A photograph of a research vessel deck at sunset. A large crane structure dominates the left side of the frame. Several crew members in safety gear are visible on the deck. A piece of equipment is being lowered from the crane into the ocean. The sky is a mix of orange and blue, and the water is dark.

Bermuda Institute of Ocean Sciences

Annual Report 2020

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and the President
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Bermuda Institute of Ocean Sciences

Cover photo courtesy of Claire Medley



Letter from the Chair & the President

Last year brought the world unprecedented challenges due to the COVID-19 pandemic. However, with these challenges came opportunities at BIOS for creativity, growth, and the development of novel ways to continue marine science research and education. This year's Annual Report documents our experiences as a strong local and international oceanographic community that remained optimistic, unified, and determined to advance new and ongoing research and education programs.

One of the most significant accomplishments during this period was the ability of personnel associated with the BIOS-operated research vessel *Atlantic Explorer* to conduct ship maintenance and planned science research under strict safety regulations and social distancing protocols. By the year's end, and despite at least three dozen revisions to the schedule over the summer and fall, the ship achieved more than 75 percent of its original 170 funded days at sea for 2020. This was a testament to the flexibility and perseverance of the ship's crew and the BIOS Marine Operations Department, who worked to ensure the continued, uninterrupted success of scientific operations.

The pandemic required BIOS scientists to develop a new approach to science collaborations, as shutdowns prevented travel and in-person meetings typically required for many research projects. When biological oceanographer Amy Maas' monthlong EXPORTS (EXport Processes in the Ocean from Remote Sensing) research cruise was canceled in the spring, she and colleagues instead synthesized and analyzed scientific data collected the previous year, allowing the project to progress while fieldwork was at a standstill. For reef systems ecologist Eric Hochberg, like many scientists around the world, the shutdowns meant shifting from in-person meetings to virtual collaborations. As a result, he co-organized and co-led a virtual workshop with NOAA's Alliance for Coastal Technology for colleagues in the U.S., Europe, and Australia. Other faculty members, including

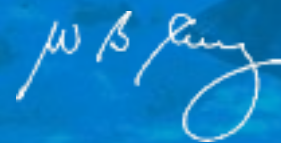
Damian Grundle, used the time for professional development purposes, learning new programming tools and taking online courses that improved their scientific skillsets.

With schools and the Institute's campus closed, the BIOS Education Department assessed available resources to expand the reach and impact of online programs to support local and international students and educators. When the BIOS campus safely re-opened in accordance with Government of Bermuda guidelines, the Education Department offered a suite of 21 paid internships designed to support the needs of local students. This represented the single largest cohort in the Institute's history for local summer internship placements. Building on the success of summer events, the Institute welcomed international university-level students in the fall, with internships supported by a number of donors including both the U.K. Associates of BIOS and the Canadian Associates of BIOS. The Education Department also supported several local Bermuda College students through an innovative weekly internship program that allowed participants to contribute to ongoing research programs at BIOS.

In 2020, the BIOS community persevered by adapting quickly and thinking creatively. Most scientific research projects continued and even expanded, and the Institute provided valuable virtual, as well as in-person, education programs that helped students and young scientists to continue learning and growing, as has been our mission since the Institute's founding in 1903. We welcome your ongoing support and interest in BIOS as we continue to extend our reach and impact.



J. William Charrier
Chair of the Board of Trustees



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President & CEO

Research

BIOS scientist Rachel Parsons shares her skills and expertise with Helix Bermuda, a clinical testing laboratory that is conducting COVID-19 testing on the island. Until late April, Helix Bermuda had the only COVID-19 authorized PCR instrument used for these tests. Parsons uses PCR instruments in her work at BIOS and was keen to assist in Bermuda's response to the growing pandemic. Photo courtesy of Rachel Parsons



The COVID-19 pandemic forced scientists around the world to change how and where they work, as well as how they collaborate with each other. At BIOS, field operations undertaken aboard small boats and the research vessel *Atlantic Explorer* were suspended until new protocols could be implemented to ensure the safety of crew and scientists. For many months beginning in mid-March, the island-wide shutdown sidelined laboratory-based research, leading the Institute's faculty and scientific staff to pivot their focus to other areas of work, often in creative ways to accommodate social distancing and travel restrictions.

The shutdown upended field research for BIOS biological oceanographer Amy Maas. Her month-long research cruise in the Atlantic, planned for the spring of 2020 as part of a multi-year plankton research project called EXPORTS (for EXport Processes in the Ocean from Remote Sensing), was canceled. Maas studies plankton, organisms that play a critical role in removing carbon dioxide from the atmosphere and in the ocean's carbon cycle. Instead of heading to sea, she and her colleagues spent weeks during the shutdown synthesizing and analyzing data they collected in the Pacific last summer. She also spent the time writing, revising, and submitting papers for a variety of scientific journals.

BIOS research specialist Tim Noyes, who received an academic grant in early May from Teledyne Marine, a U.S.-based undersea technology company, faced a similar workflow disruption. The grant gives recipients use of Teledyne's flagship scientific equipment for up to a six-month period to support research programs. Noyes planned on beginning his Bermuda-based study on water currents between deeper-water, low-light coral reef ecosystems (known as mesophotic reefs) and adjacent shallow water reefs in June, but had to postpone fieldwork due to pandemic-related restrictions on boat usage.

COVID related delays turned out to have a silver lining for Noyes' research. Because the first ADCP deployment was pushed back from June to August, the instrument, which uses sound waves to measure current profiles, captured the passing of Hurricanes Paulette and Teddy, two Category 2 hurricanes that impacted Bermuda in September representing "unique and invaluable scientific data". Photo courtesy of Tim Noyes



However, this delay turned out to have a silver lining for Noyes' research. He conducted three deployments of a Teledyne acoustic doppler current profiler (or ADCP) on mesophotic reefs around the east end of the island in August, October, and December. Each deployment lasted approximately 45 days. Because the first deployment was pushed back from June to August, the instrument, which uses sound waves to measure current profiles, captured the passing of Hurricanes Paulette and Teddy, two Category 2 hurricanes that impacted Bermuda in September. These measurements represent "unique and invaluable scientific data" according to Noyes, who turned his attention to data analysis once the final deployment was completed.

Noyes' investigation was one of many research programs that owed its success during the pandemic to the BIOS Marine Operations Department, which oversees the daily maintenance and operation of the BIOS-operated *Atlantic Explorer*. While strict safety regulations surrounded use of *Atlantic Explorer* during the pandemic, and the schedule underwent at least three dozen revisions over the summer and fall, the ship was able to complete more than 75 percent of its original 170 funded days at sea in 2020. These represented crucial trips for continuous, long-term research programs at BIOS, such as the Bermuda Atlantic Time-series Study (BATS), that make routine visits to locations off-shore Bermuda. Noyes relied on the crew of *Atlantic Explorer* to retrieve and deploy his ADCP during these cruises.

For BIOS reef systems ecologist Eric Hochberg, the pandemic meant a shift from in-person to virtual collaborations. Hochberg is a partner in the Alliance for Coastal Technologies (ACT), a collaboration of research institutions, resource managers, and private sector companies dedicated to fostering the development of new sensor technologies

The BIOS NSF REU program was one of the few REU programs to take place in-person during 2020. Shannon Lemieux, a fourth-year student at Oregon State University worked with Hochberg on a project aimed at developing a better understanding of the natural variation of coral pigments and what conditions drive that variation.



for marine and freshwater environments. Since 2017, he has worked with colleagues in the U.S. and internationally to explore and compare the various technical approaches to analyzing and interpreting hyperspectral remote sensing data, such as identifying harmful algal blooms or mapping coral reef communities.

Due to the pandemic, a workshop designed to compare hyperspectral methods in coastal environments that was originally scheduled to take place at the University of Hawaii in May was instead held virtually, successfully reshaping the program to accommodate limitations on travel.

When Bermuda resumed international travel in July, BIOS re-opened laboratories and facilities in accordance with Government of Bermuda guidelines. This allowed students and early-career researchers from abroad the opportunity to participate in research collaborations with BIOS faculty during a time when these students missed out on summer internships and access to laboratory facilities.

The BIOS National Science Foundation (NSF) Research Experiences for Undergraduates (REU) program was one of the few REU programs to take place in-person during 2020, thanks to the efforts of the Institute's University Programs Department. In August, eight interns arrived at BIOS and spent 12 weeks working alongside faculty members and scientific staff on research projects exploring a range of topics in marine and atmospheric science.

For Hochberg, this meant the valuable opportunity to continue a long-term research investigation into the phenology, or yearly cycle of change, of coral pigment in Bermuda's

While the COVID-19 pandemic presented unique challenges to scientists both locally and abroad, the creativity, perseverance, and flexibility of all BIOS faculty and scientific staff helped them to make the best of a difficult situation. The extra time during the shutdown meant that faculty could accomplish a number of key tasks, such as data analysis, writing and revising scientific papers, and engaging in professional development activities.



corals. Shannon Lemieux, a fourth-year student at Oregon State University majoring in fisheries and wildlife science, worked with Hochberg on a project aimed at developing a better understanding of the natural variation of coral pigments in the fall, and what conditions drive that variation. For Lemieux, who was a student in her university's Ecampus (distance learning) program, working in-person with Hochberg as part of the BIOS REU program offered her the only opportunity for hands-on scientific research in her undergraduate degree.

BIOS biochemical oceanographer Damian Grundle worked for five weeks in October and early November with Brett Jameson, a doctoral candidate at the University of Victoria in British Columbia, on a project investigating the microbial production of nitrous oxide (N₂O) in low oxygen marine environments. Jameson is building on work that he and Grundle—who is also one of Jameson's co-advisors—and a team of scientists recently published in the journal *Limnology & Oceanography Letters*. This research was a crucial and time-sensitive undertaking as it will form the foundation of Jameson's doctoral thesis.

Like Maas, Grundle also dedicated time during the shutdown for data analysis. "I was finally able to work up some nitrous oxide production data from the eastern tropical South Pacific that I've been sitting on for some time now," he said. He added that for years he has wanted to learn MatLab, a programming platform for scientists and engineers, and used the downtime to take online courses.

While the COVID-19 pandemic presented unique challenges to scientists both locally and abroad, the creativity, perseverance, and flexibility of all BIOS faculty and scientific staff helped them to make the best of a difficult situation. The extra time during the shutdown meant that faculty could accomplish a number of key tasks, such as data analysis, writing and revising scientific papers, and engaging in professional development activities. When Bermuda's travel restrictions were lifted, scientific research programs began again in

Education



The COVID-19 pandemic stalled many in-person education experiences worldwide in 2020...when the campus re-opened in accordance with Government of Bermuda safety guidelines, BIOS proceeded with a suite of internships designed to support the needs of both local and international students.



The COVID-19 pandemic stalled many in-person education experiences worldwide in 2020 and, for BIOS's Education Department, the immediate impact meant the cancellation and disruption of on-campus education programs. Months later, when the campus re-opened in accordance with Government of Bermuda safety guidelines, BIOS proceeded with a suite of internships designed to support the needs of both local and international students. These research-based internships paired students with BIOS faculty and research staff, allowing them to work together on projects in field and laboratory settings while exploring a range of topics in marine and atmospheric sciences.

As college campuses around the world remained closed, students missed out on opportunities to gain skills outside of classrooms, explore potential career fields, and network with professionals and mentors. In response, the BIOS Education Department increased the number of paid internship placements available to local students over the summer months. By combining the popular Bermuda Program (for Bermudian students ages 18 and older) and Marine Science Internship (for students ages 14 to 16), the Education Team facilitated a total of 21 Ocean Academy internships ranging in length from two to eight weeks. This represented the largest cohort in the Institute's history for local summer internship placements.

Lakshmi Magon, a 2020 Ocean Academy intern and 2018 Bermuda Program intern, worked on an ongoing project that helps scientists understand how marine organisms respond to physical and chemical changes in seawater conditions.



Lakshmi Magon, a 2020 Ocean Academy intern and 2018 Bermuda Program intern, worked in BIOS's Microbial Ecology Laboratory with research specialist Rachel Parsons on a long-term project investigating the natural marine processes at Devil's Hole in Harrington Sound, Bermuda. The ongoing project helps scientists understand how marine organisms respond to physical and chemical changes in seawater conditions. "My internships at BIOS have given me confidence in my own abilities and I've left with a toolbox of skills that is much fuller than when I started," Magon said. "In 2018, gaining experience with lab work helped me understand my desire and aptitude for a science communications role. Then, in 2020, my internship confirmed this and taught me technical knowledge that will help me in my future career endeavors."

In an effort to further bolster local student learning that had been disrupted by the pandemic, the BIOS Education Department hosted an internship during the fall informally known as the Ocean Academy Saturday Intern Program. The weekly science program offered several students attending Bermuda College paid internships that allowed them to learn while contributing to four ongoing research projects conducted by BIOS faculty, staff, and other university students. Some days the program participants sifted coastal sand for microplastics, then identified the size classes of the plastic fragments. Other days they catalogued and repotted mangrove saplings, or collected mangrove propagules from Walsingham Nature Reserve to grow for future plantings. They also deployed and recovered plankton nets, and learned

In an effort to bolster local student learning that had been disrupted by the pandemic, the Education Department hosted an internship during the fall. The weekly science program offered several students attending Bermuda College paid internships that allowed them to learn while contributing to four ongoing research projects conducted by BIOS faculty, staff, and other university students.



about the island’s native corals while working on an ongoing project to catalogue reef species.

While local students participated in learning programs on campus earlier in the summer, hands-on training activities for international university-level students resumed in late August. At that point, BIOS was able to open its doors to a small number of international students amidst a new regime of stringent protocols, including strict quarantine measures and social distancing procedures. Generous philanthropic support from a number of BIOS’s partners, including the Canadian Associates of BIOS (CABIOS) and the U.K. Associates of BIOS, provided scholarship funding to interns.

CABIOS was founded in 1975 by the late Dr. Earlston Doe, a former BIOS Life Trustee and Bermuda-born Canadian oceanographer, to honor the memory of his youngest son Learmont “Leary” Doe. The organization provides support for Canadian students, as well as students studying at Canadian universities and colleges, to participate in educational programs and research internships at BIOS. Similarly, the U.K. Associates of BIOS is a registered charity established in 1984 to provide financial support for early career marine science students from the U.K., and those studying within the U.K., to participate in BIOS’s educational opportunities and research offerings.

The university-level internships supported by CABIOS and the U.K. Associates of BIOS, among other donors, enabled students to choose from a list of potential re-

BIOS Internships provided unique insights into the process of conducting science, as well as the opportunity to learn valuable skills—such as critical thinking, data analysis, and communication—that may transfer to a wide range of career paths. Throughout the fluctuating logistical challenges presented by the pandemic, BIOS continued to offer students the opportunity to obtain relevant, in-person research experiences.



search projects developed by BIOS faculty and staff. Rather than tackling classwork remotely, as many of their peers were, the small cohort of international interns gained hands-on experience in a variety of topics including atmospheric sciences, marine biology, genomics, microbial ecology, oceanographic sciences, and natural hazard and risk prediction. “The three months at BIOS were an invaluable research and personal experience,” said participating intern Naomi Villiot, a PhD candidate at Heriot-Watt University, Scotland. “Not only have I collected enough data to complete an entire chapter of my PhD thesis, I am also currently working on writing a paper with my BIOS mentors, as well as exploring the possibility to work further with BIOS researchers after completing my degree.”

Among the many lessons reinforced at BIOS by the COVID-19 pandemic is the value of a highly-skilled scientific workforce capable of serving the broader community. BIOS internships provided unique insights into the process of conducting science, as well as the opportunity to learn valuable skills—such as critical thinking, data analysis, and communication—that may transfer to a wide range of career paths. Throughout the fluctuating logistical challenges presented by the pandemic, BIOS continued to offer students the opportunity to obtain relevant, in-person research experiences.

Selected Financial Highlights

In 2020 worldwide challenges introduced global struggles to which BIOS was not immune. BIOS's community felt the pain and hardship as borders closed, lives were lost, and media sources were filled with uncertainty about COVID-19 and what its true impact would be both locally and globally. Bermuda, as a very resilient country facing almost annual hurricane disasters, made tough national safety decisions which included temporary border closures and the subsequent introduction of many of the strictest travel and testing protocols in the world. This shift in the freedom of movement impacted BIOS operationally but ensured a focus on the safety of our team members, local community, and partners both on-island and abroad.

With grit and determination, an extraordinary amount of effort was deployed to develop and communicate the new safety protocols and pivots which were necessary to safeguard lives. BIOS's leadership, management and employees each displayed these attributes which was imperative to our ability to collectively forge onward.

Selected Highlights

- Cash and investments grew by nearly \$3M over prior years. This growth correlates with prudent financial management and renewed support by our trustees and private donors.
- At yearend BIOS net assets were nearly \$40M, a growth of \$10M from 2019. Net assets are the difference between the Institution's assets and liabilities and are a key indicator of the organization's monetary worth and future ability to carry out its mission.
- Overall revenues increased by \$9M to \$24M over the prior year of which \$11M were with donor restrictions. Federal support contributed 37% to total revenues, and tuition fees and guest revenues dipped steeply (\$900K) as national COVID travel restrictions reduced on-site enrollment in our experiential education offerings. 2020 investment returns were \$1.7M after a volatile Q1 where losses nearly exceeded 2019 total gains.
- Total expenses decreased by \$3M as they were significantly impacted by educational summer and fall course cancellations. 90% of 2020 expenses supported BIOS research and education programs and the remainder were G&A (8%) and fundraising (2%) costs.

This Annual Report is more than numbers and statistics reflecting BIOS's performance during the year. This report demonstrates the achievements of teamwork and sacrifice, and a commitment to persevere through an unprecedented crisis. BIOS's commitment remains steadfast, and our strategic goals remain fully aligned to our mission and purpose as we move forward from a challenging year.

Victoria Millett CPA, BCOMM
Treasurer and Controller



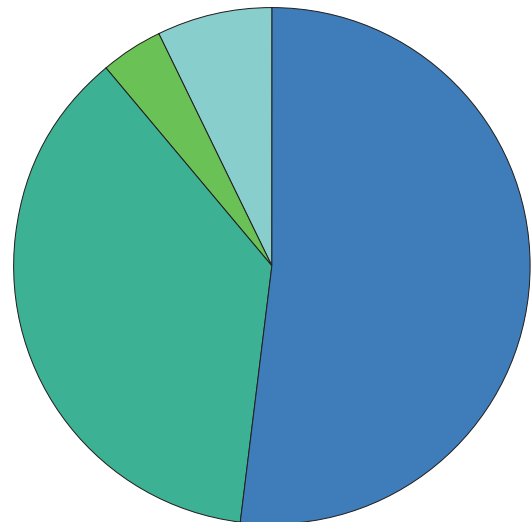
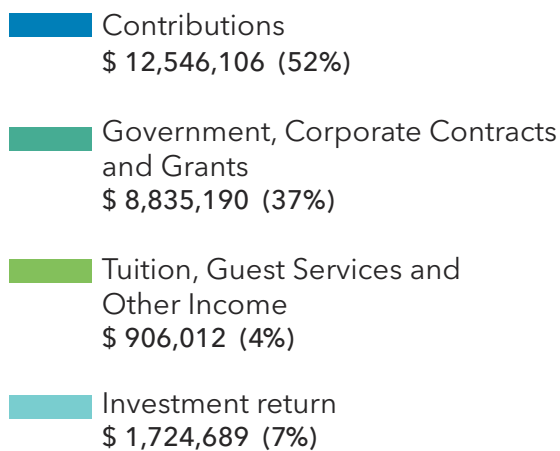
Please visit www.bios.edu/about/annual-reports/ for a full financial report.

Summary Financial Highlights

December 31, 2020

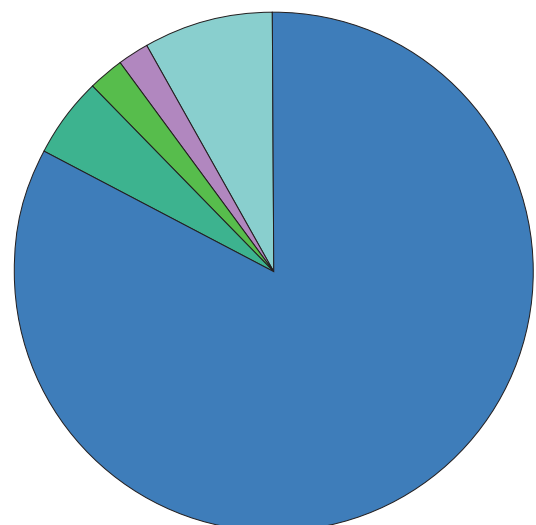
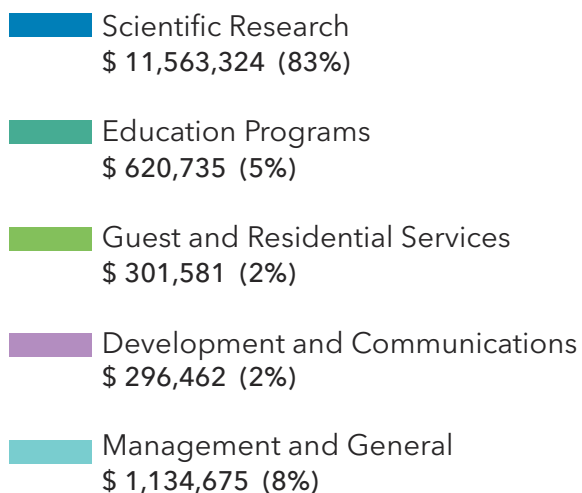
2020 REVENUES & SUPPORT

Revenue and support is derived from gifts; individual, corporate and foundation donors (52%); and grants and contracts received through the U.S. and Bermuda governments (37%). 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 (4%), and investment return pertaining to endowment funds (7%).



2020 EXPENSES

Program expenses include scientific research (83%); education activities (5%); and guest and residential services (2%). Other expenses include development, marketing and communications (2%); and management and general (8%).



Summary Financial Highlights

December 31, 2020

Statements of Financial Position

	2020	2019
Assets		
Cash and cash equivalents	\$ 4,153,650	\$ 2,260,391
Grant receivables and other assets	1,004,518	889,120
Contributions receivable, net	8,254,960	94,751
Investments	19,139,935	18,051,990
Property and equipment, net	17,043,269	18,019,147
Total Assets	\$ 49,596,333	\$ 39,315,399
Liabilities and Net Assets		
Liabilities		
Payables, accruals, advances and deposits	\$ 1,589,219	\$ 1,353,838
Loans payable	9,330,649	9,380,317
Total Liabilities	10,919,868	10,734,155
Net Assets		
Without donor restrictions	\$ 9,523,066	\$ 9,259,441
With donor restrictions	29,153,399	19,321,803
Total Net Assets	38,676,465	28,581,244
Total Liabilities and Net Assets	\$ 49,596,333	\$ 39,315,399

Statements of Activities

Support and other Revenues		
Contributions	\$ 12,546,106	\$ 1,471,972
Grants and contracts	8,835,190	9,458,723
Tuition, guest services and other income	906,012	1,712,493
Investment return	1,724,689	2,735,651
Total Revenue and Other Support	24,011,997	15,378,838
Expenses		
Program services		
Scientific research	\$ 11,563,324	\$ 13,472,765
Education courses and programs	620,735	1,670,663
Guest and residential services	301,581	93,924
Total Program Services	12,485,640	15,237,352
Support Services		
Development, marketing and communications	\$ 296,462	\$ 525,944
Management and general	1,134,675	1,118,765
Total Expenses	13,916,777	16,882,062
Increase (Decrease) in Net Assets	\$ 10,095,220	\$ (1,503,224)

Summary Financial Highlights

December 31, 2020

	2020	2019
Investments		
Global Multi-Asset Fund	\$ 16,677,016	\$ 15,651,043
Treasury Money Market Fund	2,412,202	2,400,947
Common Stock	50,717	-
Total	\$ 19,139,935	\$ 18,051,990

Endowment Funds		
Balance on January 1	\$ 15,685,985	\$ 13,663,317
Contributions	25,600	34,941
Investment return		
Net appreciation	\$ 1,772,362	\$ 2,480,998
Investment (fees) return	(59,265)	204,084
Distributed during the year	(722,065)	(697,355)
Balance on December 31	\$ 16,702,617	\$ 15,685,98
Represented on the Balance Sheet as:		
Without donor restrictions	\$ 1,771,359	\$ 1,595,141
With donor restrictions	14,931,259	14,090,845
Balance on December 31	\$ 16,702,617	\$ 15,685,985



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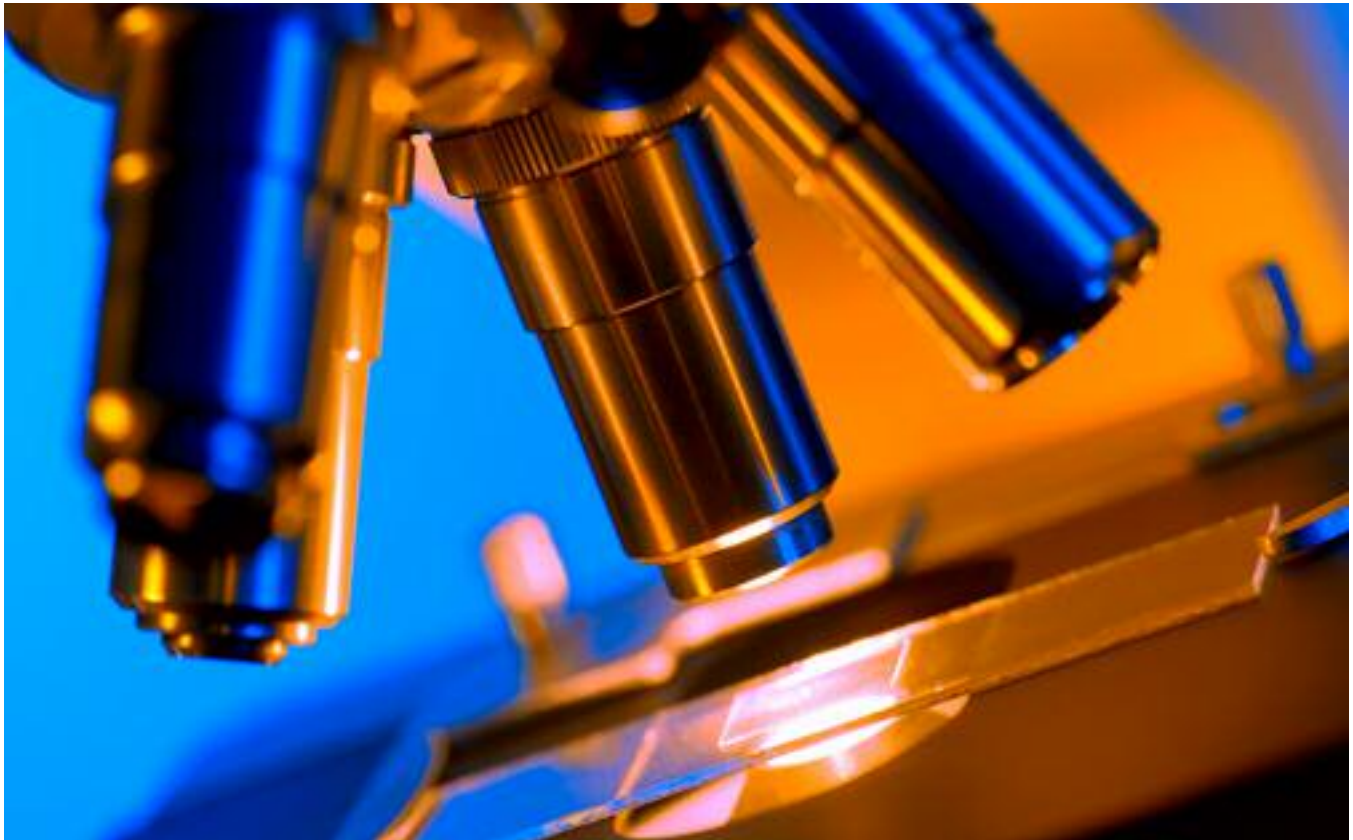
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University of Bergen

Deborah Steinberg, PhD
Virginia Institute of Marine Science

Simon J. Ussher, PhD
Plymouth University
Scientific Technical Staff



The Bermuda Atlantic Time-series Study team. Photo by Ella Cedarholm

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Community Engagement

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Marine Technician
Rory O'Connell

Marine Technician
Lydia Sgouros

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Chris Sheridan

Relief Chief Mate
Larry Morris

Relief Chief Mate
Patrick Redmond

Relief Chief Mate
Emily Jarris

Relief Second Mate
Paul Carty



Relief Second Mate
Emily Jarris

Relief Chief Engineer
Robert Cruise

Relief Chief Engineer
Lance Wardle

Relief Chief Engineer
Jens (Mike) Kierkegaard

Relief Chief Engineer
Eric Hahn

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

Relief Second Mate
George Yu

Cook
Dexer Ojano

Cook
Carlos Calayo

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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
Raymund Laureano

Able Seaman
Joven De Guzman

UNOLS Tech Pool

Marine Technician
Tony D'Aoust

Faculty & Staff

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

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 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

Tiffany Wardman
Marketing and Media
Relations Manager



Bermuda Institute of Ocean Sciences

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