

Bermuda Institute of Ocean Sciences

Annual Report 2019



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Bermuda Institute of Ocean Sciences

Cover photo by Alex Pilgrim and contents page photo by Tiffany Wardman



Letter from the Chair & the President

Partnerships and collaborations have always been at the heart of BIOS's scientific and education endeavors. More than a century ago, the introduction of a marine science field station in Bermuda was the direct result of governments and academia working together to address the growing need for more robust oceanic observations. Today, BIOS continues to benefit from active cooperation among various sectors, collaborations between researchers, and educational partnerships that cut across disciplines and borders. This report highlights some of the successes that BIOS has achieved in 2019 arising from our strong professional relationships both locally and around the world.

Research efforts in 2019 relied upon cooperation between BIOS, external research and education collaborators, industry, and private organizations. Advances in technology helped to bolster existing monitoring capacity on the container vessel *Oleander*, leveraging the ship's weekly travel between Bermuda and New Jersey to enhance data collection within ecologically and climatically important regions of the western North Atlantic Ocean. A grant-funded collaboration between scientists and interns at BIOS and the Bermuda Government Department of Environmental and Natural Resources resulted in a novel study demonstrating the value of population genetics for informing and adapting fisheries management measures. And BIOS scientists and educators leveraged funding from the National Science Foundation (NSF) to create a unique opportunity for local participation in oceanographic research aboard our research vessel, the *Atlantic Explorer*.

In 2019, BIOS also worked closely with Bermuda College to develop synergies between the College and the educational offerings of BIOS's University Programs and Ocean Academy departments. This ongoing effort will improve science, technology, education, and mathematics (STEM) educational offerings for Bermudian students, effectively building a 'STEM pipeline' for school-aged

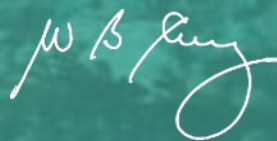
and university-level students. Collaborations with overseas schools, including the University of Delaware and the Ashford School in Connecticut (U.S.), brought unique expertise to Bermuda, giving dozens of local teachers and students the opportunity to learn about ocean technology and participate in engineering challenges that leveraged different cultural, socioeconomic, and geographic backgrounds to address issues of local ecological importance. Experiences such as these are crucial in fostering a collaborative mindset from a young age and imparting the skills required for success in the 21st century workforce.

The scientific understanding derived from our long-standing work at BIOS is not only for the benefit of the academic community, but also contributes insights and analyses that are vital to public understanding, policy development, and environmental management. In 2019, societal relevance was showcased through our involvement with the Bermuda Ocean Prosperity Project, which seeks to grow the area of protection afforded to Bermuda's economically vital marine species and environment. BIOS also helped progress a burgeoning conversation about climate change through our collaboration with the Bermuda Tourism Authority and the PGA Tour. From this came Bermuda's first Climate Risk Forum, which brought together representatives from science, industry, and government to discuss global climate change and the tools and resources available to develop long-term resilience.

In 2019, we remained committed to working across geographic and economic divides to deliver cutting-edge scientific discoveries, once-in-a-lifetime educational experiences, and deep understanding of the marine environment for societal benefit. Thank you for your friendship and support as we continue these efforts.

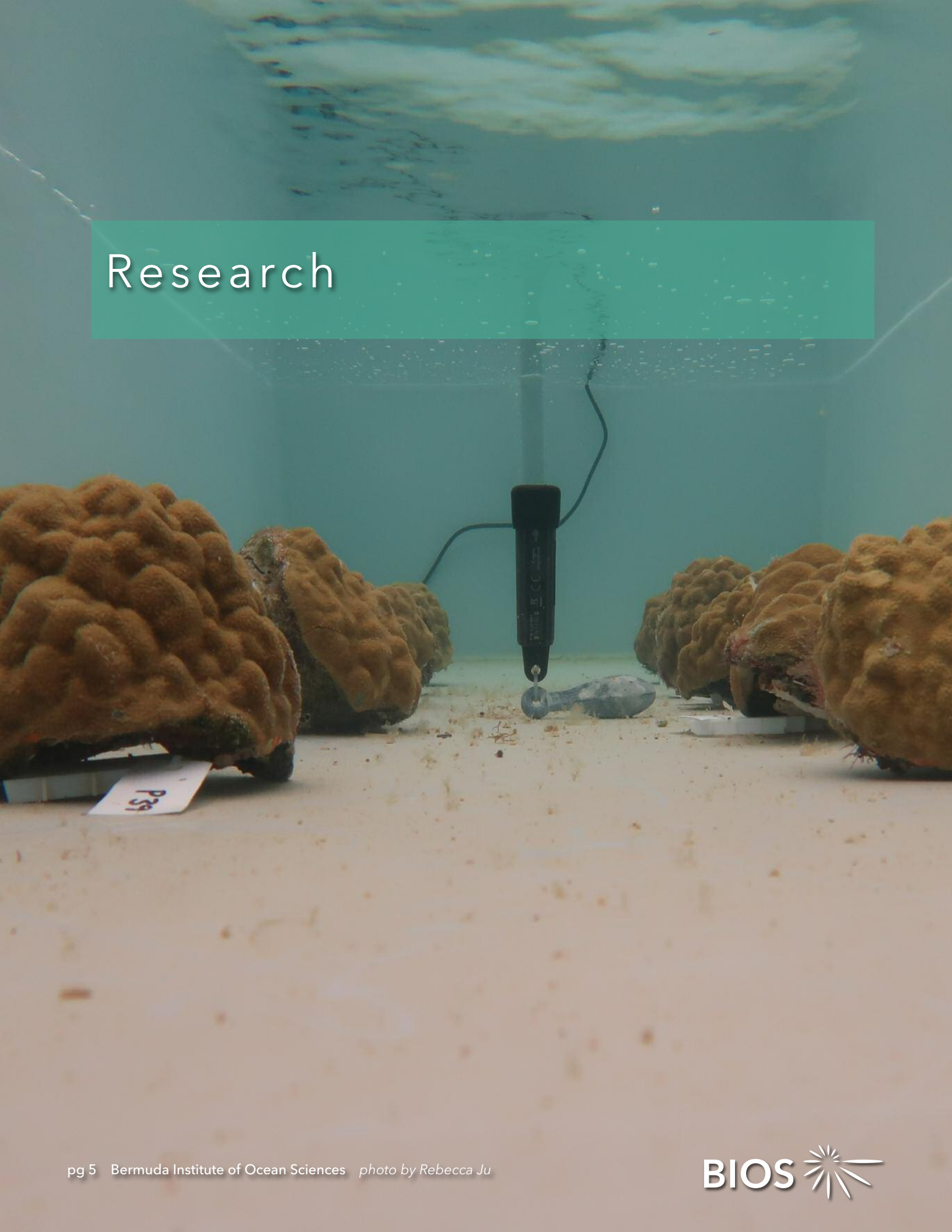


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Chair of the Board of Trustees



William B. Curry
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Research



An Autonomous eXpendable Instrument System (AXIS) unit attached to the rail of the ship releases an eXpendable BathyThermograph (XBT) probe to collect data on ocean climate and circulation. Prior to the development of the AXIS, these probes had to be manually released by a crew member every hour, for up to 36 hours at a time.

Photo by Tiffany Wardman



As the questions people ask about the world around us become more complex, scientific collaborations are increasingly common. Multi-disciplinary and multi-institutional research efforts let scientists leverage resources and expertise to address issues of both local importance and global relevance. In 2019, BIOS researchers acted as key members of several collaborations, working closely with educators, industry representatives, international scientists, and the Government of Bermuda.

In May, a four-day cruise aboard the research vessel *Atlantic Explorer* gave two local educators and a senior school student the opportunity to gain insight into what it means to live and conduct science at sea. The cruise was part of a project funded by the National Science Foundation (NSF) investigating the migrations of small marine zooplankton called copepods. Principal investigator Amy Maas, a biological oceanographer at BIOS, and co-investigators Leocadio Blanco-Bercial of BIOS and Ann Tarrant of the Woods Hole Oceanographic Institution, looked at daily cycles of zooplankton physiology to better predict the contributions of zooplankton to the ocean's biological pump.

Maas and her collaborators utilized the hands-on partnership as a way to more broadly disseminate their research findings and bridge the gap between scientific

Marcus Rewan, a senior school student at Cedarbridge Academy and a graduate of BIOS's Ocean Academy, collects samples from the CTD while on a cruise on the research vessel *Atlantic Explorer*. Photo by Tiffany Wardman.



research and education. Kaitlin Noyes, director of BIOS's Ocean Academy, joined the team as a co-investigator and used her educational background to develop a learning module, aimed at senior school students, focusing on the biological pump and the process of daily migration in copepods. She partnered with Paul Wright, a physics and general science teacher at Saltus Grammar School in Bermuda, and Marcus Rewan, a senior school student at Cedarbridge Academy and a graduate of BIOS's Ocean Academy.

This collaboration increased the impact of the resources and personnel involved, effectively creating a multiplier effect that extended the reach of the project far beyond those immediately involved. Scientists gained additional manpower and avenues for communicating their results to the public; a student scientist gained critical ocean science research skills; and educators received hands-on oceanographic experiences and real-world data sets for use in the classroom.

BIOS scientists also partnered with commerce and the ocean technology industry, forming additional opportunities for gathering valuable oceanographic data and field-testing scientific equipment. In April, the new container vessel *Oleander* arrived in Bermuda ready to commence weekly round-trip passages between Port Elizabeth, New Jersey in the United States and Hamilton, Bermuda. Designed to be larger and more efficient than its predecessor, the new *Oleander* also ushered in the next phase of the collaborative Oleander Project.

A new study, undertaken by a team of scientists from BIOS, the Bermuda Government Department of Environment and Natural Resources, and the University of Rhode Island, used DNA markers to characterize the genetic diversity of Bermuda's baitfish
Photo by Joanna Pitt.

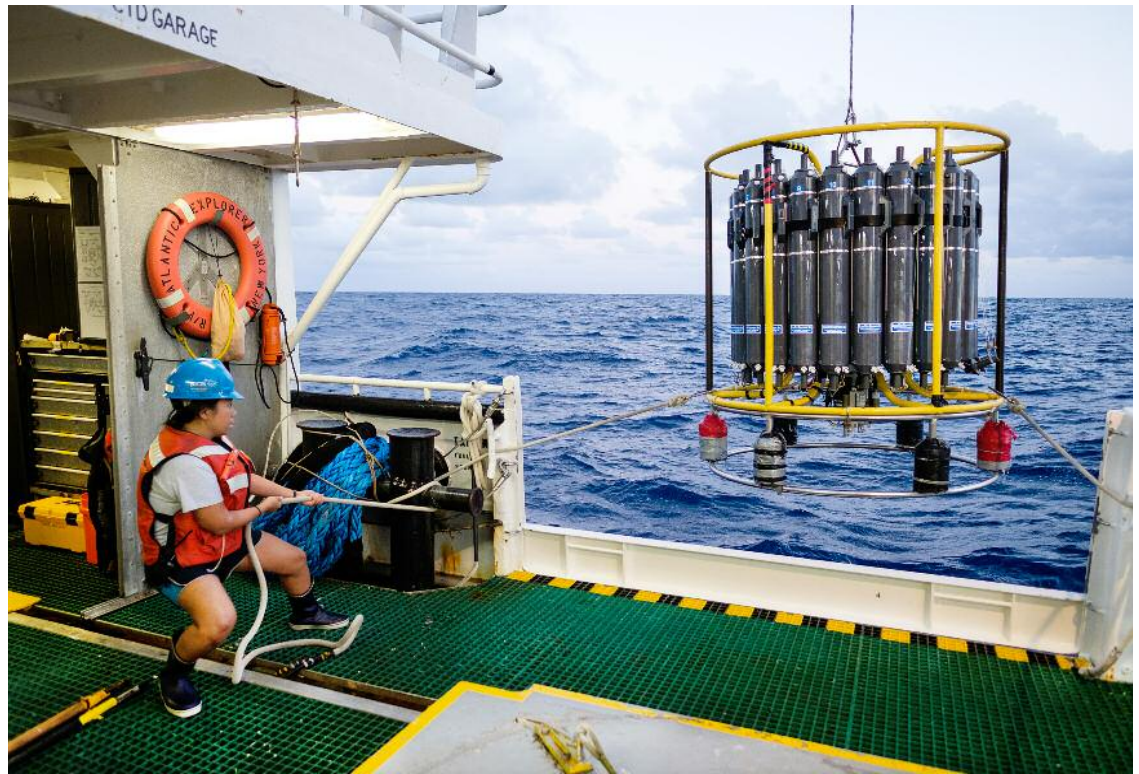


Started in 1992, the project leverages the *Oleander's* weekly trips across the Western North Atlantic Ocean to collect oceanographic data for scientific research purposes. BIOS oceanographer Ruth Curry leads this effort from Bermuda, in close collaboration with scientists at the University of Rhode Island (U.S.), Stony Brook University (New York, U.S.), and NOAA's Atlantic Oceanographic and Meteorological Laboratory, as well as individuals with the Bermuda Container Line and the crew, engineers, and officers of the *Oleander*.

With funding from NSF and support from the National Oceanic and Atmospheric Administration (NOAA), the new vessel was turned into a "volunteer observing ship" that is outfitted with an improved suite of scientific sensors. While the ship is underway, these sensors collect measurements on carbon dioxide concentration in the seawater, ocean current strength and velocity, and sea surface salinity and temperature, providing scientists with data to understand the ocean's heat structure and monitor changes in ocean acidification over time. The *Oleander* Project highlights the positive impacts that partnerships between science and industry can have when commercial equipment is leveraged to provide additional research capacity.

Collaborations between scientists and government are also becoming the norm, particularly as scientific data is used to drive conservation and management decisions. In Bermuda, where marine resources are vital to local businesses and the tourism

BIOS serves as an internship placement site for the Marine Advanced Technical Education (MATE) Center. MATE internships provide college students with intensive, hands-on learning opportunities in the field of marine technology. MATE intern Maya Thompson deploys the CTD (conductivity, temperature, and depth) instrument off the ship to collect physical oceanographic data throughout the water column. Photo courtesy of Maya Thompson



industry, BIOS scientists play an important role in ensuring the delivery of high-quality data to the Government of Bermuda. In July, a two-year study characterizing the genetic diversity of Bermuda's baitfish was concluded, indicating that the island's six baitfish species should be considered as a single, highly-mixed population that is unlikely to be replenished from populations in the Caribbean or other areas of the Western North Atlantic.

The research team, led by BIOS reef ecologist Gretchen Goodbody-Gringley, included Joanna Pitt, a marine resources officer for the Government of Bermuda's Department of Natural Resources, and Emma Strand, a doctoral student at the University of Rhode Island. Their work yielded insights for resource managers (such as Pitt) tasked with balancing the sustainability of fish populations and their role in commercial and recreational fishing. Studies such as this demonstrate the value of scientific data—in this case, population genetics—for informing and adapting fishery management measures.

BIOS has long recognized the importance of strong working relationships outside not just the Institution, but the scientific enterprise as well. These collaborations are key to making the most of limited funding and resources and serve to enhance the role of science in many aspects of society, including commerce, education, government, and industry. As BIOS continues its long tradition of scientific research, it remains committed to developing novel collaborations that deliver broad benefits reaching beyond its campus.

Education



A novel partnership between BIOS's Ocean Academy and the University of Delaware gave Bermuda's teachers and students a unique opportunity to learn about marine robotics. BIOS welcomed 89 students and 16 teachers from nine local schools to take part in the full-day ocean robotics and career awareness workshop.
Photo by Tiffany Wardman



BIOS is committed to utilizing its world-recognized multidisciplinary research team and facilities to train a broad spectrum of students. Bermuda's primary, middle, and high school pupils, as well as international undergraduate and postgraduate students, benefit from the collaborative partnerships BIOS has established. These partnerships, consisting of relationships with individuals and educational groups both locally and abroad, enable BIOS to deliver unique hands-on learning opportunities. In 2019, BIOS's educators partnered with numerous associates to provide valuable experiential training that contributed to the development of a robust scientific community.

Both BIOS and Bermuda College are known for providing outstanding educational opportunities in science, technology, engineering, and mathematics (STEM) subjects for the island's young people. While Bermuda College is a degree-granting institution and BIOS is a not-for-profit research and education facility, both organizations share a common goal: to provide the island's children and young adults with the knowledge, skills, and experiences required for future success in academics and the workforce.

In light of these shared goals, the two institutions have been working together for the last 12 years in a unique partnership that leverages the resources and expertise of each organization, with the overall goal of improving STEM education and

Jecar Chapman graduated from Bermuda College and spent five summers as an intern at BIOS working on a variety of molecular biology and biochemistry projects. He graduated from Dalhousie University in 2017 with a Bachelor of Science in molecular biology/biochemistry and currently works at the Bermuda Hospital Board.



learning opportunities for students in senior school and college. BIOS's partnership with Bermuda College began in 2007 with a field-based program designed to introduce College students to endemic, native, and invasive species around the island. This program continues to run today, and the relationship between BIOS and Bermuda College has solidified as several College graduates have conducted research internships at BIOS.

In 2019, Bermuda College and BIOS sought to strengthen their collaborative relationship when the College looked to BIOS for guidance as it began development of a marine science degree program that would allow students to complete an associate degree on island, then finish their bachelor's degree at a partner institution in the United States or Canada. Education staff, faculty members, and researchers from BIOS sat on the advisory committee for the potential new marine science program at the College and participated in a number of development meetings.

In January, a novel partnership between BIOS's Ocean Academy and the University of Delaware (U.S.) gave Bermuda's teachers and students a unique opportunity to learn about marine robotics. BIOS welcomed 89 students and 16 teachers from nine local schools to take part in the full-day ocean robotics and career awareness workshop. Undergraduate students from the University of Delaware's College of Earth, Ocean, and the Environment hosted interactive stations placed around the BIOS campus, while local students moved among the stations to learn about the many ways that robotic technologies are used to investigate and understand the ocean. "Having students attend the workshop let them put the theory they've been learning in the classroom into practice," said one local educator.



National Geographic Society product development manager Alan Turchik (at right in grey) and project partner Laura-Ashley Henderson (in red) of the University of the West Indies explained the Deep Ocean Dropcam system to a group of students from Clearwater Middle School's robotics team. Photo by Tiffany Wardman

"The collaboration demonstrated the power of BIOS's education programs in facilitating connections between international universities and local students," said Kaitlin Noyes, director of BIOS's Ocean Academy. "Thanks to the team from the University of Delaware, we were able to expose Ocean Academy students to new career possibilities, while also having the opportunity to provide a hands-on experience at BIOS."

A new collaboration between Ashford School in Connecticut (U.S.), Macomb Mathematics Science Technology Center in Michigan (U.S.), and BIOS came to fruition in 2019 with funding from the National Geographic Society. Each summer a group of educators from around the world gathers at BIOS to take part in a workshop that delivers professional development and the opportunity to connect with like-minded STEM teachers. During a recent workshop, BIOS scientists and educators introduced participants to the issue of invasive lionfish, including how they are threatening Bermuda's natural marine biodiversity with their voracious consumption of smaller fish, invertebrates, and mollusks, and their high reproductive capacities.

The lionfish issue piqued the interest of three attendees from Ashford School and the Macomb Centre, who worked with BIOS educators to develop a collaborative, worldwide student initiative to further address the problem. The project relied on a concept called "geo-inquiry," which encourages students to use their unique geographic perspectives to analyze connections between humans and nature.

Marine Science
Internship field trip
on a calm Bermuda
day.
Photo by
Alex Pilgrim.



To address the issue of invasive lionfish, 15 students from Bermuda, Connecticut, and Michigan spent six months engineering solutions to protect Bermuda’s marine biodiversity. In May 2019 the cohort gathered at BIOS to work collaboratively on the suite of underwater robots they had designed to collect reliable data on lionfish. To make the project globally relevant and applicable to other diverse populations, it was designed to address United Nations Sustainable Development Goals, a blueprint for addressing global issues related to climate, environmental degradation, poverty, inequality, and prosperity.

BIOS’s dynamic programming delivers the educational experiences necessary for students to succeed as global citizens. In order to become informed decision-makers and contributing members of society, students must first develop the skills required to understand the societal impacts of universally pressing global issues. Ongoing collaborations such as those developed during 2019 are essential for building a pipeline of researchers and developing today’s students into tomorrow’s scientists.

Selected Financial Highlights

We are pleased to present the audited financial results of the Bermuda Institute of Ocean Sciences (BIOS) for the year ended 2019. Funding for the Institute is from four main sources: Contributions, Grant and Contracts, Tuition and Investment Returns. Each source of funding supports the BIOS mission of knowledge sharing, oceanographic focused scientific research, and extraordinary education programs. We are thankful to our numerous funders and resilient trustee support, which enable BIOS to execute its mission in a challenging funding climate.

Selected Highlights

- BIOS's balance sheet remains strong and ended with \$28 million in net assets for use in 2020 and beyond. Our unrestricted assets free from donor restrictions will be designated for strategic purposes under careful consideration by our Board of Trustees in consultation with BIOS management.
- BIOS's investment portfolio increased by \$2M to \$18M at yearend. Endowment returns improved remarkably in the 2019 fiscal year over negative returns in 2018. Operating support distributed from our endowment totaled nearly \$700K in 2019. Endowment distributions are supported by a rolling 3-year average percentage based formula and are approved annually by our Board in conjunction with the annual operating budget.
- Fixed assets decreased marginally due to full year depreciation costs on our \$2M investment in physical infrastructure improvements which were completed in 2018. Upgrades to our facility included air conditioning and lighting which continue to reap environmental and cost benefits.
- Expenses totaled \$16.8M in 2019 of which \$3.4M was paid from restricted funds and the remainder came from unrestricted funds. Of every dollar of expenses, approximately 90 cents was spent directly on BIOS programs. The remainder was spent on general and administrative costs (about 7 cents) and fundraising (about 3 cents).

Summary and Outlook

2019 was an exciting year for BIOS as we strengthened our faculty with the hire of a molecular biologist as part of the organization's ongoing strategic plan. We also enjoyed federal award success in a reduced federal funding environment. We have identified and implemented several operational efficiencies this year and as we move into 2020 we will continue to evaluate where we can achieve cost effectiveness.



Victoria Millett CPA, BCOMM
Treasurer and Controller

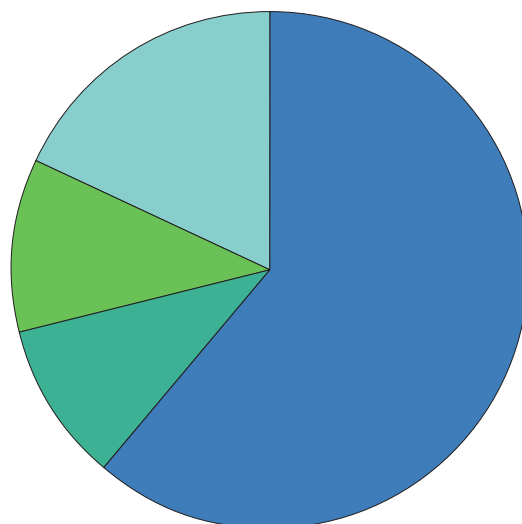
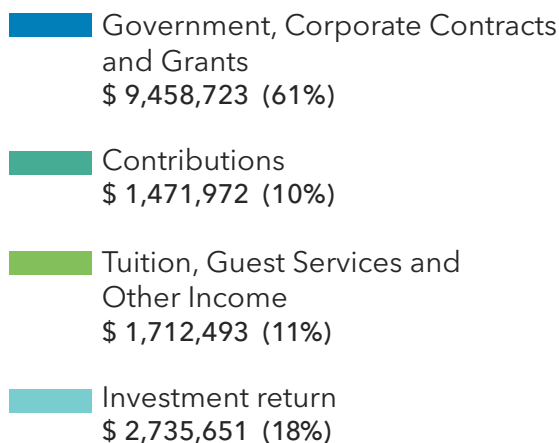
Please visit www.bios.edu/about/annual-reports/ for a full financial report.

Summary Financial Highlights

December 31, 2019

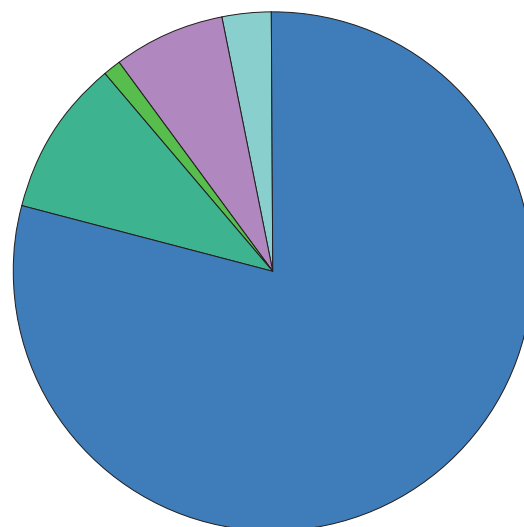
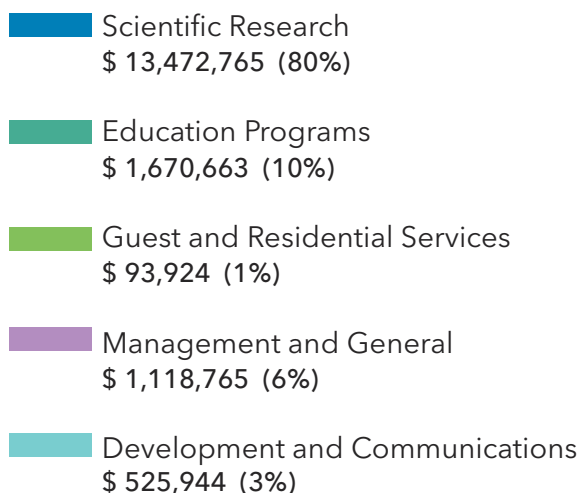
2019 REVENUES & SUPPORT

Revenue and support is derived from grants and contracts received through the U.S. and Bermuda governments (61%) and gifts; individual, corporate and foundation donors (10%). Additional sources of support are tuition and fees for the use of BIOS's various scientific, marine and housing facilities and attendance at our many educational programs (11%), and investment return pertaining to endowment funds (18%).



2019 EXPENSES

Program expenses include scientific research (80%); education activities (10%); and guest and residential services (1%). Other expenses include management and general (6%); and development, marketing and communications (3%).



Summary Financial Highlights

December 31, 2019

		2019	2018
Statements of Financial Position	Assets		
	Cash and cash equivalents	\$ 2,260,391	\$ 1,824,950
	Grant receivables and other assets	889,120	700,801
	Contributions receivable, net	94,751	1,702,301
	Investments	18,051,990	16,021,206
	Property and equipment, net	18,019,147	18,346,376
	Total Assets	\$ 39,315,399	\$ 38,595,634
	Liabilities and Net Assets		
	Liabilities		
	Payables, accruals, advances and deposits	\$ 1,353,838	\$ 1,684,759
	Loans payable	9,380,317	6,826,407
	Total Liabilities	10,734,155	8,511,166
	Net Assets		
	Without donor restrictions	\$ 9,259,441	\$ 10,368,256
	With donor restrictions	19,321,803	19,716,212
Total Net Assets	28,581,244	30,084,468	
Total Liabilities and Net Assets	\$ 39,315,399	\$ 38,595,634	

Statements of Activities	Support and other Revenues		
	Contributions	\$ 1,471,972	\$ 1,650,232
	Grants and contracts	9,458,723	9,149,200
	Tuition, guest services and other income	1,712,493	1,520,535
	Investment return	2,735,651	(926,696)
	Total Revenue and Other Support	15,378,838	11,393,272
	Expenses		
	Program services		
	Scientific research	\$ 13,472,765	\$ 12,068,247
	Education courses and programs	1,670,663	1,574,050
	Guest and residential services	93,924	355,271
	Total Program Services	15,237,352	13,997,568
	Support Services		
	Development, marketing and communications	\$ 525,944	\$ 606,942
	Management and general	1,118,765	1,253,440
Total Support Services	1,644,709	1,860,383	
Total Expenses	16,882,062	15,857,951	
Decrease in Net Assets	\$ (1,503,224)	\$ (4,464,679)	

Summary Financial Highlights

December 31, 2019

	2019	2018
Investments		
Commonfund Global Multi Asset Portfolio LLC	\$ 15,651,043	\$ 13,637,517
Vanguard Federal Money Market Fund	2,400,947	2,383,689
Total	\$ 18,051,990	\$ 16,021,206

Endowment Funds		
Balance on January 1	\$ 13,663,317	\$ 15,300,175
Contributions	34,941	25,800
Investment return		
Net appreciation (depreciation)	\$ 2,480,998	\$ (1,206,106)
Income (interest & dividends)	204,084	238,646
Distributed to operations	(697,355)	(695,199)
Balance on December 31	\$ 15,685,985	\$ 13,663,316
Represented on the Balance Sheet as:		
Without donor restrictions	\$ 1,595,141	\$ 1,238,771
With donor restrictions	14,090,845	12,424,545
Balance on December 31	\$ 15,685,985	\$ 13,663,316

An underwater photograph of a diver in a coral reef. The diver is wearing a black wetsuit, a silver scuba tank, and blue fins. They are positioned in the lower-left quadrant of the frame, looking towards the right. The reef is composed of large, rounded, yellowish-brown coral structures and various types of sea fans. The water is clear and blue, with sunlight filtering through from above. A semi-transparent green rectangular box is overlaid on the upper-left portion of the image, containing the text "Leadership Faculty & Staff".

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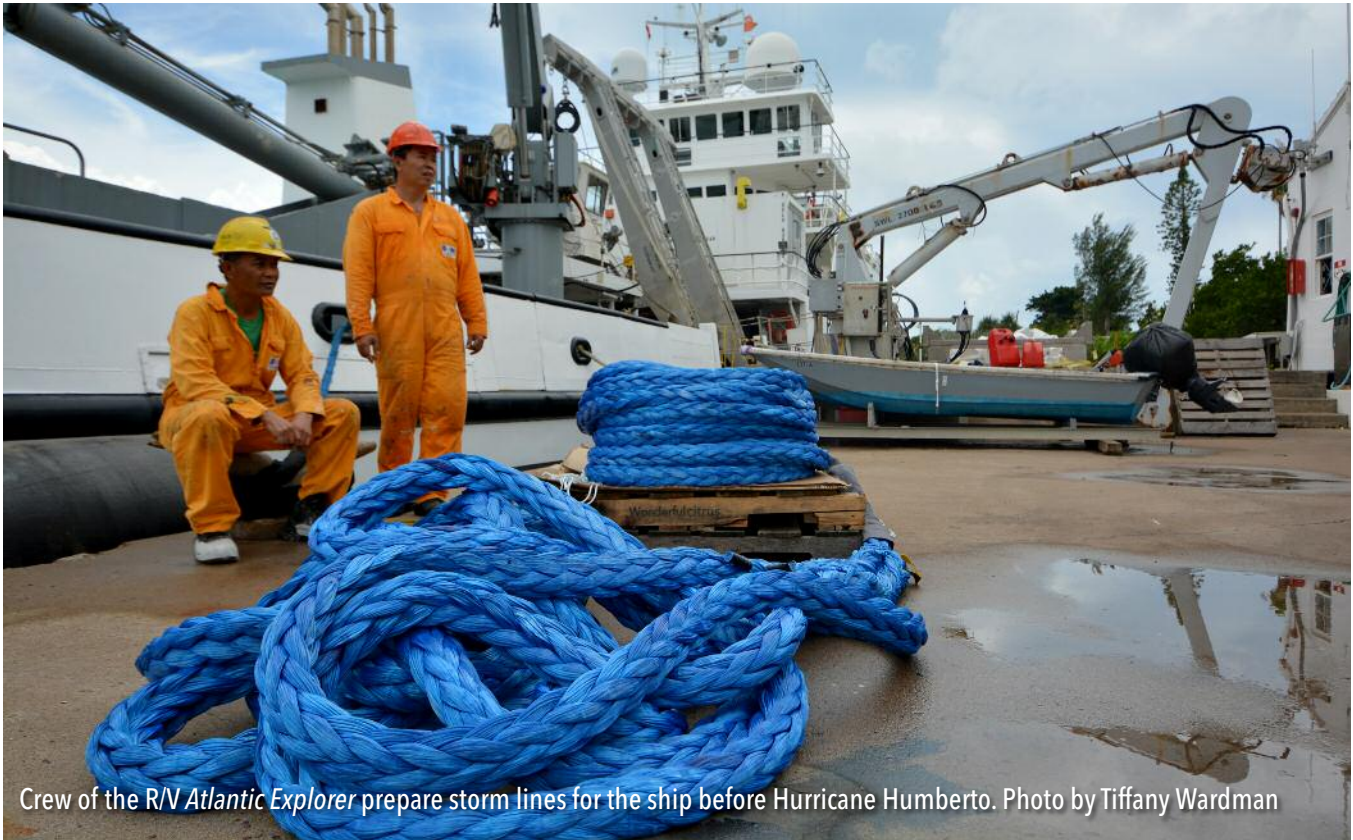
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Crew of the R/V *Atlantic Explorer* prepare storm lines for the ship before Hurricane Humberto. Photo by Tiffany Wardman

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Ruth Curry and Cordie Goodrich conduct diagnostics checks of one of the gliders prior to deployment. Photo by Tiffany Wardman

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Oceanographic Technical Services Manager
Kent Larsen (Nov 2019)



R/V Atlantic Explorer Chief Engineer Richard "Chief" Smith Jr. 1946-2019

Chief Engineer
Richard Smith Jr. (retired Feb 2019)

Marine Technician
Mason Schettig

Marine Technician
Jillon McGreal

Marine Technician
Rory O'Connell

R/V Atlantic Explorer

Relief Chief Mate
Chris Sheridan

Relief Chief Mate
Larry Morris

Relief Chief Mate
Patrick Redmond

Relief Chief Mate
Robert Shakespeare

Relief Second Mate
Robert Shakespeare

Relief Second Mate
Patrick Redmond

Relief Second Mate
Caroline Tippetts

Relief Second Mate
Courtenay Barber

Relief Second Mate
Owen Robinson

Relief Chief Engineer
Robert Cruise

Relief Chief Engineer
Lance Wardle

Relief Chief Engineer
Jens (Mike) Kierkegaard

Relief Chief Engineer
Ken Potter

Relief Able Seaman
John Crofts

Relief Able Seaman
Eric Parcon

R/V Atlantic Explorer **Crew, Bernhard Schulte** **Ship-Management Co**

Cook
Dexer Ojano

Cook
Carlos Calayo

Cook
Riggie Sanqui

Bosun
Jojo Paitone

Faculty & Staff

Bosun
Ronnie De Leon

Motorman 1
Berlin Jamelo

Motorman 1
Rodney Jumeras

Motorman 1
Al Soliva

Able Seaman
Jake Ambrocio

Able Seaman
Jhun Mutas

Able Seaman
George Yu

Able Seaman
Joven De Guzman

UNOLS Tech Pool

Marine Technician
Tony D'Aoust

Marine Technician
Austin McHugh

Marine Technician
Jason Agnich

Marine Technician
Sheldon Blackman

Operations

Jane Burrows
**Accommodation and
Catering Manager**

Chris Flook
Small Boats and Docks Supervisor

Ruth M. Heron-Watts
Accountant

Gillian Hollis
**Assistant to the President and
CEO, and Secretary to the
Board of Trustees**

Kevin Hollis
**Facilities Manager and
Safety Officer**

Alexander Hunter
**Dive Safety Officer and Small
Boats Supervisor**

Sharon King
Assistant Controller

Michael Lee
IT Manager

Charlene Millett
Kitchen Assistant

Victoria Millett
CPA Treasurer and Controller

Sharon Minors
Office/Room Attendant

Donika O'Mara
Office/Room Attendant

Carol Pitcher
Office/Room Attendant

Helena Simoes
Chef

Antar Smith
**Network and Systems
Administrator**

Heidi Smith
**University Programs and Library
Assistant**

Warren Smith
Electrician/Plumber

Kenneth Trott
Truck/Bus Driver

LeeAnn Tuzo
Accounts Payable Clerk

Gregory Wade
General Maintenance

Georgianna White
Laboratory Attendant

Bruce Williams
**Laboratory Operations
Technician**

William Welton
**Chief Financial and
Operating Officer**

Martin Wyr
Human Resources Manager

Development, Communications & Marketing

Pamela Amaral
Development Officer

Mark Guishard, PhD
**Director of Corporate and
Community Relations**

Ali Hochberg
Science Writer and Webmaster

Amy Nevala
Science Writer

Audrey Rogerson, PhD
**Director of Resource
Development**

Tiffany Wardman
**Marketing and Media
Relations Manager**



Bermuda Institute of Ocean Sciences

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