$826,369 to D Randolph Watts from multiple sources for "Inverted Echo Sounder (IES) Technology/ Research: Pressure Recorders (PIES) and Current Meters (CPIES)"

$107,782 to Meng (Matt) Wei from the Department of Defense, Defense Threat Reduction Agency for "Yield Estimate Based on InSAR"

$18,011 to Mingxi Zhou from Naval Undersea Warfare Center for "Towards Autonomous UUV-Based Seafloor Reconnaissance Using Artificial Intelligence"

$293,134 to Mingxi Zhou and Brice Loose from National Science Foundation for "NSF EAGER: Navigating Unmanned Underwater Vehicles (UUV's) at Ice-Water Horizon

2019

ROLL OF DONORS

Our thanks go out to the following contributors during the 2019 fiscal year—July 1, 2018 to June 30, 2019.

Every gift to GSO makes a difference, and we are grateful. All donors—GSO alumni, individuals, foundations and corporations—are friends of GSO and recognized below.

Dean's Advisory Council

Under the direction of Dean Bruce Corliss, the Council shares in developing fundraising plans and priorities and in disseminating this vision. On behalf of the entire community of GSO alumni and friends, we extend to these individuals our heartfelt appreciation for their insights and guidance in the 2019 fiscal year.

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Recognition Society	Giving Level
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In 2019, GSO students were awarded $130,000 in scholarships and fellowships funded by gifts from friends and alumni. Above: some recipients gathered at the Mosby Center for the awards presentation.

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Stephanie Anderson, a Ph.D. student in Tatiana Rynearson's lab, was awarded $1,000 for travel to the American Geophysical Union's Ocean Sciences Meeting.

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Jessica Carney, an M.S. student advised by Colleen Mouw, was awarded $1,000 for travel to the American Geophysical Union's Ocean Sciences Meeting.

Xuanyu Chen, a Ph.D. student in the Ginis and Hara labs, received a $500 grant for collaborative work at Penn State.

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Isabel Dove, an M.S. student advised by Rebecca Robinson, received $1,000 for travel to Oregon State University.

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Bing He, a Ph.D. student in Matt Wei's lab, was awarded $1,000 for travel to attend the fall meeting of the American Geophysical Union.

Maggie Heinichen, an M.S. student advised by Jeremy Collie, received a $600 grant to attend the annual meeting of the American Fisheries Society.

Kristin Huizenga, an M.S. student advised by Candace Oviatt, was awarded $1,000 to help pay for a course at the Cary Institute of Ecosystem Studies.

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Joseph Langan, a Ph.D. student in Jeremy Collie's lab, received a $500 grant to attend the annual meeting of the American Fisheries Society.

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Nina Santos, an M.S. student advised by Kelton McMahon, was awarded $1,000 for travel to the American Geophysical Union's Ocean Sciences Meeting.

Virginie Sonnet, a Ph.D. student in Colleen Mouw's lab, was awarded $1,000 for travel to the American Geophysical Union's Ocean Sciences Meeting.

Angela Stahl, an M.S. student advised by Kelton McMahon, was awarded $1,000 for travel to the American Geophysical Union's Ocean Sciences Meeting.

Rebecca Stevick, a Ph.D. student advised by Anton Post and Marta Gomez-Chiarri, received a $1,500 grant that was applied to a publication.

Jacob Strock, a Ph.D. student in Susanne Menden-Deuer's lab, was awarded $1,000 for equipment used on the Northwest Passage Project.

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Xiaozhuo Wei, a Ph.D. student in Yang Shen's lab, was awarded $1,000 for travel to attend the fall meeting of the American Geophysical Union.

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2019 was the last full year of Bruce Corliss' tenure as dean of URI's Graduate School of Oceanography. His achievements and legacy—how his leadership shaped the course of GSO—is reviewed in the spring issue of *Aboard GSO.* On these pages, Dean Corliss shares reminiscences and inspirations from his time as a GSO student in the '70s and from his seven-plus years of service as the school's dean. URI and the GSO communities extend their thanks and a hearty "bon voyage" to Bruce as he departs for the next chapter in his remarkable career.