

THE
UNIVERSITY
OF RHODE ISLAND
GRADUATE SCHOOL
OF OCEANOGRAPHY



2018 ANNUAL REPORT



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GSO LEADERSHIP

Bruce Corliss, Dean
James Patti, Director of Administration
David Smith, Associate Dean for Academic Affairs
—
Ellen Anderson, Director of Development
Robert Ballard, Director, Center for Ocean Exploration

Dwight Coleman, Director, Inner Space Center
Thomas Glennon, Director of Marine Operations
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

Above the Puerto Rico Trench: During *R/V Endeavor's* mission 622, URI professors and co-principal investigators Steven D'Hondt, Christopher Roman and Robert Pockalny tested an autonomous CTD lander beneath this surface. On September 22, 2018, their device sampled the deepest water ever from the Atlantic Ocean at 8.4 kilometers down.

2018 was an extraordinary year for the Graduate School of Oceanography, and I'm pleased to share this annual report to highlight the important work led by the dedicated faculty, staff, and students of this institution.

The East Coast Oceanographic Consortium (ECOC) was formed to operate the R/V *Endeavor* and to submit a proposal to the National Science Foundation for operation of its new Regional Class Research Vessel (RCRV). Led by the University of Rhode Island, the ECOC comprises URI, University of New Hampshire and Woods Hole Oceanographic Institution as primary members, and thirteen institutions along the Eastern Seaboard as associate members. The objectives of the ECOC are to operate the NSF-owned vessel for the oceanographic community and to promote collaboration in research, education and outreach.

The ECOC was awarded operation of the new RCRV, which is valued at \$125 million and slated to join the UNOLS fleet in 2021. We are delighted that the Honorable Gina Raimondo, Governor of Rhode Island, will be the vessel's sponsor and will christen her in 2021. The vessel is to be named *Resolution*, after Captain James Cook's second vessel of exploration, *HMS Resolution*. The name follows the precedent of naming *Endeavor* after Cook's first vessel, *HMS Endeavour*.

GSO had another strong year in research funding by securing nearly \$30 million in new research grants—a funding level similar to the last two years and representing the highest funding levels that GSO has enjoyed. This outcome reflects well on the hard work and dedication of faculty, staff, and graduate students and on GSO's ambitious nature. The teaching effort in 2018 was also outstanding, reaching more than 1,000 students, twice as many as last year.

The Greenfins Aquaculture Facility was completed this year and given by Greenfins Global to URI as a \$1.8 million gift-in-kind. This is a great example of a public-private partnership that can serve as a model for other research efforts on the Narragansett Bay Campus.

The Narragansett Bay Campus Master Plan is a 10-year (and counting), \$300-plus million project that began with Rhode Island voters approving Question 2 in last November's election. The bond measure included \$45 million for a new dock, Marine Operations building, Ocean Technology building, relocation of the entrance road, and preliminary design work for the next phase of the plan to be funded by a future state bond.

We ended the year with a generous \$1 million gift from Stephen and Donna Greenlee for support of the Master Plan renovations, which was greatly appreciated by all in the GSO community.

These accomplishments reflect the efforts of GSO and the Narragansett Bay Campus community working together to address critical needs and opportunities that will have a major impact on both the future of oceanography at URI and our ability to better understand and protect the oceans.

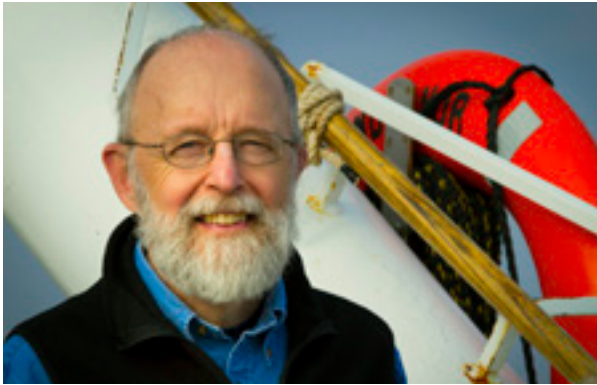
We are entering an exciting period in GSO's history, and I hope you enjoy this annual report and its highlights from a most extraordinary 2018.

Best wishes,



Bruce H. Corliss
Dean

FROM THE DEAN



Alumnus and Spouse Make \$1 Million Gift

New Fund Established to Support Construction On Narragansett Bay Campus

A \$1 million gift will advance efforts to revitalize facilities at the University of Rhode Island (URI) Graduate School of Oceanography (GSO). Stephen M. Greenlee (M.S. '82) and Donna Church Greenlee made the gift to support detailed development efforts to expand research and teaching capacity.

The Greenlee Family GSO Campus Redevelopment Fund supports construction on the Narragansett Bay Campus. The Greenlees hope to inspire interest in and support of oceanographic research, building on recent momentum at GSO.

The gift follows the Rhode Island bond issue passed in November 2018 authorizing \$45 million to GSO to enhance research capabilities and prepare for the new Regional Class Research Vessel arriving in 2021. In July 2018, the National Science Foundation awarded the vessel—one of just three in the nation—to the East Coast Oceanographic Consortium led by URI.

“Donna and I feel that our investment in GSO’s Bay Campus renewal will help to ensure that their mission of research, education and outreach can be fulfilled well into the future,” said Stephen Greenlee. “We believe strongly in GSO’s capacity to impact our knowledge of the world’s oceans and help solve critical challenges in this area.”

Bruce Corliss, dean of the school, will oversee the use of the funds in accordance with the school’s strategic plan and in coordination with

the upgrades facilitated by the bond. Greenlee and Corliss believe the new fund will inspire others to support the ongoing renewal of the Narragansett Bay Campus and grow GSO’s reputation for research and educational excellence.

“We are grateful for the Greenlees’ confidence in our work, particularly at this key moment for the school,” said Dean Corliss. “Their gift will expand the possibilities for our faculty, researchers and students.”

The establishment of the Greenlee Family GSO Campus Redevelopment Fund follows the 2018 contribution to URI’s Narragansett Bay Campus of the nearly \$2 million Greenfins Aquaculture facility from Peter Mottur, co-founder and president of Greenfins Global, LLC.

Stephen M. Greenlee is a geoscientist and president of the ExxonMobil Exploration Company. He is a member of the Society of Exploration Geophysicists and the American Association of Petroleum Geologists. He earned an M.S. in oceanography at GSO, after a B.S. in geology at Duke University. Donna Church Greenlee, originally from Portsmouth, Rhode Island, worked as a geophysicist at ExxonMobil and Kerr McGee. She earned a B.S. in geophysics at Boston College. Stephen and Donna are residents of the greater Houston, Texas area.

“We believe strongly in GSO’s capacity to impact our knowledge of the world’s oceans and help solve critical challenges in this area.”

—Stephen M. Greenlee



Stephen and Donna Greenlee

Led by GSO, institutions along the eastern seaboard will guide the operations and scientific agenda of a new regional class research vessel.

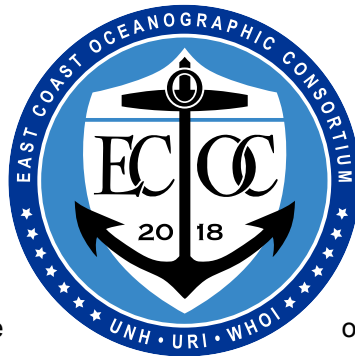
East Coast Oceanographic Consortium Gets Underway

By Todd McLeish

The East Coast Oceanographic Consortium (ECOC) was established in 2018 to combine the expertise of three powerhouse research institutions and more than a dozen East Coast partners from Maine to Puerto Rico. Formation of the Consortium, in an era when resources are scarce and collaboration is vital to success, is a milestone in marine science research, education and outreach. This new model for tackling the oceans' complex challenges is certain to result in greater efficiencies, cooperation and vision far into the future.

The Consortium's three founding members—the University of Rhode Island's Graduate School of Oceanography, the Woods Hole Oceanographic Institution and the University of New Hampshire's School of Marine Science and Ocean Engineering—have nearly 200 years of combined experience in ocean science and exploration.

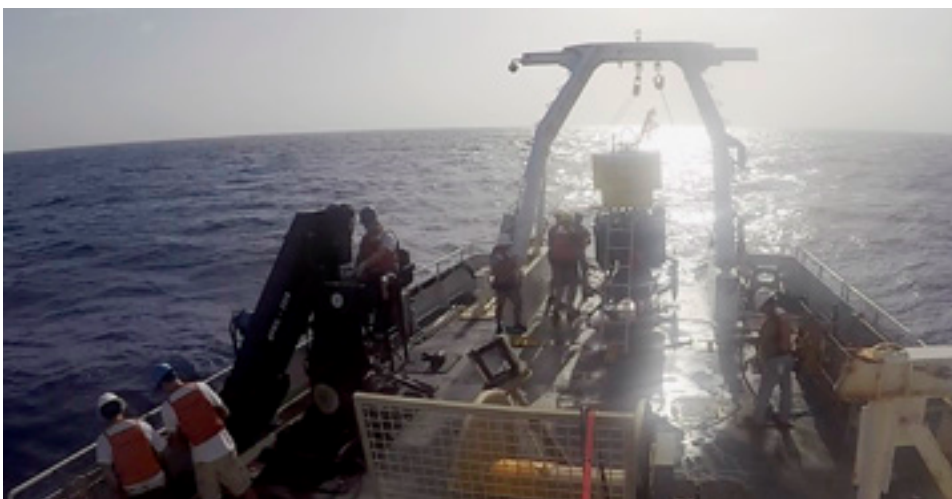
"With all of that scientific experience and the participation of many of the world's leading oceanographers, the Consortium has the expertise, resources and commitment to safely and effectively manage a new research vessel to address critical scientific questions worldwide," said Bruce Corliss, dean of the Graduate School of Oceanography and leader of the Consortium.



Corliss noted that GSO brings a long history of ship operations to the Consortium, as well as the unique telepresence capabilities of the Inner Space Center that will enable research activities to be broadcast live to scientists and other audiences around the world. The other major partners bring equally impressive qualities to the organization.

The Center for Coastal and Ocean Mapping at UNH, for instance, is a national center of excellence for ocean mapping. "We hope to help ensure that the new vessel is capable of collecting and processing state-of-the-art ocean mapping data as well as developing new applications for these data," said Larry Mayer, professor and director of the Center and the UNH School of Marine Science and Ocean Engineering. UNH also has a long history of working and collecting observations, including long time-series, in the Gulf of Maine.

WHOI's international reputation in oceanography and engineering will significantly amplify the standing of the organization. "Logistically, WHOI's skills and resources in ship operations, maintenance and overhaul, and mission planning and scheduling will be available to the Consortium and will help ensure the highest utility, quality
(continued next page)



"Oceanography is by definition a collaborative science that involves many disciplines and even more investigators."

and reliability of the consortium's vessel to the user community," said WHOI Vice President Robert Munier. "As a case in point," he added, "Woods Hole is providing engineering services to the Consortium in support of the design and construction of the new vessel."

Setting a Course

The Consortium has already achieved its first and most important objective: winning the competition to operate one of the National Science Foundation's (NSF) new regional class research vessels. NSF announced in July that the Consortium had been selected to operate the \$125-million ship. The decision set in motion a series of activities and events designed to launch the Consortium's management and oversight role.

The first step is establishing the committees that will serve to guide the scientific and operational management of the vessel. That process is well underway.

The Consortium's Policy Board, consisting of senior level administrators from the founding partners, will advise Dean Corliss, who is responsible for the leadership, management and oversight of the entire Consortium. The board will set long-range goals and ensure that those goals are achieved. It will also oversee the function of the Consortium and promote collaborative and innovative research initiatives. The group will meet at least once each year for the duration of the agreement.

The group's Program Advisory Committee, consisting of two scientists from each major partner, will provide guidance on shipboard science, technology, equipment and instrumentation.

"It will be more of a nuts and bolts group, and the first item on their agenda will be identifying the instrumentation that the ship will need," said Corliss. "We submit an instrumentation proposal to NSF every year, and I'll be looking for the committee's recommendations."

Role of Associate Members

In addition to the founding partners, the Consortium also consists of 13 associate members, whose participation is encouraged in the deliberations of the Program Advisory Committee. Those members are: Bermuda Institute of Ocean Sciences, Bigelow Laboratory for Ocean Sciences, Brown University, Lamont-Doherty Earth Observatory of Columbia University, Harvard University, Ocean Exploration Trust, University of Maine, University of Miami, University of Puerto Rico, University of Massachusetts at Dartmouth, University of Massachusetts at Boston, Florida Institute of Oceanography, and the University of South Florida.

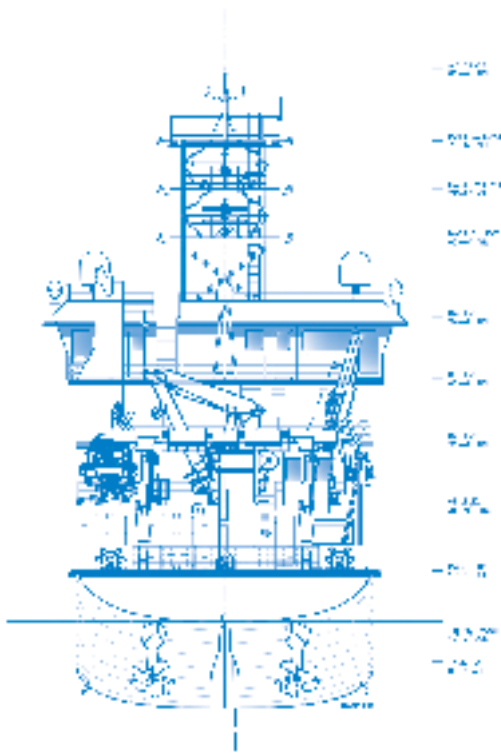
"Our associate members extend the reach of the ECOC, and we will all benefit from scientific collaborations," said James Patti, GSO director of administration and director of the Consortium. "We're already thinking about how to leverage these new relationships."

For example, he noted that discussions are already underway to expand GSO's Summer Undergraduate Research Fellowships in Oceanography program to the students at the University of Puerto Rico, in part to increase the program's participation by students from under-represented groups.

The associate members will be key partners in scientific collaborations, something Corliss said is "as important—or more important—than ship operations. Everyone recognizes that this is a huge advantage of the Consortium, to bring people together and promote the use of the ship."

"We're not waiting for the new ship... The idea is to put the organization in place and make sure the last years of Endeavor are—from an operational and scientific standpoint—as successful as possible."





Above, architect's renderings of the new regional class research vessel. Below, R/V *Endeavor* at her pier as day breaks over Narragansett Bay.

The Future Begins Now

As the new ship is being built, the Consortium committees will not only be looking to the future operation of the new vessel, but it will also guide operations for the final two years of missions with R/V *Endeavor*.

"We're not waiting for the new ship to get the Consortium started," said Corliss. "The idea is to put the organization in place and make sure the last years of *Endeavor* are—from an operational and scientific standpoint—as successful as possible. And we'll have a Consortium-wide meeting this year to get everyone together for the first time."

"Oceanography is by definition a collaborative science that involves many disciplines and even more investigators," concluded Mayer. "No one institution can cover all bases, and the Consortium helps formalize the cooperation and collaboration necessary."

"Facilitating access to the sea for scientists and engineers is a critical objective of any oceanographic institution," added Munier. "The Consortium provides an excellent mechanism to meet that critical objective of getting access to the sea for our own researchers, while serving the community at the same time."

2018

ADMINISTRATION

The year was filled with memorable moments, positive trends, and concrete indicators of growth.



WWW.VOTEYESON2RI.COM

2018 was an extraordinarily consequential and productive year at GSO. In just twelve months, the school secured more than \$175 million in new resources, including a research vessel, an approved state bond initiative, and multiple philanthropic commitments including donation of the Greenfins Aquaculture Research Facility and a \$1-million gift from GSO alumnus Stephen Greenlee (M.S. 1982) (see page 2). All of these developments have a significant impact on the advancement of a school, and we are grateful to everyone who helped make them happen. They represent only the beginning of what GSO expects to achieve.

The GAO administration’s focus is to grow and support the research enterprise, provide a platform for educating the next generation of oceanographers, scientists and policy-makers, and share our work with K-12 students and the public.

Following are highlights of 2018:

Strategic Growth

- Passage of a **\$45-million bond** with more than 58 percent approval from R.I.’s voting public—an eight-point gain over the most recent (2004) ballot question for support of GSO.
- Began working with our partners at Oregon State University and the Gulf Island Shipyard to plan, design and construct the **new Regional Class Research Vessel**, which is scheduled to arrive in Narragansett in 2021.

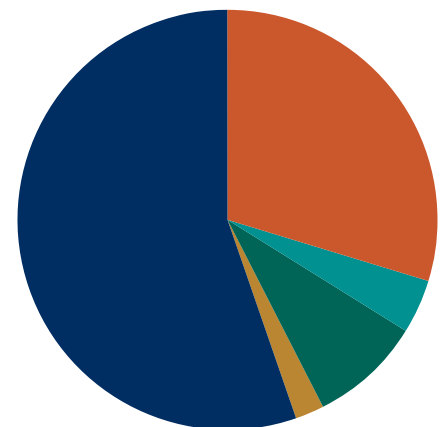
Research and Education

- Secured **\$30 million in new research funding** from federal sponsors (see page 15). GSO accounts for more than one-third of URI’s total sponsored research,

and is perennially the largest component of URI’s total research funding.

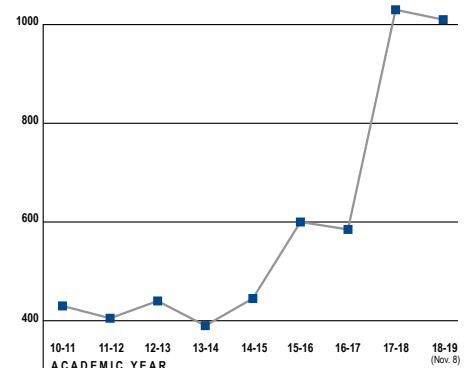
- Increased GSO’s contribution to URI’s education mission. GSO **faculty members teach more than 1,000** undergraduates per academic year, primarily through URI’s interdisciplinary “Grand Challenge” courses.
- GSO’s Inner Space Center provided **at-sea telepresence** services to multiple vessels for hundreds of operational ship days in the Atlantic and Pacific oceans.
- **R/V Endeavor was at sea for nearly 200 days** (see page 8), from the Gulf of Maine to the mouth of the Amazon River, to support various research and educational initiatives.

FY18 Awards by Unit



Faculty	\$16.4 million
Coastal Resources Center	8.8
RI Sea Grant	1.2
R/V Endeavor	2.6
Other	0.5

Undergraduate Enrollment





Outreach

- Reinvested in the Office of Marine Programs' **marketing and communications** function. A new team took on a full slate of projects to help share ocean science with audiences in Rhode Island, around the country and throughout the world.
- At Open House on October 13, the Bay Campus community welcomed **more than 3,000 guests** to discover the ocean science taking place along the shores of Narragansett Bay. Students and faculty from GSO, URI's Ocean Engineering department, and the College of the Environment and Life Sciences staffed more than thirty exhibits. Guests also toured R/V *Endeavor*, Inner Space Center, Marine Geological Samples, Lab the Aquarium and more.
- The GSO **website received an overhaul** to upgrade features and to make it a mobile-friendly platform. With the additional functionality, there will be more video and interactive features. GSO's Twitter and Facebook accounts have been more active. Reach to digital audiences has expanded greatly in the second half of 2018.
- Now in its 15th year, the Rhode Island Teacher At Sea Program **brought educators aboard R/V Endeavor** to participate in ocean-science research. In turn,

they bring their experiences into K-12 classrooms. WPRI Channel 12 meteorologist, T.J. Del Santo, reported live from the ship during several WPRI Eyewitness News newscasts. Telepresence support from GSO's Inner Space Center was key to making these live broadcasts possible.

- Narragansett Bay Classroom **engaged more than 1,300 K-12 students**, presenting nearly 60 programs on ocean science to RI schools. The programs were led by URI graduate students (13 from GSO and four from other URI graduate programs) who served as outreach scientists.

Facilities

- Began **renovation of Mosby Center**—a venerable structure weathered by time and the salt-laced winds of Narragansett Bay. This unique and valuable gathering place has a new roof, will soon have a new deck, and will benefit from long-overdue enhancements to its interior.
- Replaced the 40-year-old **roof on Watkins Laboratory** and refurbished elements of the building envelope. The work included replacing windows in all south-facing offices on the third floor, repointing brick chimneys, and enhancing insulation to meet modern energy-code requirements.

Left, many exhibits at Open House gave children an up-close, hands-on experience of ocean science. Right, Rhode Island K-12 teachers aboard Endeavor learn about the day-to-day work of oceanographic research.

Looking ahead to 2019 and beyond:

- Construction of a **new pier and an ocean technology building** is moving forward (see *article, page 10*). These are important steps in implementation of the Narragansett Bay Campus Master Plan, yet they represent only the beginning.
- **Public and private funding** will be pursued to finance construction of a new research facility, a teaching commons and other critical campus needs. The fundraising strategic plan also calls for creating endowments to support outstanding scientists and students.
- To **better engage Rhode Island's K-12 students** and share our expertise in ocean science, we will reevaluate GSO's various outreach initiatives and look for how best to build on the successes and proud history of the Narragansett Bay Classroom, Rhode Island Teachers at Sea, Oceanography Explorers camp, Open House and other programs.

2018

R/V ENDEAVOR AT SEA

Missions this year included deploying sensors, hosting educators, researching algal blooms, weathering nor'easters, and testing an autonomous lander system.



EN 608: Departed Senesco Ship Repair Yard Jan. 31 for a Long Term Ecological Research (LTER) cruise sponsored by the National Science Foundation (NSF). Principal Investigator (PI) and Chief Scientist was Heidi Sosik of Woods Hole Oceanographic Institution (WHOI). Conductivity, temperature and depth (CTD) casts, bongo net tows, and sand-rake deployments were performed along with continuous underway sampling, using *Endeavor's* newly installed experimental biological underway sampling system.

EN 609: *Endeavor's* departure was delayed two days, until Mar. 4, while the first of two nor'easters passed through Rhode Island with 50-60 knot winds. PI and Chief Scientist was Purnima R. Makris of Northeastern University. Scientists staged a large hydrophone array, which *Endeavor* slowly towed while acoustics were recorded and analyzed in the main lab. The ship remained at sea, heaving to for a day and a night, to endure a second nor'easter packing 40-50 knot winds.

EN 610: Departed Mar. 22 on a Rhode Island Endeavor Program (RIEP) cruise under the direction of GSO faculty members Steven D'Hondt, Christopher Roman and Robert Pockalny. For a project funded by NSF, co-PIs Roman and Pockalny designed, built, and tested a deep-water autonomous lander

system. This mission focused on testing the lander in shallow water.

EN 611: Departed Apr. 3 with students from the URI Honors program for a six-day RIEP research expedition. The Inner Space Center (ISC) broadcast live from *Endeavor* to Facebook on Apr. 5, 6, and 7 and sponsored a community event at URI's White Hall on Apr. 6. The expedition focused on whale and zooplankton interactions with the environment that occur in Rhode Island's coastal and offshore waters. The expedition was part of "CSI Oceans," a URI honors course led by Karen Wishner and Chief Scientist Christopher Orphanides.

EN 612: Departed Apr. 14 on a Naval Research Laboratory (NRL) cruise under the direction of Zhiqiang Liu from the Acoustics Division of NRL. Deployed and recovered a variety of acoustic modem moorings at different depths and towed a sound source to test reception of the acoustic modems.

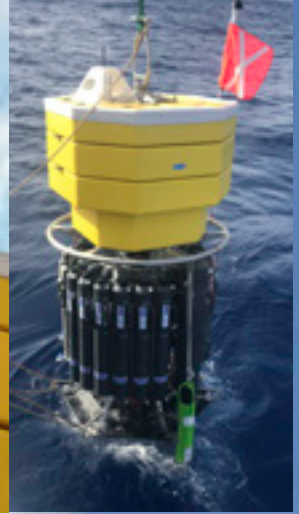
EN 613: Departed Apr. 27 for Barbados. Hosted 11 undergraduates from the NSF-funded STEMSEAS program. Onboard, students were mentored by ship technicians, three experienced scientists, and PI/Chief Scientist Joseph Montoya of Georgia Tech. The team explored factors that promote algal blooms at sites featuring dense populations of N₂-fixing organisms.

EN 614 : For "Collaborative Research: Impact of the Amazon River Plume on Nitrogen Availability and Planktonic Food Web Dynamics in the Western Tropical North Atlantic," scientists sampled the northern reaches of the Amazon Plume during the high-flow season. They focused on blooms and how fixed nitrogen moves into the food web. *Endeavor* then departed for San Juan, Puerto Rico, arriving June 1.

EN 615: This 20-day cruise sponsored by the Navy and Office of Naval Research (Navy/ONR) was directed by PI Jennifer Miksis-Olds from the School of Marine Science and Ocean Engineering at the University of New Hampshire. Seven long-term moorings with passive acoustics and a full complement of oceanographic and meteorological measurement systems were deployed.

EN 616: This 12-day cruise was sponsored by NSF and directed by William M. Balch from Bigelow Laboratory for Ocean Sciences. Scientists sampled water for coccolithophores and performed isotope incubations with various dissolved organic carbon (DOC) compounds and fluorescently labeled bacteria.

EN 617: Departed July 20 on a LTER cruise sponsored by NSF and directed by Heidi Sosik of the Biology Department at WHOI. Conducted sampling and experiments to help characterize how



planktonic food webs change through space and time in response to changes in the physical environment.

EN 618: Departed on the annual Rhode Island Teachers At Sea cruise sponsored by Rhode Island *Endeavor* Program and directed by David Smith, associate dean at GSO. The teachers participated in equipment deployment, data logging, and sample analysis. Typical instruments—e.g., CTD rosette, multi-core, Acoustic Doppler Current Profiler (ADCP), and plankton-net tows—were deployed in Rhode Island Sound and at the edge of the continental shelf. WPRI-TV weather reporter T.J. Del Santo reported live from *Endeavor* throughout the cruise.

EN 619: Conducted a STEMSEAS transit to Gulfport, Mississippi, with 11 students and three scientists/mentors (see EN 613). Scientists gave instruction while, along the way, *Endeavor* performed Multiple Opening and Closing Nets and Environmental Sampling System (MOCNESS) tows, CTD casts, and some plankton net tows.

EN 620: Beginning Aug. 19, a science team directed by Andrew R. Juhl of Columbia University's Lamont-Doherty Earth Observatory investigated temporal changes in nitrogen and phosphorous nutrients as a water mass moves offshore. CTD rosette and bottles were triggered at six depths between the surface and 150 meters. *Endeavor* returned to Gulfport on Sept. 2.

[*Endeavor* remained in port in Gulfport, Mississippi, and waited out tropical storm/hurricane *Gordon* with nearby winds that approached 70 knots. She got underway one day late in transit to San Juan, Puerto Rico, arriving Sept. 12.]

EN 622: On this NSF-sponsored cruise, PI Steven D'Hondt of URI and co-PIs Roman and Pockalny continued development and testing of their CTD lander (see EN 610). The autonomous system capable of conducting water column analysis and sample collection at depths of up to 11 kilometers was successfully tested at 8.4 kilometers. *Endeavor* returned to San Juan on Sept. 23,

then arrived in Narragansett a week later.

[A biennial inspection by NSF surveyed all science and ship machinery and deck equipment and tested for safe and proper operation. *Endeavor* earned high praise for her readiness and condition.]

EN 625: Departed Oct. 20 with Chief Scientist John M. Toole of the Physical Oceanography department at WHOI for a four-day NSF-sponsored cruise. A 400-meter-tall subsurface mooring southeast of Woods Hole was deployed for a six-month trial.

EN 626: For the Atlantic Deepwater Ecosystem Observatory Network, seven long-term moorings were deployed by PI Jennifer Miksis-Olds of UNH along 1,000-kilometers of the outer continental shelf. There are passive acoustics and a full complement of oceanographic and meteorological measurement systems on each mooring. Long-term series data will be collected during the next several years. The cruise was sponsored by the Navy/ONR.

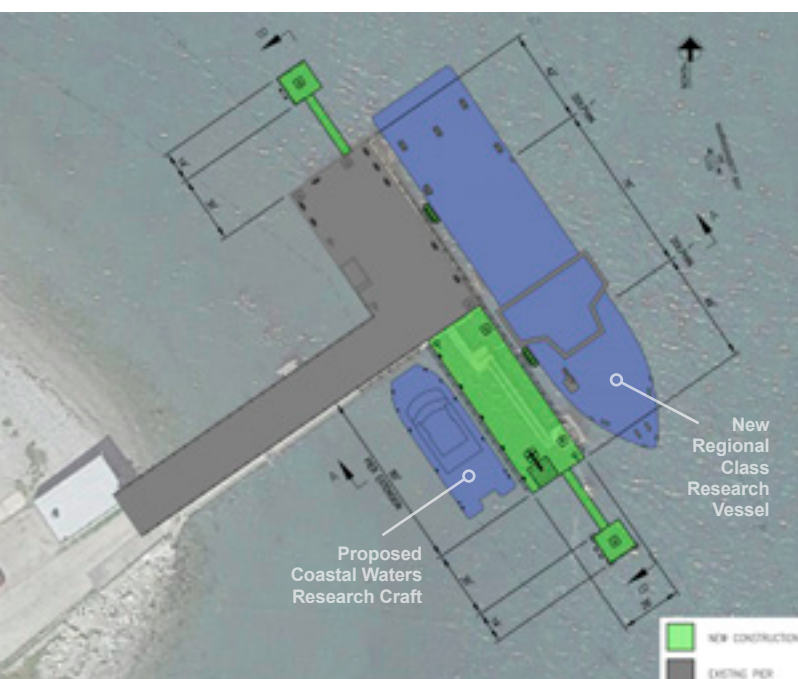
[*Endeavor* concluded the 2018 sailing season on Nov. 15. She then transited to Senesco Ship Repair Yard for major hull, tank and winch work as well as a new paint job. The 2019 sailing season commenced on Jan. 31.]

Background; *Endeavor* in the Gulf of Mexico during EN 620. Top left; Students from the STEMSEAS program. Top center; algal blooms like this one at South Padre Island, Texas, were studied during EN 613 and 614. Top right; During EN 622, an autonomous CTD system is prepped and deployed for testing.

With bond funding approved, campus construction to begin

By Todd McLeish

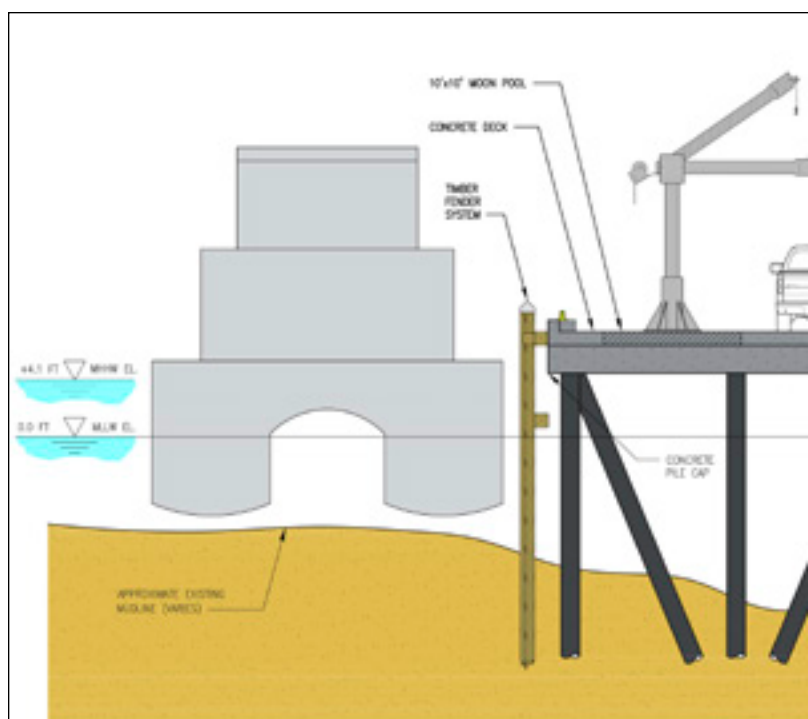
When Rhode Island voters approved a bond referendum in November in support of new and upgraded facilities at the Narragansett Bay Campus, the oceanography community was thrilled. And now the work commences.



The \$45 million in new funding, most of which will become available in the summer of 2019, will be used to replace the existing pier, construct a new building to consolidate Marine Operations, build a new Ocean Technology facility, and upgrade campus infrastructure.

A New Pier for a New Era

According to David Palazzetti, Director of Facilities and Operations at the Bay Campus, the new pier is the first priority. In order to have the pier designed, permitted and constructed before the new ship arrives in the fall of 2021, he issued a request for proposals in January to hire an engineering firm to design the pier.



“Because the structure will be in the water and along the shore, there will be a lot of permitting involved,” he said, noting that it will likely take a year to secure permits from the Army Corps of Engineers, the Coastal Resources Management Council and other state and federal agencies before construction can begin.

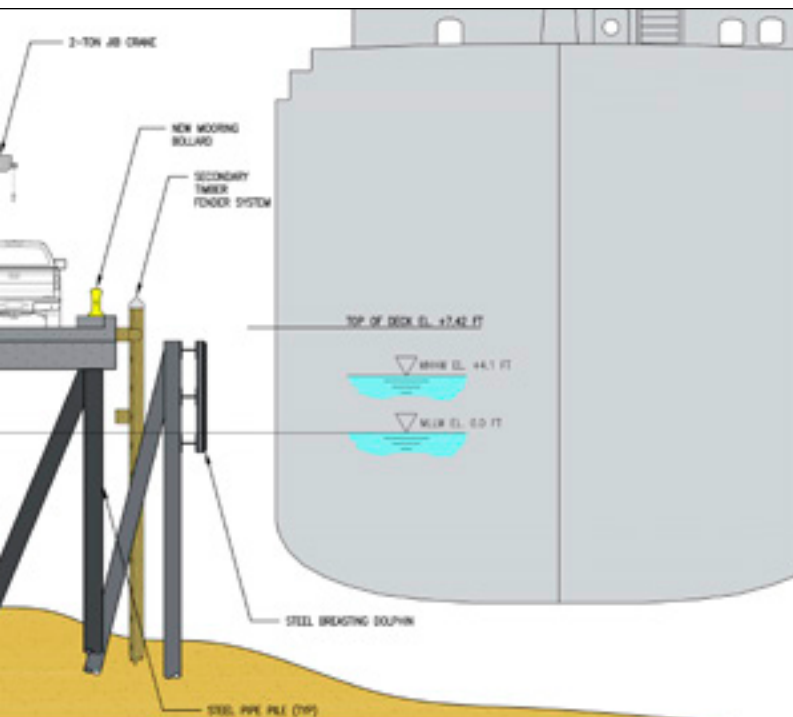
The new pier will be T-shaped and 200-feet long on its outboard face—more than twice the length of the existing pier—enabling cranes on the forecastle and stern of the new 199-foot vessel to load supplies and science equipment. It will also accommodate a visiting boat of up to 68-feet to tie up on its shoreside face.

Planning for the Marine Operations and Ocean Technology buildings and infrastructure improvements will begin in the summer.

Supporting Ocean Science

The 12,250-square-foot Marine Operations building, to be located adjacent to the Marine Logistics building on Pier Road, will consolidate the offices, labs and storage areas used by those responsible for managing the operation of the research vessel and the marine technicians who support the scientists aboard ship. The URI Research Diving operations staff and equipment will also be housed in this new facility. It will include high-bay work space with an electronics shop and machine shop and large staging areas where gear can be worked on and prepared for deploying on the ship.

“When the ship comes to us, it’s just a blank research vessel that the marine technicians configure to meet the needs of the scientists on each cruise,” Palazzetti



explained. “They need space for staging equipment, some of which needs testing and assembly. Presently, they are forced to do some of that work in parking lots on campus.”

Following design and permitting, construction of the building will commence around the summer of 2020.

A Home for Innovation and Invention

Construction of the new Ocean Technology building will follow just behind that of Marine Operations because the campus entrance road and utilities will first need to be relocated to the west.

“We have to shift Pier Road to open up the flatter land on that portion of the campus to site some of those new buildings,” said Palazzetti. “Using that space allows for larger buildings located well above the flood zone with better vehicle and pedestrian access.”

With Pier Road no longer in the way, the building will sit northwest of the Center for Atmospheric Chemistry.

The new Ocean Technology building will provide laboratory and shop space for faculty conducting marine robotics and sensor research and development. The building will feature overhead cranes, ballast tanks and pools to test new marine technologies, as well as shared space to encourage collaboration.

“The road and utility work will be completed in anticipation of future bond funding,” said GSO Dean Bruce Corliss. “Next up in our master plan will be replacement of the Horn Research Lab, construction of a new Ocean Engineering building, as well as a new teaching facility and a new repository for our rock and sediment core collections.”



Above, from left: a footprint view from a preliminary engineering study defines the likely dimensions and position of a reconstructed pier; from the same engineering study, a side view depicts the position of research vessels and indicates bottom clearance at low tide; shown on this satellite view of the Narragansett Bay Campus are sites of the pier reconstruction, a Marine Operations building, an Ocean Technology building, and a new path for Pier Road.

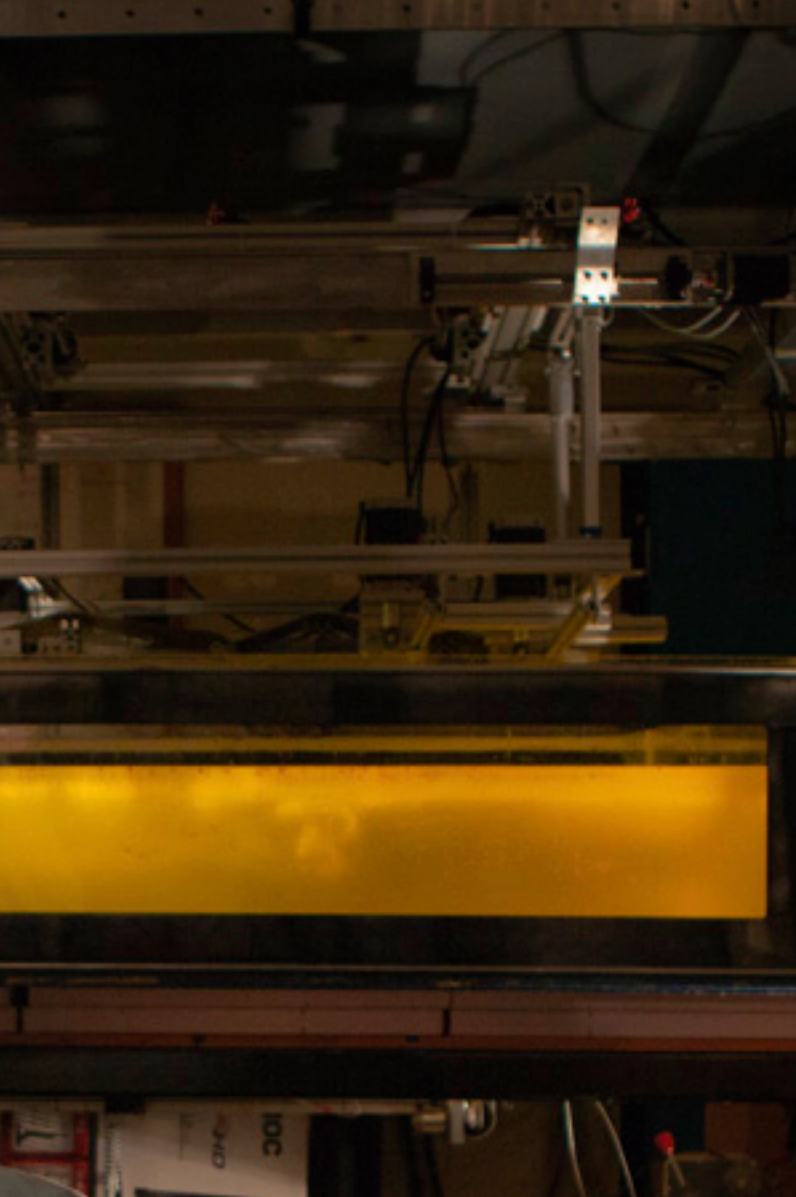
2018

ACADEMICS AND EDUCATION

While at GSO, graduate students infuse Narragansett Bay Campus with their academic thirst, hopeful spirit, and creative energy.



Top, Loes van Dam in Chris Kincaid's laboratory with her research that drew national media attention; above left, Jacob Strock was one of scores of student volunteers who staffed the 2018 Open House; above right, organizers and participants of the Bay Informed Discussion Series—from left, Christine Gardiner, Matt Dunn, Joe Langan, Nina Santos, Diana Fontaine, Catrina Nowakowski, Maya Morales-McDevitt, Michelle Hauer, Melanie Feen, Sam Katz and Nicole Flecchia.



Our faculty members have created new courses that can help undergraduates address compelling issues—climate and the ocean, ocean life and food security, and extreme weather events—that society will face in the future.

Graduate students continue to produce new research results. In 2018, these results were presented to the scientific community at national and international meetings and published in more than 20 articles in peer-reviewed literature. Carrie McDonough (Ph.D. 2017, advised by Rainer Lohmann) was awarded the C. Ellen Gonter Environmental Chemistry Award from the American Chemical Society in recognition of her work on organic pollutants. The research conducted by graduate student Loes van Dam (advised by Chris Kincaid)—a physical model to visualize seafloor spreading—was featured in an article that was picked up by the popular press across the U.S. and beyond.

Student-led and well-attended, the “Bay Informed Discussion Series” continues to be an exemplary program for engaging the broader community in GSO’s work. Students enjoy a terrific opportunity to hone presentation skills by speaking with the public about their research, ocean science and related issues.

The GSO faculty is playing a far more prominent role in undergraduate education at URI than in years past. For decades, GSO faculty taught undergraduate-level courses predominantly to students majoring in ocean engineering and marine biology. GSO faculty now teach large, general education courses that reached more than 1,200 students last year. Our faculty members have created new courses that can help undergraduates address compelling issues that society will face in the future. These topics include such “grand challenges” as climate and the ocean, ocean life and food security, and extreme weather events.

Sponsored by the National Science Foundation, the Summer Undergraduate Research Fellowship in Oceanography (SURFO) program was held for its 31st consecutive summer at GSO. Twelve students from around the country spent ten weeks on the Narragansett Bay Campus conducting research in faculty labs. Paired with GSO graduate students, these undergraduates learned new analytic techniques to take on basic questions in oceanographic research. Historically, this program has proved to be extremely useful in recruiting graduate students.

We look forward to the discoveries our current students make, even as we actively recruit the next cohort.

The academic program continues to be at the heart of GSO’s mission. Each fall, new students reinvigorate the campus, while, each spring, graduates depart to pursue their careers and extend GSO’s influence around the world.

In May, 24 students celebrated their graduation. These new alumni completed the Master of Oceanography (9), Master of Science (9), and Doctor of Philosophy (6). Some accepted positions nearby at the RI Department of Environmental Management and the US Naval Undersea Warfare Center, while others began post-doctoral research far afield, in places like Sweden and Tasmania. As usual, GSO graduates accepted an array of assignments in academia, industry, non-profits and government.

Seventeen new students arrived in September to begin work toward the Master of Oceanography (4), Master of Science (4), or Doctor of Philosophy (9). These students were recruited nationally and internationally and will soon research such diverse topics as optical properties of seawater, symbiotic relationships at hydrothermal vents, and hurricane modeling.

2018

RESEARCH AND DISCOVERY

From submerged cultural sites in Rhode Island Sound to earthquakes in the Pacific, GSO generates new knowledge.

PROJECT: Identifying ancient cultural sites on southern New England's continental shelf

The U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) is responsible for leasing submerged lands on the continental shelf for offshore energy development and mineral resource extraction. By law, the agency must consider potential impacts to submerged cultural sites as part of its project review and permitting processes.

To help it protect submerged ancient Native American cultural sites, BOEM funded GSO researchers to conduct a five-year program of geoarchaeological research in the nearshore and offshore waters of Rhode Island.

Working with partners from federal- and state-recognized Indian Tribes, federal and state agencies, universities, the international research community and industry, the GSO-led team developed "best practice" recommendations for a culturally sensitive, science-based approach to identifying ancient Native cultural sites submerged by post-glacial global sea-level rise. The results of this project will inform BOEM's decision-making related to assessing and avoiding impacts to submerged ancient Native cultural sites identified within proposed offshore permit areas.

In addition to developing best practices to identify submerged cultural sites, the project also created a model that can be used

to help identify the possible location of submerged ancient landscapes on the southern New England continental shelf. Project research also documented the local paleoenvironmental record through sediment coring, which provided a view of local environmental conditions dating back over 12,000 years. Three submerged paleocultural sites—two west of Block Island dating from approximately 6,500 years ago and one in Greenwich Bay dating from 1,500 years ago—were also identified during the project. Consisting of *in situ* quartz "chipping debris" from stone tool-making, pre-cultigen plants, and a hearth feature (burned ground surface,

charred pieces of wood, and fire-exposed rock cobbles), the finds demonstrated that such sites could survive inundation and be preserved underwater.

The project, which is scheduled to be completed by spring 2019, is led by GSO professor John King (lead principal investigator), working with GSO research staff David Robinson (co-PI), Carol Gibson, Brian Caccioppoli, Monique LaFrance-Bartley, and Danielle Cares, along with several students, consultants, and volunteers, and local and regional tribal representatives.



Top, GSO professor John King; above, URI undergraduate student and Narragansett Indian Tribal member Chali Machado moves a sediment probe into position to collect visual data on Greenwich Bay's buried stratigraphy.

SPONSORED RESEARCH AWARDS

GSO's faculty and marine research scientists earned the following awards in 2018:

- \$585,618** to Roxanne Beinart from National Science Foundation for "The Impact of Symbiont-Larval Interactions on Species Distribution Across South-western Pacific Hydrothermal Vents"
- \$899,732** to Robert Campbell from National Science Foundation for "The Role of Planktonic Lower Trophic Levels in Carbon and Nitrogen Transformations in the Central Arctic, a MOSAIC Proposal"
- \$122,163** to Steven Carey from National Science Foundation for "NSFGEO- NERC Caldera-Forming Eruption-Generated Tsunamis"
- \$196,487** to Steven Carey and Katherine Kelley from National Science Foundation for "An Integrated Study of the Driving Forces and Deposits of Shallow Water Eruptions of Volatile-Rich Basalt: Socorro 1993 Revisited"
- \$250,000** to Bruce Corliss et al. from Oregon State University for "Regional Class Research Vessel (RCRV) #2: Phase III – Ship Construction Oversight"
- \$36,922** to Peter Cornillon from Earth Space Research for "Evaluate the Temporal and Spatial Variability of the SST Gradient Field in the Arctic and Sub-Arctic"
- \$405,493** to Annette DeSilva from National Science Foundation for "Ocean Observatories Initiative Facility Board (OOIFB) Administrative Support Office"
- \$823,479** to Kathleen Donohue and D Randolph Watts from National Academy of Sciences for "Understanding Gulf Ocean Systems, Topic 2, Pressure and Current Meters"
- \$445,813** to Isaac Ginis and Tetsu Hara from National Science Foundation for "Surface Wave Impacts on Upper Ocean Response to Tropical Cyclones"
- \$50,806** to John King from INSPIRE Environmental LLC for "Deep Water Wind EMF Survey: EMF Study of the Export and Inter-Array Cables, Rhode Island"
- \$694,511** to John King from Bureau of Ocean Energy Management for "Electromagnetic Field Impacts on American Eel Movement and Migration from Direct Current Cables"
- \$33,601** to John King from New England Interstate Water Pollution for "Sediment Profile Imagery Survey to Evaluate Benthic Habitat Quality in Narragansett Bay"
- \$262,421** to Rainer Lohmann from Strategic Environmental Research and Development Program for "Field Testing a Passive Multisampler to Measure Dioxins/Furans and Other Contaminant Bioavailability in Aquatic Sediments"
- \$18,480** to Rainer Lohmann from Environment and Climate Change of Canada for "Preparation and Analysis of Passive Samplers for Organic Contaminants in Lakes and Seawater"
- \$269,485** to Brice Loose from National Science Foundation for "Measuring Dissolved Gases to Reveal the Processes that Drive the Solubility Pump and Determine Gas Concentration in Antarctic Bottom Water"
- \$541,432** to Brice Loose from National Science Foundation for "Identifying the Controls on Gas Flux and Microbial Carbon and Energy Transformation Across the Sea-Ice-Seawater Interface in the New Arctic"
- \$250,000** to Jennifer McCann from R.I.'s Coastal Resources Management Council for "Narragansett Bay Special Area Management Plan (BAY SAMP)"
- \$745,815** to Jennifer McCann from National Oceanic and Atmospheric Administration/Sea Grant for "Expanding Rhode Island Aquaculture through a Web-Based, Entry-Level Farm Worker Training Program with Model/Learnings to other States"
- \$76,224** to Kelton McMahon from Rhode Island Science and Technology Advisory Council for "Developing Novel Amino Acid Fingerprinting Tracers to Understand Shifts in Phytoplankton Community Structure of Narragansett Bay"
- \$70,000** to Susanne Menden-Deuer from National Aeronautics and Space Administration for "Light Dependence in Herbivory Rates for North Atlantic Plankton"
- \$45,000** to Melissa Omand from National Aeronautics and Space Administration for "Net Community Production Across Scales: From Autonomous Profiling to Ocean Color Remote Sensing"
- \$450,002** to Melissa Omand and H Thomas Rossby from National Science Foundation for "Minions: A Low-Cost Float for Distributed, Lagrangian Observations of the Biological Carbon Pump"
- \$40,014** to Jaime Palter from National Science Foundation for "NSF-RAPID: Observing Heat and Carbon Fluxes with an Autonomous Wind-Powered Surface Vehicle in the Gulf"
- \$106,327** to Glenn Ricci from Department of Interior for "Conducting a Vulnerability Assessment at George Washington Birthplace National Monument and Identifying Options to Increase Resilience at Multiple Parks"
- \$199,258** to Glenn Ricci and Elin Torell from International Union for Conservation of Nature for "Central America Regional Coastal Biodiversity Project"
- \$396,783** to Rebecca Robinson from National Science Foundation for "The Nitrogen Isotopic Composition of Diatom Resting Spores in Southern Ocean Sediments: A Source of Bias and/or Paleoenvironmental Information?"
- \$73,834** to Rebecca Robinson, John King and Brice Loose from Rhode Island Science and Technology Advisory Council for "Exploring the Capabilities of a New Benthic Lander System for Investigating Sediment Biogeochemical Exchange—A Critical Boundary Condition for Ecosystem Modeling in Narragansett Bay"
- \$39,000** to Christopher Roman from Creare LLC for "Autonomous Bathymetric Survey System"
- \$20,800** to Pamela Rubinoff from University of Connecticut for "Inland and Coastal Flooding Preparation, Mitigation and Recovery in Continuous States"
- \$159,715** to Gail Scowcroft and Dwight Coleman from National Science Foundation for "NSF-EAGER: Antarctic Broadcasts: Broader Impacts Through Telepresence"
- \$7,775** to Yang Shen from National Science Foundation for "NSF-RAPID: OBS Survey of Kilauea's Submarine South Flank Following the May 4, 2018 M6.9 Earthquake and Lower East Rift Zone Eruption"
- \$185,248** to Elin Torell and Brian Crawford from Mississippi State for "URI Fisheries Innovation Lab"
- \$239,324** to David Ullman from National Science Foundation for "Investigating the Air-Sea Energy Exchange in the Presence of Surface Gravity Waves"
- \$79,968** to David Ullman and Melissa Omand from Rhode Island Science and Technology Advisory Council for "Glider-Based Observations of Hydrography and Nutrients in Rhode Island Sound in Support of RI C-AIM Modeling"
- \$64,704** to John Walsh from National Science Foundation for "NSF-RAPID: Examining Seafloor Dynamics Offshore Bogue Banks, NC Related to Hurricane Florence"
- \$559,849** to D Randolph Watts from multiple sources for "Inverted Echo Sounder (IES) Technology/Research: Pressure Recorders (PIES) and Current Meters (CPIES)"

PROJECT: Investigating submarine earthquakes after the Kilauea eruption

GSO professor Yang Shen is at the forefront of seismology science. This spring, he and collaborators at Western Washington University and Rice University applied for a National Science Foundation (NSF) nRAPID (Rapid Response Research) grant to investigate a magnitude 6.9 earthquake following the eruption of Hawaii's Kilauea volcano. NSF RAPID grants are a funding mechanism for NSF to respond to natural hazards and events in near real-time with scientific research. Shen and graduate student Jiahang Li received their RAPID award in June to survey Kilauea's submarine south flank following the May 2018 earthquake and Lower East Rift Zone eruption.

Only one month prior, a dramatic shift took place in the ongoing eruption of Kilauea: both the summit lava lake and the vent at Pu'u O'o, active for 35 years, catastrophically drained, sending magma to the Lower East Rift Zone, where it began to erupt. The shift in activity was accompanied by a dramatic increase in seismicity within the rift zone, at the summit, and beneath the volcano's submarine south flank. The resulting earthquake ruptured the south flank; this was the largest earthquake recorded in Hawaii since the 1975 Kalapana event occurred at virtually the same location.

In July, off the coast of the Big Island, aboard the R/V KOK, the team deployed a network of ocean-bottom seismometers (OBSs) to record the aftershocks and hydro-acoustic activity associated with the ongoing eruption. The resulting seismoacoustic recordings can be used to locate offshore earthquakes and identify submarine eruptive processes such as lava-water explosions, submarine lava flows, and landslides.

The OBSs were collected in the fall, and preliminary analysis suggests that many more earthquakes occurred offshore than were detected by the land-based seismic network. The OBS data substantially improved the ability of scientists to determine the location of offshore earthquakes, which will lead to better understanding of the seismic, submarine landslide and tsunami hazards of Kilauea's south flank.



Top, GSO professor Yang Shen. Above, left to right, graduate students Jiahang Li (URI's Graduate School of Oceanography), Martin Rapa (Scripps Institution of Oceanography), and Lena Gibbs (Western Washington University) deploy an ocean-bottom seismometer off the Hawaiian coast.

2018

BAY CAMPUS CHRONICLE

**Highlights from Coastal
Institute, Coastal Resources
Center, Inner Space Center,
and Rhode Island Sea Grant**

Coastal Institute

Interdisciplinary Teams

The Coastal Institute (CI) fosters and supports interdisciplinary collaborations with special emphasis on CI Senior Fellows who embody a variety of disciplines and represent a diversity of institutions, public agencies, private sectors and citizen scientists. Once again, the CI brought the Senior Fellows together for their annual field trip to explore the upper watershed of both the Taunton and Blackstone Rivers. This fresh air think tank provides valuable feedback on CI investments as well as the opportunity to imagine future collaborations.

Once these discussions spark a proposal concept and identify a source, the CI participates in grant development by using its Grants-in-Aid, Catalyst Grants, and Leveraging Grants programs to provide staff or financial support during grant development, application, and maintenance. As one example, a CI Grants-in-Aid investment of \$15,000 supported the Coastal Resources Center staff travel to the Philippines to research and prepare a U.S. Agency for International Development grant proposal. This led to a \$25 million award—the largest in URI history—focusing on protecting the Philippines marine biodiversity by addressing some of the major key threats, overfishing and illegal fishing.

As part of the CI Climate Response Demonstration Site initiative, Warren and Barrington were identified as towns in urgent need of planning for sea-level rise. These foresighted municipalities are engaging with an evolving consortium of URI experts—led by Dr. Charles Roman (CI/ URI Department of Natural Resources Science), Teresa Crean (Coastal Resources Center), and Amber Neville (CI)—multiple state agencies, the U.S. Department of Housing and Urban Development, and the University of Pennsylvania.

The culmination of three years of investment in workshops, the CI hosted a regional gathering of experts in “R” programming—a free software environment for statistical computing and graphics—at the first Nor’eastR Conference.

Innovative Science Communication

For the second year, the CI has served as the Research Translation Core for the \$8 million National Institute of Environmental Health Sciences Superfund Research Program led by GSO professor Rainer Lohmann in partnership with Harvard University and the Silent Spring Institute. At the program’s annual meeting, the CI’s outreach materials were lauded as the clearest and most compelling science communication seen.

Following its mission to enrich the conversation regarding coastal management, the CI hosts a range of speakers and events. The 2018 Scott W. Nixon Lecture Series featured his former student, Dr. Robinson “Wally” Fulweiler, who vividly demonstrated her expertise as an estuarine scientist with her

(continued next page)



Top, Coastal Institute Senior Fellows on the Blackstone River during an annual field trip; above, Dr. Jeffrey Hollister opens the Nor’eastR conference in Providence.

talk *So Many Estuaries, So Little Time: Narragansett Bay as a Model for Coastal Systems Under Change.*

In support of the CI's ongoing training related to Scientific Support for Environmental Emergency Response, speakers Dana Tullis from the U.S. Coast Guard, and Lisa DiPinto and Steve Lehman from the National Oceanic and Atmospheric Administration provided in-depth lessons learned from the Deepwater Horizon oil spill.

The RI Environmental Monitoring Collaborative (EMC), chaired by Dr. Nicole Rohr (CI), was statutorily established to coordinate environmental monitoring strategies as well as to identify state monitoring priorities. In service of the people of Rhode Island and its elected officials, the EMC developed a much-needed database dashboard that serves to educate the public about the health of our environment (www.rimonitoring.org).

Complementing STEM perspectives, the CI looks to aesthetics as a means to stimulate ways of thinking about science. Ecologists worked in partnership with renowned artist Lori Jeremiah to explore threatened salt marshes in the Studio Blue exhibit, "Fading Landscapes: the fragility of coastal beauty," which was a feature of the GSO Open House.



The painting "Grassy Routes in Jamestown" by Lori Jeremiah

Coastal Resources Center

The Center continued last year making local and global impacts in its three portfolio areas—sustainable seafood; thriving, resilient communities; and well-planned coasts and oceans.

National Innovation

In Rhode Island, CRC kicked off a Blue Economy project with support from GSO. The project is focused on forging new connections between the state's marine-based businesses, from boatbuilding and aquaculture to the defense industry, while also engaging government, community and academic partners in the conversation. The Narragansett Bay Special Area Management Plan (Bay SAMP) picked up momentum with CRC facilitating the process for the RI Coastal Resources Management Council (CRMC) to develop draft policies that define and protect bay resources. Through public dialogue for this project, key issues, such as identifying locations for underwater cables of potential wind farm installations, are being researched and resolved. In other wind farm-related activity, the CRC developed indicators for the U.S. Bureau of Ocean Management that will assist coastal states countrywide as they assess the impact of offshore renewable

energy facilities on their communities and economies.

The adoption of the Shoreline Change Special Area Management Plan (Beach SAMP) was a major milestone for the RI CRMC, garnering national media attention. The plan includes comprehensive guidance and recommendations for community-based adaptation planning for flooding and erosion associated with storms and sea-level rise. CRC also continued the momentum of its PREP-RI (Providing Resilience Education for Planning Preparedness in RI) Initiative, providing sought-after technical assistance to government, private sector, and community entities, and launching new pilot programs in Providence and Portsmouth, RI. The domestic team remains an important trainer and resource for the shellfish aquaculture industry, providing education and services to farmers and farmhands alike through a recent large federal grant. CRC continues to work to facilitate the RI Shellfish Initiative by building engagement among private sector, government and community partners. Another federally funded project is enabling CRC to investigate options for enhancing the nascent kelp farming market in Rhode Island and the New England region as a whole.

Actions for Global Sustainability

In 2018, the U.S. Agency for International Development COMFISH program, which focused on improving fisheries management in Senegal, concluded after seven very successful years. A major effort of COMFISH was the development and support of Local Artisanal Fisheries Councils (CLPAs) across the country.



The success of the project was clear this fall when the Senegal government agreed to remit 60 percent of the revenue from fishing licenses to support functions and any loss claims of the CLPAs. As part of the project, CRC hosted a study tour in Rhode Island and Washington, D.C. for a delegation from Senegal to learn and engage with several entities in the U.S., such as the U.S. Coast Guard, Navy and the RI Department of Environmental Management.

While some projects ramped down, others have started up. New projects, funded through USAID, include the Fish Right Program in the Philippines, the Hay Tao project in Madagascar, the Regional Coastal Biodiversity Project in three countries of Central America, and the Fish Innovation Lab (multi-country).

The Fish Right Program in particular is being implemented in partnership with Philippine universities, non-governmental organizations, and government agencies thanks to the largest grant in URI history (\$25 million). While the goal is to increase fish biomass in three study areas, the project team is also working to engage the public and private sector to increase fisheries management capacity and reduce threats to coastal and marine biodiversity. CRC continues to work hard on ongoing projects in Ghana that have made a tremendous impact on fisheries, post-harvest markets and communities across the country.



Top, URI President Dooley (far right) stands with Philippines and U.S. representatives at the launch ceremony for the USAID Fish Right Program. Center, A Senegalese woman celebrates in Missirah, a town on the Sine Saloum delta in Senegal. Bottom, a stop at the hurricane barrier in Providence, R.I., during a CRC-led field trip for URI undergraduates in Spring 2018.

Inner Space Center

The Center continued to support ocean exploration through telepresence activities aboard research vessels including the R/V *Endeavor*, NOAA ship *Okeanos Explorer*, and E/V *Nautilus*.

Blending Space and Ocean Exploration

ISC worked closely with NASA, NOAA, and the Ocean Exploration Trust to support the SUBSEA (Systematic Underwater Biogeochemical Science and Exploration Analog) research program, designed to bring together the worlds of space and ocean exploration and science. In August 2018, the *Nautilus*' mapping and ROV systems were used off the Big Island of Hawaii to explore recently erupted volcanic flows on the seafloor and the active Lo'ih'i Seamount at up to depths of 4,000 meters. This underwater volcano was investigated as an analog for potential hydrothermal systems that could exist on moons like Enceladus and other "Ocean Worlds." The NASA team was stationed in Mission Control at the ISC, learning how scientists and engineers conduct remote science and direct ROV dives via telepresence. The NASA team will return in May 2019 for the next phase of the program, where newly developed software tools and exploration protocols will be employed



to handle data visualizations and enable decision-making in near real time.

Tri-Ship Connection

The ISC coordinated and hosted a live interaction with three ocean science and exploration vessels: the NOAA Ship *Okeanos Explorer*, E/V *Nautilus*, and RV *Falkor* on June 8, 2018, as part of the globally celebrated World Oceans Day. The event reached over 6,000 viewers across four YouTube and four Facebook live streams, a tenfold increase from the previous year's event.

Rhode Island Endeavor Program

In April 2018, undergraduate students from a University of Rhode Island Honors Program course taught by GSO professor Karen Wishner departed on a six-day oceanographic expedition aboard the R/V *Endeavor*.

The ISC team equipped the ship with portable telepresence technologies and conducted four live broadcasts to a variety of school groups. More than 1,000 students connected with the ship, learned about research activities, and were able to ask questions of cruise participants in real time.

Yes-on-2 Bond Campaign Live Event

Ahead of the November 2018 statewide election, the ISC facilitated and hosted a live interaction with a class of engineering students at Central Falls High School, scientists and engineers onboard E/V *Nautilus* and scientists and educators at ISC Mission Control. Showcased were connections between telepresence-enabled ocean science and live educational opportunities provided to K-12 schools, a capability that will be greatly expanded through approval of the ballot's Question 2.



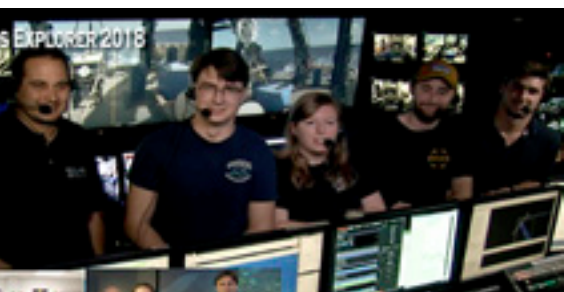
Skype a Scientist

The Skype a Scientist program (<https://www.skypeascientist.com/>) matches classrooms with scientists around the world. As part of this program, the ISC facilitated several live interactions between classrooms and Catalina Martinez, Regional Program Manager for the NOAA Office of Ocean Exploration and Research. One interaction featured URI Ocean Engineering assistant professor Brennan Phillips at the ISC along with URI Ocean Engineering students from his class who were sailing onboard NOAA Ship *Okeanos Explorer*.

ARISE Workshop

The ISC education team conducted the three-day Arctic Researchers and Informal Science Education (ARISE) Workshop in October for 47 Arctic scientists and education professionals from across the U.S. The workshop provided opportunities for broadening the impacts of Arctic research funded by the National Science Foundation. It also introduced the scientists to leaders in polar education, who shared information on effective practice, examples of successful broader impact activities, and models for sharing research results with diverse audiences.

Top left, members of the NASA team at work in ISC's Mission Control. Below, far left, engineering students at Central Falls H.S. in R.I. interact with scientists and engineers at GSO and on board *E/V Nautilus*. Below, during the ARISE workshop, R.I. high school students converse with scientists on board *Okeanos Explorer*.



Rhode Island Sea Grant

One of the hallmarks of the program, based at GSO, is its ability to respond quickly and thoroughly to stakeholder needs.

Rhode Island Fiberglass Vessel Recycling

One such issue arose through discussion with the Rhode Island Marine Trades Association (RIMTA), which brought forth the challenge its members were facing dealing with the disposal of end-of-life fiberglass boats. The state landfill is expected to be at capacity within the coming two decades. Once capacity is reached, there will be nowhere to dispose of fiberglass boat hulls. RIMTA further noted that boat hulls, because

of their size, accelerate the capacity deadline, as well as contribute to the overall issue of plastics disposal, which has emerged as a worldwide problem.

Rhode Island Sea Grant Director Dennis Nixon allocated program development funds for a graduate research assistant to look into mechanisms for the disposal of end-of-life

Below, Hurricane-tossed and storm-damaged, these fiberglass boats have become a total loss.

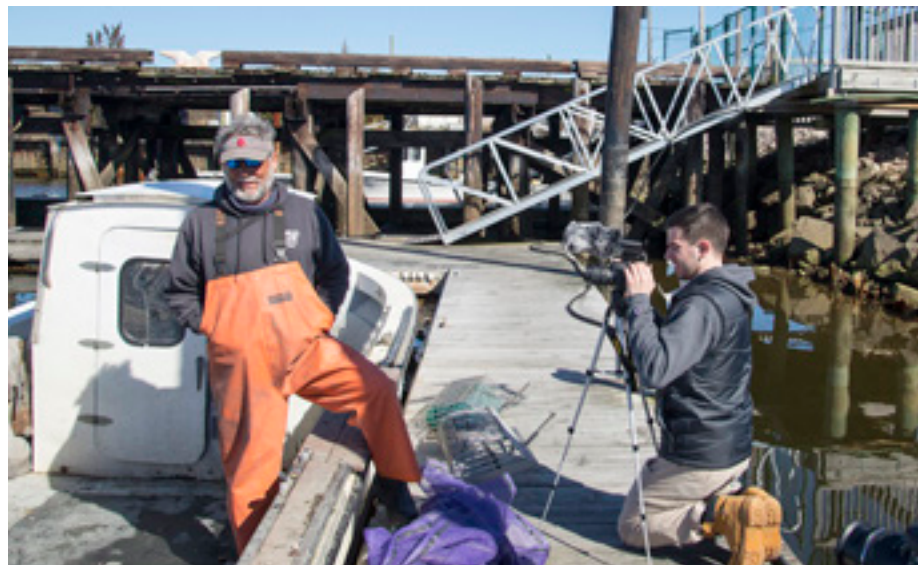


Right, Brynae Riggins from Roger Williams University was a Sea Grant Law Fellow. Below right, Sea Grant intern Ryan Donnelly films shellfisherman Mike McGiveney for the “Shellfish Shorts” video series.

fiberglass boats. The student, Evan Ridley, found that fiberglass boats are recycled in Europe in a process that turns the fiberglass into the raw material for cement production. With Nixon’s guidance, Ridley met with representatives of the Rhode Island Resource Recovery Agency, which operates the landfill, as well as marina operators and cement producers, to see if a similar process would be feasible in the U.S. The answer was yes, mechanically it could be done. A pilot program was developed to test the technical validity, which proved successful.

This project, now termed the Rhode Island Fiberglass Vessel Recycling pilot project, is in the process of testing economic feasibility. If it succeeds, fiberglass boat recycling would not only help slow the rate at which the state’s landfill capacity will be reached in Rhode Island, but could very well change the fate of end-of-life fiberglass boats at a national scale. A significant source of plastics pollution would be removed from the waste stream and recycled as both a source of fuel and as a component of cement production, both with cost savings to cement producers.

Ridley earned his master’s degree and was hired as project manager by RIMTA in 2018 to develop and implement the economic feasibility study. Funding for the position was secured by Ridley and Sea Grant and provided by 11th Hour Racing, a private foundation that works with the sailing community and maritime industries on ocean health initiatives. In less than a year at RIMTA, Ridley received a “Rising Young Leader Award” at IBEX, an international boat building exposition held in Nashville in 2018. Director Nixon was appointed by Governor Gina Raimondo to the state’s Plastics Task Force.



Law Fellow Program

Rhode Island Sea Grant has also responded to stakeholder needs through its Law Fellow program, run by the Rhode Island Sea Grant Legal Program, which matches selected law students at Roger Williams University School of Law with organizations in need of legal and policy research. Recently, this program has helped a Connecticut municipality grapple with decisions regarding the impact of sea level rise on its roadways, as well as responded to a commercial fishing industry request to examine the legal challenges to selling seafood directly to the public.

Shellfish Shorts

Sea Grant was also instrumental in developing the “Shellfish Shorts” video series to promote the Rhode Island Shellfish Initiative, a partnership among state agencies, industry and conservation organizations. The videos cover such topics as how to shuck an oyster, how to dig for quahogs and how to safely handle and prepare your shellfish.

Projects like these and many others have resulted in the Rhode Island Sea Grant program receiving high marks for meeting and exceeding National Sea Grant standards of excellence at the program’s 4-year review in November.

GOING FORWARD

DEVELOPMENT

A Fundraising Strategic Plan unveils how philanthropic support can propel GSO to achieve near-term goals and pursue a long-term vision.

GSO leadership recently adopted a Fundraising Strategic Plan that sets goals and priorities for new giving and ongoing investment—a comprehensive vision for academic leadership and sustainable growth. Elements of the plan address redevelopment and transformation of the Narragansett Bay Campus and advancement of GSO's position as a recognized leader among oceanographic institutions.

The plan calls for raising \$43 million in private gifts over the next several years that, when paired with public funds, will:

- attract and retain the most accomplished and talented faculty and students
- empower faculty, researchers and students—those who are best able to understand and impact the health of the world's oceans, coastlines and inland waters
- inspire professionals, researchers and educators the world over, and
- engender pride and support among citizens who value ocean science in the Ocean State.

Redevelop the Narragansett Bay Campus

Campus facilities, worn by weather and time, belie the school's national prominence in oceanography, coastal policy and technological innovation. A recent independent analysis revealed that nearly 60 percent of buildings and laboratories have reached the end of their service life.

"GSO East": Replace Horn Research Labs, now more than 50 years old, with a state-of-the-art research facility for faculty working in the geological and biological oceanographic disciplines. *\$6 million*

Ocean Innovation and Technology: A new building in which GSO and Ocean Engineering faculty collaborate on technological innovations for the systems and equipment that will be carried aboard and deployed by research vessels, transforming the practice of oceanography. *\$5 million*

Teaching Commons: With new construction at the east end of GSO's quad, increase the capacity to educate and serve undergraduate and graduate students and enhance their learning experience. *\$5 million*

Expand the Mission in Coastal Waters

Coastal Waters Research Vessel: Faculty at GSO and the College of the Environment and Life Sciences will collaborate on nearshore research aboard this stable platform that can accommodate up to 30 passengers. As a living classroom, the vessel will host K-12 and college students for research projects on Narragansett

Endow Support for Academics

Dean's Leadership Fund for Excellence in Oceanography: Generate funds for startup and compensation packages that the dean may offer to attract and retain renowned faculty who are performing transformative research. The Leadership Fund may also support deserving graduate students and enable the dean to invest in strategic priorities for the school. *\$5 million*

Restore and Preserve

The Mosby Center (formerly North Lab): Renovate this beloved historic building—much-used by the GSO community—and restore it to its vibrant and creative state. Upgrade the interior and its surroundings to meet today's building and safety codes. *\$500,000*

Coastal Laboratory Research Center: Build a facility that accommodates long-term research and development of biological and environmental solutions, while providing spaces for new collaboration, partnership, and enterprise. *\$8 million*

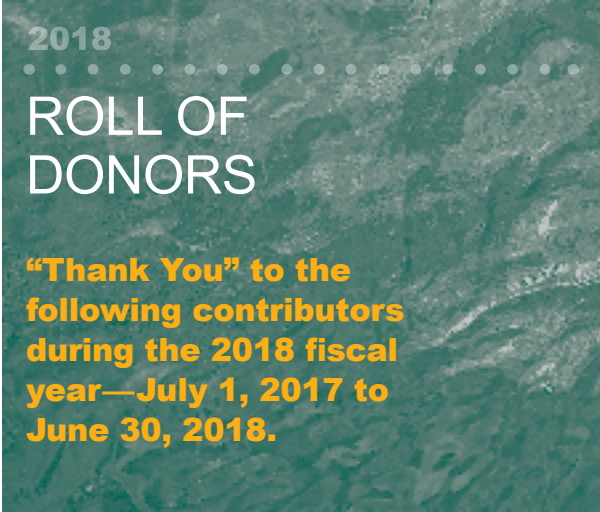
Inner Space Center (ISC): Add a telepresence conference room, an advanced autonomous-vehicle mission control and teaching lab, a new studio, and technical support for new ships such as the NSF's Regional Class Research Vessels. *\$3 million*

Partnering with the Rhode Island Public Broadcasting System: Produce ocean-focused programming that packages content into documentaries, K-12 education modules, and ultimately a dedicated television station, to be broadcast with the GSO/ISC brand. *\$500,000*

Bay and in waters throughout the New England region. Students will explore interdisciplinary marine issues in group settings as part of an ocean-science curricula. The goal is sufficient to cover construction and acquisition of the vessel and endowed support of annual maintenance and daily operations. *\$5 million*

Fellowships: Provide for annual awards that, when applied to offset the cost of attendance, will help ensure outstanding students matriculate at the Graduate School of Oceanography. *\$2.5 million*

Professorship: Create a faculty position focused on the intersection of marine science, policy and management to enhance capacity for interdisciplinary problem-solving. *\$2.5 million*



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.

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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.

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Doctoral candidate Joe Langan's, "Characterizing Changing Ecosystem Phenology in Response to Climate in a Large Temperate Estuary," was awarded Best Student Paper at the Annual Meeting of the American Fisheries Society, Fish Habitat Section.

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The Coastal Resiliency Symposium, led by Congressman Jim Langevin, addressed adaptation to impacts of climate change. Speakers and panelists included Senator Sheldon Whitehouse, Jon White from the Consortium for Ocean Leadership, and science experts from URI's Bay Campus.

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 NSF's STEMSEAS program experienced life
 on board an oceanographic research vessel
 during an 11-day mission to Barbados.

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Distinguished Achievement

The 13th annual URI Distinguished Achievement Awards were held October 20, 2018. Rear Admiral Richard “Dick” West was honored by GSO as this year’s recipient. A member of the Dean’s Advisory Council, Admiral West also gave a well-attended talk to a Bay Campus audience about his career in the Navy and his activities in the oceanographic community since retiring in 2002. Admiral West, who retired as Oceanographer and Navigator of the U.S. Navy, is widely regarded as a senior statesman in the oceanographic community. The Admiral is among a very few who are equally comfortable in the halls of Congress, the Pentagon, U.S. Navy, or on the deck of a warship.



Set Sail With Us

Today, the faculty members, researchers, and students of GSO think big and make a big difference in Rhode Island and around the globe.

Myriad challenges face the Earth's oceans. From understanding impacts of climate change, to finding paths to

sustainable energy, improving coastal resiliency, and ensuring the health of marine ecosystems, these challenges are complex. Meeting them will require both deep expertise in specific research and the broadest possible collaboration across disciplines.

Through your generosity, our capacity to meet these challenges—to create new knowledge and to develop and apply solutions—can only grow. By making a gift to GSO, you share in that success.

28°2' N / 88°14' W

20:21 GMT — Aug. 20, 2018



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Graduate School of Oceanography
Office of the Dean
Narragansett Bay Campus
Narragansett, RI 02882 USA

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At the end of the 2018 season and 25,000 nautical miles later, R/V *Endeavor* returned to drydock at Senesco Ship Repair Yard.