

2018 Annual Report



Bermuda Institute of Ocean Sciences

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Bermuda Institute of Ocean Sciences

Cover image and contents page photo by Andrew Collins

Letter from the Chair & the President

When it comes to learning, we know that multiple educational settings and experiences are required to reach students with a range of academic preparedness and socioeconomic backgrounds. At BIOS, we have long strived to enhance the in-classroom education of students from Bermuda and abroad, with engaging learning experiences that take place not only in BIOS's classrooms, but also in the Institute's research laboratories and in the immersive marine environment that surrounds Bermuda.

In 2018, BIOS launched a new educational offering—Ocean Science Camp—a five-day summer program designed to introduce students aged 12 to 15 to the marine life of Bermuda. As part of BIOS's suite of on-island educational programs called Ocean Academy, the new Ocean Science Camp is aimed at students that are interested in the ocean, but may not have had previous opportunities to study marine science. While each of BIOS's educational programs is closely aligned with the cutting-edge technology and scientific research at BIOS, we also recognize the various educational and personal development needs of local students and respond to these accordingly. The new Ocean Science Camp provides a supportive learning environment in which student curiosity in the sciences can bloom, while also nurturing confidence and camaraderie, proving yet again that science and the natural environment are powerful themes that can engage learners at a variety of levels.

The ability of BIOS to meet the changing needs of students and educators was greatly enhanced in 2018 with the renovation of the Alfred C. Redfield building. As part of this renovation, the Institute's E.L. Mark Library, Sunderman Room, and Riker Room were updated, creating a cohesive and modern teaching and learning space in the heart of BIOS's campus.

BIOS is an organization with a long and proud history that has continually evolved to maintain its relevance within the global scientific community. In completing this renovation, BIOS is poised to further enhance its role as a leader

in ocean science education. The new space will better serve the cadres of students from Bermuda and abroad that visit BIOS each year, and will also comfortably host guest scientists and lecturers, as well as professional meetings and workshops. We want to take this opportunity to thank the legions of donors who originally established the E.L. Mark Library, the Riker Room, and the Sunderman Room; and current funders for helping us modernize these spaces to meet the contemporary needs of ocean science researchers, educators and students.

In this report, we also highlight another renovation that took place in 2018—the reconstruction of a coral mesocosm on the west side of the campus. As with the renovation of the Redfield building, the construction of the mesocosm represents our commitment to maximizing the effective utilization of every space on campus. Enhancing existing coral laboratories at BIOS, the new mesocosm offers four experimental setups that can be run simultaneously and is ideally suited for research on a variety of topics, including ocean acidification, biological recovery, and ecosystem resilience. This facility, and additional instrumentation acquired in 2018 to monitor the coral reef ecosystem *in situ*, will further BIOS research into the physical and biological connections that dictate how coral reefs function and respond to environmental changes. Insights from this research will not only help determine if Bermuda’s corals are thriving or threatened, but will also advance efforts aimed at providing a scientific basis upon which society can prioritize conservation approaches in the face of future environmental uncertainty.

As the leaders of this scientific research organization, it is our job to ensure that the organizational infrastructure, processes, and programs in place will best harness the intellectual energy of our staff and enable them to share their knowledge and expertise with the next generation. In 2018, BIOS made significant progress in this regard, thanks to the efforts of our staff, management, board, and donors.



J. William Charrier
Chair of the Board of Trustees



William B. Curry
President & CEO



Research



Test launch of a new piece of scientific equipment: a remote access sampler (or RAS). With funding from the Cawthorn Innovation Fund, Yvonne Sawall—along with Eric Hochberg and Nick Bates—is using the RAS to improve the institute’s capacity to collect water samples on Bermuda’s reefs over different time and spatial scales. Photo by Yvonne Sawall.

Given the Institute’s location, it is not surprising that coral reefs have long been a research topic of interest for scientists at BIOS

Bermuda’s coral reefs are often touted as being among the healthiest reefs in the North Atlantic. Nevertheless, with wide-spread mortality events occurring throughout the world, the specter of global climate change looms, raising concerns that Bermuda’s reefs are at risk as well. Corals, with their calcium carbonate skeletons and symbiotic photosynthetic algae, are among the first organisms to be negatively impacted by climate change. Warming waters cause coral to expel the algae, called zooxanthellae, while a gradually acidifying ocean, resulting from increased amounts of atmospheric carbon

dioxide dissolved in the seawater, can weaken and even dissolve coral skeletons.

As scientists continue to study the physiology of corals, their biodiversity, and ecological role within the marine ecosystem, they are also increasingly concerned with understanding the resiliency of corals to climate change.

In 2018, a new mesocosm facility was established at BIOS, thanks to financial support from a private philanthropy. The new facility provides scientists with the experimental equipment required for long-term investigations into how corals function and respond to changing environmental conditions. With a total of 12 tanks, each with flow-through seawater systems, and an adjoining laboratory, the mesocosm has already been utilized in a variety of collaborative projects.



As part of this grant, faculty members Samantha de Putron and Gretchen Goodbody-Gringley initiated a collaboration with Hollie Putnam, an Assistant Professor at the University of Rhode Island, that combines experimental studies with molecular analyses to provide insight into coral resilience. The three-year study has three specific research goals: to document patterns of natural variation in corals and their larvae among different reef habitats in Bermuda, and to determine if this variation is due to genetics or environmental conditions; to determine if corals residing in certain reef habitats maintain a higher capacity to adapt to environmental conditions and stressors; and to assess how transplantation to different reef environments will affect the ecology and physiology of these corals and their larvae. This research aims to provide insights into processes that may allow subsequent generations of corals to better adapt to the environmental stressors experienced by their parents.

The mesocosm facility also greatly increases re-

search capacity at BIOS for local and visiting scientists, as well as interns and students. In its first few months of operation, the mesocosm facility supported a variety of other research and education activities, including a related investigation into the thermal tolerances of shallow and deep-water corals, and an investigation on the larval ecology of mustard hill coral.

While the new mesocosm expanded BIOS's coral reef research capabilities on campus, new field instrumentation was also secured to enhance the abilities of researchers to obtain critical data directly from the marine environment. The new instrumentation was part of a project funded by the Cawthorn Innovation Program, which was awarded in late 2017 to faculty members Eric Hochberg and Nick Bates and postdoctoral fellow Yvonne Sawall. Two automated water samplers were acquired that will enhance the types and scales of measurements that can be made in the reef environment, providing researchers with insights into how reef metabolic processes change on an hourly basis.



*Bermuda Program intern, Emily Andrew, looked at larval ecology of *Porites astreoides* in the new mesocosm facility. Photo by Tiffany Wardman.*

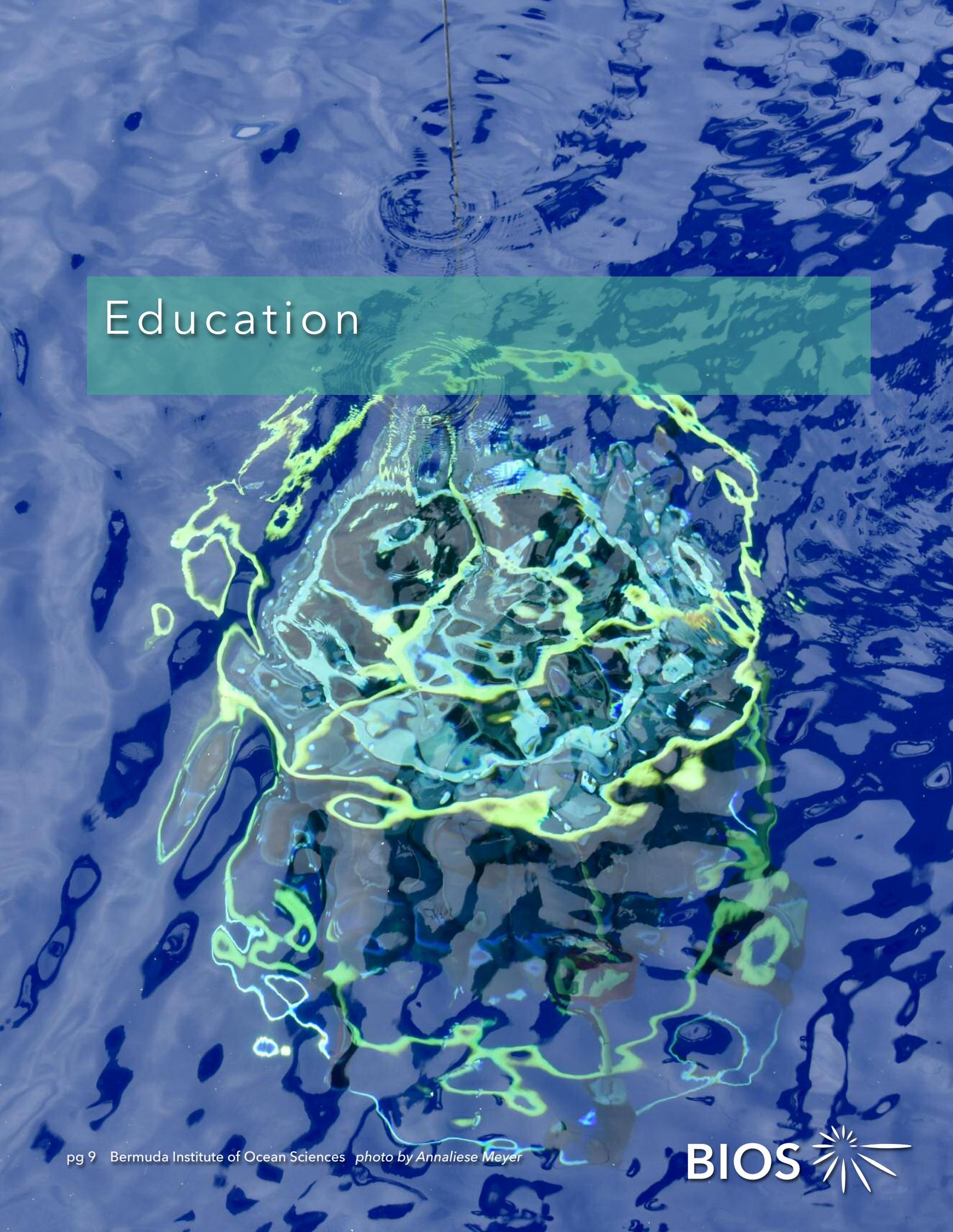
Coral reef scientists have long grappled with the challenge of accurately measuring ecosystem processes—such as photosynthesis and calcification—within a system that changes over the course of a day and between days (depending on water flow, tides, sunlight, and weather, among other factors).

As with many terrestrial ecosystems, like forests, one measure of the health of coral reefs is primary productivity, or the rate at which photosynthesis is occurring. However, unlike terrestrial ecosystems, another metric—calcification, or the rate at which new reef growth occurs—is also a vital component of reef health and function. Accurately measuring and describing these two processes would allow scientists to better understand how reef ecosystems function and respond to changing environmental conditions, such as a warming ocean.

However, studies are often restricted to short

windows of time, sampled over one small area of reef habitat, or lack additional data that provide links to environmental conditions. With the newly acquired sampling system, researchers are now obtaining hourly data that is crucial in understanding this rapidly changing reef environment. And, unlike traditional water sampling methods, these automated samplers can be left in the field for up to a year, increasing the length of sampling time from hours and days to weeks and months.

The additional research capacity represented by the acquisition of new instruments and the construction of new facilities is crucial to ensuring that BIOS stay on the leading edge of ocean science research. At the same time, these new tools add to BIOS's reputation as a world-class research facility and serve to increase the numbers and types of research projects that can take place in collaboration with other scientists, interns, and visiting student groups.



Education



Visiting students from Johns Hopkins University study in the MAGIC Room. Photo by Tiffany Wardman.

In 2018, the Bermuda Institute of Ocean Sciences completed a major renovation of the Alfred C. Redfield building, providing a fresh and re-energized space to better meet the needs of students, educators, and scholars.

As part of this renovation, the institution's E.L. Mark Library, Sunderman Room, and Riker Room were updated, completing the transformation on the first floor of the Redfield Building that began in 2016 with the establishment of the Mid-Atlantic Glider Initiative and Collaboration (MAGIC) Room.

The newly renovated space offers flexible learning opportunities, adaptable for individual study or

group collaboration, and technology upgrades such as high-speed internet access, interactive touchscreen whiteboards, and video teleconferencing capabilities. These modernizing upgrades provide spaces that complement the adjacent MAGIC Room to facilitate data visualization and analyses, scientific collaboration, and learning among students and visitors from Bermuda and abroad.

The E.L. Mark Library has been reconfigured into a 1,700-square-foot study space and teaching facility. The library continues to serve as a repository of approximately 3,000 reference books and science journals, which now line the walls of the renovated space rather than occupying stacks in the center of the room. This has opened up space for new tables and seating, enabling students and researchers to learn and work together or make use of the space for quiet independent study.



Students learn about plankton in the newly renovated Sunderman Room. Photo by Tiffany Wardman.

The E.L. Mark Library originally opened in 1947, one year after the death of its namesake, Edward Laurens Mark. Mark, a Harvard professor and a founder of the Institute, as well as its first director, served as chair of the library committee until he died. Among the library's most significant holdings is one of the few remaining and complete 50-volume sets of the report of the famed HMS Challenger expedition, a four-year-long global circumnavigation in the 1870s that provided the foundation for oceanography. The library also houses a collection of 1,783 peer-reviewed, scientific publications from research conducted at BIOS during its first century of operation, beginning in 1903.

The recent renovation is part of an ongoing effort to modernize facilities on the BIOS campus while honoring the library's history and legacy. In keeping with Mark's dedication to BIOS and the library that bears his name, the newly renovated space enables BIOS to offer a high-quality environment for teaching and scholarship to researchers from the world over, as well as to hundreds of local and

international students from grade schools, high schools, and universities that use the space each year. Although the majority of patrons are staff and students, the library continues the tradition of being open to the general public, serving as the main scientific library on the island. Additionally, BIOS hosts approximately 35 groups a year, from the island and internationally, who use this space for lectures, presentations, and various meetings.

The Riker Room is one of BIOS's key classrooms. Dedicated to Samuel Riker (Trustee & Treasurer, 1969-1970), Anne T. "Nancy" Riker (Trustee & Life Trustee, 1970-2002), and Samuel Riker III (Trustee, 1976-1981), the room received key upgrades during the renovation process including new flexible-use furnishings and IT equipment that will better enable it to serve as a teaching computer lab. The Sunderman room honors the service and generosity of F. William Sunderman (Life Trustee) and his wife Martha Lee Sunderman. Originally dedicated in 1992, the Sunderman Room was relocated from the second floor to the first during this renovation effort. Utilized for BIOS's Board of



Interns work around the table in the newly renovated E.L. Mark Library. Photo by Tiffany Wardman.

Trustees meetings as well as for classroom instruction, the relocation brings the Sunderman Room into the hub of BIOS's educational and public-use space. In addition to new furnishings, the Sunderman Room was equipped with state-of-the-art video teleconferencing capability, new projection equipment, and interactive whiteboards.

2018 also saw the addition of a new camp program within BIOS's Ocean Academy to appeal to students who are interested in oceanography but lack previous marine science experience. Designed for local students ages 12 to 15, the new Ocean Science Camp gives students an introduction to Bermuda's marine environment and provides a strong foundation in scientific research, both in the laboratory and the field. The goal of the 5-day program is to provide students with collaborative experiences that allow for exploration and idea-generation, while also improving their confidence and inspiring a respect for the marine environment. To achieve these goals, each of the five days involves a scientific in-

vestigation that requires students to develop a hypothesis, plan an experimental design, collect marine organisms in the field, and provide ongoing care of these organisms during the study period.

Students first conducted experiments to investigate the feeding preferences of the zebra nudibranch, a local marine invertebrate also called a "sea slug." Using both the classroom and the wet-bench facility on the BIOS waterfront, students set up aquarium tanks with nudibranchs and three species of local marine sponges. Each morning, they recorded the weight of the sponges to determine how much sponge material the nudibranchs consumed overnight. After four days of observation and data collection, the students reported the nudibranchs preferred one species of sponge—the blue, or ethereal, sponge—over the other two.

A second investigation focused on a local group of crustaceans called decorator crabs. These unique marine organisms use their pincer-like claws to remove small pieces of sponge and



Instructor Kyla Smith helped students with an investigation into the feeding habits of a local marine invertebrate called the zebra nudibranch as part of the Ocean Science Camp. Photo by Tiffany Wardman.

algae, which they attach to their shells for camouflage. Students placed two species of decorator crabs in the aquarium tanks along with various materials collected from Ferry Reach. After three days of observation and a day of data analysis, the students found that one species of crab—which was orange-red in color—preferred fire sponge as a camouflage material, while the other species—which was darker in color—preferred green algae.

Following these investigations, students spent afternoons on field excursions to practice snorkeling skills, explore Bermuda’s coastal and marine environments, and take part in fish and coral identification activities. These daily outings took them along Ferry Reach by kayak to the Coney Island seagrass beds on the northeastern portion of the island, and by boat to Harrington Sound, as well as to the wreck of the Sea Fern in St. George’s Harbor. On the last day of the camp, students had an introduction to SCUBA diving and practiced basic SCUBA skills in the protected waters of Whalebone Bay.

In their camp evaluations, a majority of students expressed increased knowledge of local marine species and habitats, as well as various scientific methods and tools; and all students reported a stronger connection to the ocean after attending the camp.

In order to be successful, ocean science education programs—and the facilities in which they operate—must adapt to both the changing needs of students and teachers, and the innovations in research taking place locally and abroad. The much-anticipated renovation of the E.L. Mark Library and adjacent classroom spaces creates a flexible learning environment that can meet the needs of a variety of visitors, ranging from individual students and researchers to larger class groups. The modernization of technologies within these spaces increases the types of teaching and learning that take place within them. Likewise, the development of new programs designed for new audiences expands the reach of BIOS’s education offerings and broadens participation among students across the island, creating a strong foundation of scientific literacy among Bermuda’s young people.

Selected Financial Highlights

The Bermuda Institute of Ocean Sciences is pleased to present our financial statements for the fiscal year 2018. BIOS continued with the implementation of its strategic plan and successfully weathered uncertainty through disciplined financial management. Prudent cash management allowed us to repay short term borrowings by year end. We continue to closely engage with U.S. federal grant-making entities, while also seeking other sources of support to ensure our mission's success. The unwavering support of our stalwart trustees and management team will allow us to forge confidently ahead into the next fiscal year and beyond.

SELECTED HIGHLIGHTS:

- Last year, BIOS recognized the need to invest in capital assets. In 2018 we invested further into our infrastructure; a move afforded by generous gifts and 2017 debt refinancing. During this time, we also reaped the benefits of lower costs in energy consumption, improved facilities, and a reduction in our carbon footprint. These infrastructure improvements and additions provide necessary physical contributions to support BIOS research initiatives and student experiences.
- BIOS's balance sheet totals \$38.5M, with its largest asset categories including investments (\$16M) and capital assets (\$18M). Net Assets of \$30M comprises \$20M classified as with donor restrictions and \$10M without. Unrestricted net assets include assets free from donor restrictions but will be designated for specific purposes by direction of our Board of Trustees or BIOS management.
- Operating income distributed from endowment totaled \$695,199 in 2018. Our portfolio valuation at yearend was \$13.6M.
- Operating expenses decreased in the prior year due to programmatic support, along with continued efforts to support thoughtful and focused spending. This is aligned with the programmatic and strategic goals of BIOS.

SUMMARY AND OUTLOOK:

BIOS remains resilient, with successful research grant proposals continuing to provide strong support to the institution. Our education teams continue to identify new streams of revenue through tuition from visiting groups, as well as donors supporting both international and local education programs. Private philanthropic foundations and corporate donors have indicated resolute confidence in our mission. The complete participation by our trustees in annual giving is a testament to their confidence in BIOS and its continued success.

As we look ahead, BIOS understands that realizing its objectives will require ongoing prudent financial oversight and continued focus by BIOS management on operational efficiencies to buffer the Institute against financial pressures. We, our management and trustees, are confident that our organization is well-positioned to carry out important initiatives in the coming years.



Victoria Millett CPA, BCOMM
Treasurer and Controller

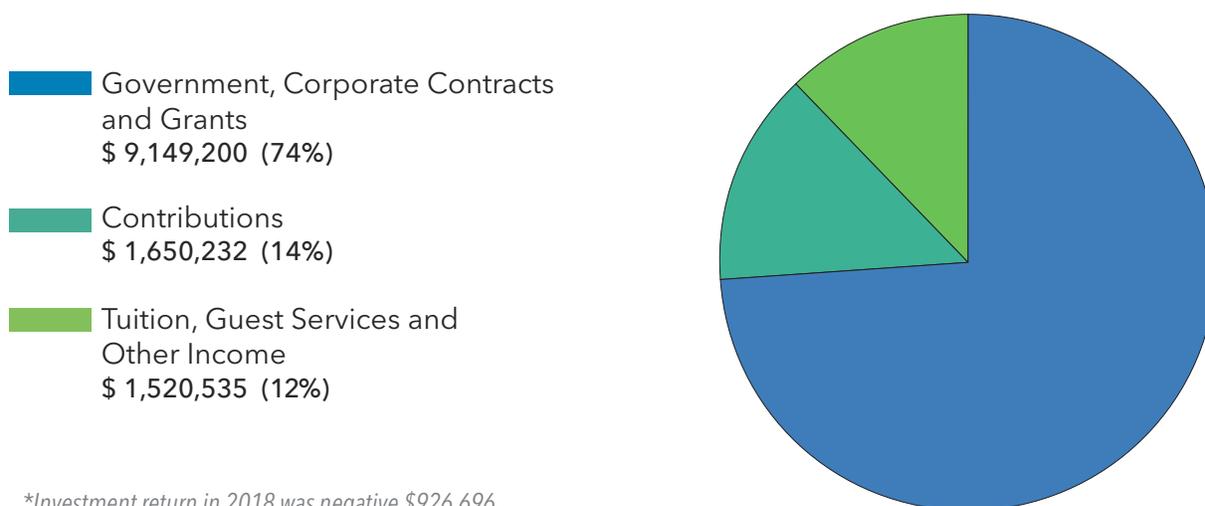
Please visit www.bios.edu/about/annual-reports/ for a full financial report.

Summary Financial Highlights

December 31, 2018

2018 REVENUES & SUPPORT

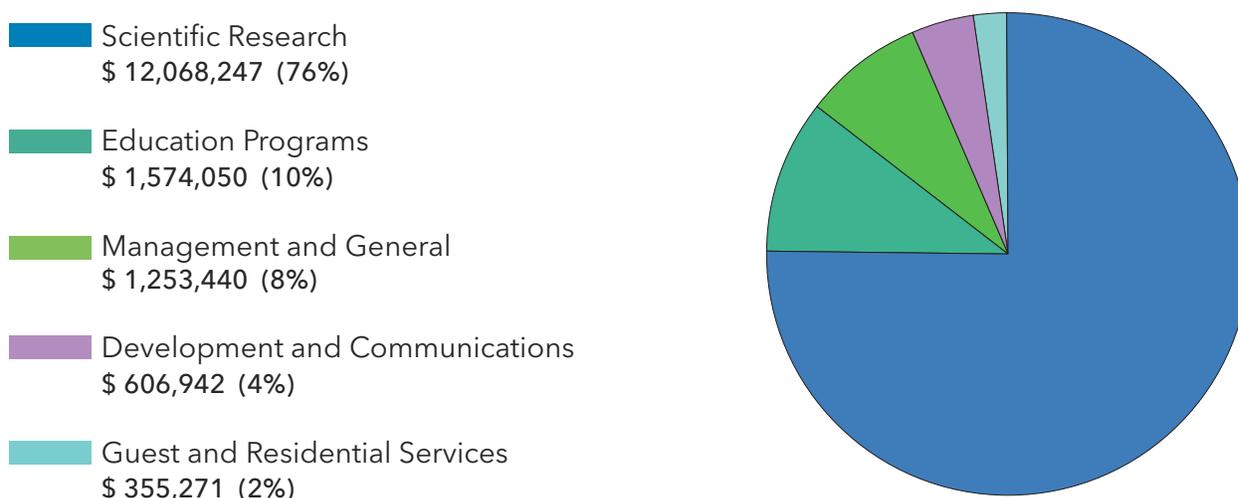
Revenue and support is derived from grants and contracts received through the U.S. and Bermuda governments (74%) and gifts; individual, corporate and foundation donors (14%). Additional sources of support are tuition and fees for the use of BIOS's various scientific, marine and housing facilities and attendance at our many educational programs (12%).



**Investment return in 2018 was negative \$926,696*

2018 EXPENSES

Program expenses include scientific research (76%); education activities (10%); and guest and residential services (2%). Other expenses include management and general (8%); and development, marketing and communications (4%).



Summary Financial Highlights

December 31, 2018

Statements of Financial Position

	2018	2017
Assets		
Cash and cash equivalents	\$ 1,824,950	\$ 2,857,760
Grant receivables and other assets	700,801	890,608
Contributions receivable, net	1,702,301	3,176,915
Investments	16,021,206	17,406,118
Property and equipment, net	18,346,376	18,754,675
Total Assets	\$ 38,595,634	\$ 43,086,076
Liabilities and Net Assets		
Liabilities		
Payables, accruals, advances and deposits	\$ 1,684,759	\$ 1,667,751
Loans payable	6,826,407	6,869,177
Total Liabilities	8,511,166	8,536,928
Net Assets		
Without donor restrictions	\$ 10,368,256	\$ 11,421,176
With donor restrictions	19,716,212	23,127,972
Total Net Assets	30,084,468	34,549,148
Total Liabilities and Net Assets	\$ 38,595,634	\$ 43,086,076

Statements of Activities

Support and other Revenues		
Contributions	\$ 1,650,232	\$ 6,943,266
Grants and contracts	9,149,200	11,766,726
Tuition, guest services and other income	1,520,535	1,978,786
Investment return	(926,696)	2,016,794
Total Revenue and Other Support	11,393,272	22,705,572
Expenses		
Program services		
Scientific research	\$ 12,068,247	\$ 13,207,922
Education courses and programs	1,574,050	1,887,002
Guest and residential services	355,271	87,419
Total Program Services	13,997,568	15,182,343
Support Services		
Development, marketing and communications	\$ 606,942	\$ 631,419
Management and general	1,253,440	1,962,286
Total Support Services	1,860,383	2,593,705
Total Expenses	15,857,951	17,776,049
(Decrease) Increase in Net Assets	\$ (4,464,679)	\$ 4,929,524

Summary Financial Highlights

December 31, 2018

	2018	2017
Investments		
Commonfund Global Multi Asset Portfolio LLC	\$ 13,637,517	\$ 15,069,999
Vanguard Federal Money Market Fund	2,383,689	2,336,119
Total	\$ 16,021,206	\$ 17,406,118

Endowment Funds		
Balance on January 1	\$ 15,300,175	\$ 13,732,391
Contributions	25,800	276,352
Investment return		
Net (depreciation) appreciation	\$ (1,206,106)	\$ 1,812,983
Income (interest & dividends)	238,646	190,224
Distributed during the year	(695,199)	(711,774)
Balance on December 31	\$ 13,663,316	\$ 15,300,176
Represented on the Balance Sheet as:		
Without donor restrictions	\$ 1,238,771	\$ 1,541,784
With donor restrictions	12,424,545	13,758,392
Balance on December 31	\$ 13,663,316	\$ 15,300,176

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Amy Maas and Andrea Miccoli process samples from the "EXPORTS" for EXport Processes in the Ocean from Remote Sensing project, a multidisciplinary team of scientists, spent six weeks this summer focused on the Pacific Ocean to study the lives and deaths of plankton, organisms that play a critical role in removing carbon dioxide from the atmosphere and in the ocean's carbon cycle. Photo by Tiffany Wardman.

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Bermuda Government

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Crew launched the autonomous underwater vehicle Sentry from the stern of the BIOS research vessel *Atlantic Explorer* on a 10-day research cruise in the waters off Bermuda. The AUV was used as a platform to test a trio of oceanographic navigational instruments aimed at improving the navigation of underwater robotics used in long-term scientific investigations. Photo by Nick Mathews.

Education

Kaitlin M. Noyes
Director of Ocean Academy

Chloe Baron
Administrative Assistant,
University Programs

Dr. Samantha de Putron
Assistant Director of University
Programs/Senior Lecturer

Andrew Peters, PhD
Director of University Programs
& Associate Scientist

Audrey Pope
University Programs Internship
Coordinator, Communications
and Data Manager

Heidi Smith
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Leocadio Blanco-Bercial, PhD
Ruth Curry
Samantha de Putron, PhD
Gretchen Goodbody-
Gringley, PhD
Eric J. Hochberg, PhD
Andrew J. Peters, PhD

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Captain & Marine
Superintendent
Quentin Lewis

Captain
George Gunther

Port Captain
Richard Verlini, III

Marine Consultant
Captain John Moore

Oceanographic Technical
Services Manager
Nicholas Mathews

Chief Engineer
Richard Smith Jr.

Marine Technician
Mason Schettig

Marine Technician
Jillon McGreal



Nick Mathews (left), the oceanographic technical services manager at BIOS, gives instructions to crew and scientists on the deck of the R/V Atlantic Explorer during the deployment of the Multiple Opening/Closing Net and Environmental Sensing System (or MOCNESS) on a recent BIOS-SCOPE cruise.

Marine Technician
Rory O'Connell

Marine Operations Coordinator
Deborah Moran

R/V Atlantic Explorer
Rotational Crew for 2018

Relief Chief Mate
Chris Sheridan

Relief Chief Mate
Larry Morris

Relief Second Mate
Robert Shakespeare

Relief Second Mate
Patrick Redmond

Relief Second Mate
Gary Ramos

Relief Second Mate
Courtenay Barber

Relief Second Mate
Paul Carty

Relief Chief Engineer
Bob Cruise

Relief Chief Engineer
Greg White

Relief Chief Engineer
Joseph Howard

Relief Able Seaman
John Crofts
Alex Forsythe
Bruce Kolp

R/V Atlantic Explorer Crew
Bernhard Schulte Ship

Able Seamen
Jake Ambrocio
Jhun Mutas
George Yu

Bosun
Jojo Paitone
Ronnie De Leon

Motormen
Berlin Jamelo
Rodney Jumeras

Cooks
Dexer Ojano
Carlos Calayo
Riggie Sanqu

UNOLS Tech Pool
Marine Technician
Tony D'Aoust
Elizabeth Ricci
Austin McHugh

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Accommodation and Catering
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Chris Flook
Small Boats & Docks Supervisor

Ruth M. Heron-Watts
Accountant

Gillian Hollis
Assistant to the President and
CEO, and Secretary to the
Corporation

Kevin Hollis
Facilities Manager and Safety
Officer

Alexander Hunter
Dive Safety Officer/Small Boats
Supervisor

Charles King
Communications
Technician

Kelly McLaren
Qualified Accountant

Michael Lee
IT Manager

Miranda Medeiros
Human Resources Officer

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/Library
Assistant

Jeremy Smith
Painter/General Maintenance

Warren Smith
Electrician/Plumber

Sandy Spurling
Projects Officer

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 Wyer
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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