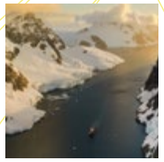
# TRANSECT

BIGELOW LABORATORY FOR OCEAN SCIENCES / SUMMER 2026

**2** Collaborative Science

**8** Ocean Discovery

**12** Field Notes: Antarctica



**ON THE COVER**

This winter, Senior Research Scientist Ben Twining participated in a research cruise around Antarctica highlighting how small amounts of metal play a big role in regulating the Earth's climate. Learn more about his experience on page 12.

Photo: Lewis Bumstead



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## Message from the President

Like many people around the world, I was inspired by the Artemis II mission this spring, and looking up at the moon that week filled me with wonder. It reminded us what people and science are capable of when we work together.

As an ocean gal, however, I'm compelled to remind folks that while we should absolutely explore space, there's so much to discover in the sea.

Case in point, we know very little about the ocean's midwater region despite it being the largest habitat on Earth. On page 8, you'll read about an expedition to the South Atlantic that two of our researchers went on this spring, deploying new technologies to study this "twilight zone." There, between the sunlit surface and the ocean floor, lies a little-understood ecosystem filled with beautiful and mysterious creatures. (If you're interested in the far corners of our amazing ocean, you can also hear from one of our scientists about a recent expedition to Antarctica on page 12.)

Of course, exploration is only part of the story. On page 2, you'll learn about the long-running relationship between our scientists and the Maine Department of Marine Resources. These collaborations help translate our laboratory's foundational research and discoveries into real-world solutions that benefit the state of Maine and beyond.

You'll hear a bit more from me on page 7. Ever since the upheaval in our federal funding landscape, I've been inundated with questions and concerns from our community. People want to know what's at stake and what we're doing about it, so we took a moment to address some of the questions we've been hearing most often.

There's also a profile of Howard Adams, a truly wonderful supporter of our lab, on page 10. One of the things I love about his story is how our Café Sci series inspired him to get involved. It's a nice reminder that great things happen when we open our doors and share our science!

Speaking of which, if you're interested in coming to the series this summer, you'll find the schedule on page 6. It's going to be a great season, and we look forward to seeing you there. In the meantime, I encourage you to find inspiration wherever you can, whether you're looking up at the stars or across the sea.

Warm regards,

Deborah A. Bronk

**DEBORAH A. BRONK,** Ph.D.

# CONTENTS

**2** Collaborative Science
**6** Café Sci 2026
**7** Q&A With Deborah Bronk
**8** New Technology for Ocean Discovery
**10** Profile: Howard Adams
**11** Science Snap
**12** Field Notes: Antarctica
**14** Thanks to Our Donors

**COLBY COLLEGE STUDENTS** learn about algae innovation and biotechnology at Bigelow Laboratory during their immersive "Jan Plan" term. The course, one of two this winter providing hands-on learning opportunities at the lab, was arranged through the Maine Algal Research Infrastructure and Accelerator project. Learn more about the institute's broader efforts to grow a blue biotechnology sector in Maine on page 11.

Photo: Gabe Souza

# COLLABORATIVE SCIENCE

## FOR A STRONGER GULF OF MAINE

**FOR DECADES**, the Maine Department of Marine Resources has been one of Bigelow Laboratory's closest partners, with each organization bringing its own perspective and expertise to the relationship. Together, researchers have advanced a number of applied research projects that are illuminating the changing ecology of the Gulf of Maine in a way that benefits coastal communities, industries, and ecosystems.

**LEFT** Postdoctoral Scientist Melissa Rocker handles a lobster used in an experiment testing the effects of temperature on shell disease in collaboration with DMR.

**ABOVE** Researchers at Bigelow Analytical Services, like Senior Research Associate Craig Burnell, partner with DMR to run samples for the shellfish toxin monitoring program.



Since its earliest days, Bigelow Laboratory for Ocean Sciences has had a steady, strong partner in the Maine Department of Marine Resources (DMR). In fact, until 2012, the two organizations were next-door neighbors in adjoining facilities. Together, scientists at both institutions have developed molecular tools for identifying *Pseudo-nitzschia*, a type of algae that can produce a potent neurotoxin. They've amassed a baseline understanding of zooplankton communities around an offshore wind testing site. They've studied the physiology of larval lobsters coming into the fishery. They've worked to quantify the nutritional value of plankton that whales feed on — and so much more.

"We're advancing foundational science, but we also want to have a real impact," said Senior Research Scientist Nick Record. "With DMR, we're able to answer management questions and translate our research into solutions. Together, we're making sure our work has value to both everyday life and the broader scientific endeavor."

**'TOGETHER, WE'RE MAKING SURE OUR WORK HAS VALUE TO BOTH EVERYDAY LIFE AND THE BROADER SCIENTIFIC ENDEAVOR.'**

By combining DMR's community connections, long-term datasets, and management insight with Bigelow Laboratory's life sciences expertise and analytical prowess, this joint work has transformed understanding of the dynamic Gulf of Maine and contributed to more sustainable, science-based resource management.

"Our teams approach many of the same questions from different angles," said Jesica Waller, the director of DMR's Division for Biological Monitoring and Assessment who has unique insight having worked at both institutions. "Together, we can build a comprehensive understanding of the Gulf of Maine and what the future may hold for our commercial fisheries, aquaculture industry, and coastal communities."

### ADDRESSING A TOXIC PROBLEM

Certain algae species produce harmful compounds that can concentrate in filter-feeding species like mussels. Saxitoxin, for example, is produced by a species of *Alexandrium* and can cause Paralytic Shellfish Poisoning (PSP), which can be fatal in humans. Joint efforts to understand the drivers of *Alexandrium* blooms and develop methods to monitor shellfish toxins have blossomed into one of the most fruitful collaborations between the two organizations.

"It's an area of long-standing scientific interest for all of us, and with the two labs 100 meters apart in those early days, it was a natural thing to work on together," said Steve Archer, senior research scientist and director of Bigelow Analytical Services (BAS).

DMR has long tracked the abundance of harmful algae species to ensure no shellfish harvesting occurs while toxin levels are high. Historically, they determined if shellfish were safe to consume by injecting extracts into mice that were then monitored to see if they got sick or died. That less-than-ideal method is still the norm in most states.

The agency began looking for alternatives after devastating shellfish closures in 2008 and 2009, explains Kohl Kanwit, the director of DMR's Bureau of Public Health and Aquaculture.

They partnered with Archer to implement an advanced chemical technique out of Canada called high-performance liquid chromatography, which can provide rapid, precise results, even at lower toxin concentrations, and doesn't rely on mice. In 2014, Bigelow Laboratory became the first lab in the country approved by the FDA to deploy it. "It became apparent that we didn't have the staff capacity to consistently run the chemical method, whereas Bigelow could provide the expertise and staffing, especially when it comes to trouble shooting the equipment," Kanwit said. "This has proven to be a rich partnership that allows for finer-scale decision making and serves the industry well."

Today, DMR monitors coastal waters for spikes in harmful algal species, and then, based on those counts, collects and sends shellfish to Bigelow Laboratory for analysis. The BAS team tracks 12 different compounds in each sample. DMR is BAS's biggest client, Archer says, and the partnership has opened doors for countless research projects and analytical advances.

Despite how dangerous some of these toxins are, there have been no fatalities from PSP in Maine due to the effective monitoring program.

"This is a great example of a really effective collaboration between an independent research organization and government institution," Archer said.

### MONITORING A CHANGING ECOSYSTEM

The shellfish toxin program is one of a number of projects that are helping monitor the health of Maine's marine resources.

For the last several years, Senior Research Scientist Doug Rasher has drawn on the agency's extensive monitoring data to understand the causes and consequences — and future trajectory — of kelp forest decline along Maine's coast. In 2024, his team published a significant paper, featuring DMR scientists, that provided the first census of Maine's kelp forests in decades, in part by drawing on 20 years of invaluable data from the state's sea urchin survey. Rasher calls that survey, which is fishery-focused but includes several broader environmental components, the "preeminent dataset of its kind" in the region. The scale

Photos (previous page), left to right: Catie Cleveland, Greta Rybus

and longevity of it — covering much of the coast, regularly, for years — he says, would be impossible for a research institution to replicate.

"To have both widespread and repeated measures over time is really impressive," he said. "Combined with our short-term, higher-resolution sampling, DMR's dataset enabled us to paint a holistic picture of kelp forest dynamics. The results really reflect our complementary strengths."

He adds that the work has catalyzed a number of related projects. Most recently, he has partnered with DMR on a new proposal to study what determines sea urchin reproduction and survival, which will provide new knowledge on Maine's reef ecosystems and could inform future fisheries management.

DMR says the collaboration has filled in critical data gaps and helped them refine the survey so that the agency can better document the broad effects of climate change.

"Bigelow researchers work on the cutting edge of their fields, and we look to them to complement our field-based expertise to answer emerging questions," Waller said. "They've helped turn a single-species monitoring program into a more comprehensive, benthic ecology monitoring program, which will improve the quality of our work and the sustainability of these valuable resources."

Fellow Senior Research Scientist Maya Groner is also working closely with DMR colleagues on one of Maine's most charismatic species.

Epizootic shell disease causes prominent lesions on lobster shells that can be fatal. Even in mild cases, the disease makes them less commercially valuable and eats up precious energy the lobsters must spend molting out of their degraded shells. Funded by the American Lobster Initiative, Groner is working with DMR to understand how the disease has progressed in the past and how vulnerable Gulf of Maine lobsters are.

The project included a large-scale experiment over several months that Groner's team ran from DMR's facilities.

"Our wet lab had recently undergone renovations, and we were eager to utilize its new capabilities for collaborative projects," said Heather Glon, a DMR lobster biologist working with Groner on the project. "We knew that Maya and her team, being adaptable and strong communicators, would be excellent partners. We also knew that their results would be immensely informative for understanding lobster health."

As with Rasher's kelp forest work, the shell disease project relies on extensive monitoring efforts. DMR's powerful lobster survey, for example, collects multiple measurements every month from along the coast on lobster size, sex, and disease state. Combined with environmental information, that data is helping Groner's team model how the disease may spread in the future as the ocean warms.

**'DMR HAS A BIG-PICTURE PERSPECTIVE AND AN INCREDIBLE AMOUNT OF DATA. WE HAVE THE CAPACITY AND INFRASTRUCTURE TO TAKE DEEP DIVES INTO THAT DATA.'**

Both projects reflect the benefits each organization gets out of the relationship.

From a professional standpoint, joint work gives Bigelow Laboratory's early career scientists experience with resource managers, and it gives DMR scientists opportunities to mentor students through the institution's education programs.

DMR's "eyes on the water" and management mandate also gives them unique insight into community needs and the broad-scale patterns shaping the Gulf of Maine. Bigelow Laboratory can then dig deeper with hypothesis-driven studies on what's driving those patterns.

"DMR has a big-picture perspective and an incredible amount of data. We have the capacity and infrastructure to take deep dives into that data," Groner said. "We love co-developing research ideas with them."

"We greatly value the cross-pollination of ideas and diverse strengths and interests that help us tackle challenging questions," Glon added. "Together, we can reach more people and find answers to big questions that couldn't be addressed by a single institution."

**LEFT** Scientists point to the tell-tale lesions of epizootic shell disease on an infected lobster as part of a collaborative project on the disease's spread in the Gulf of Maine.

**ABOVE** Scientists in Bigelow Analytical Services, like Research Associate Gabriella Iacono, can test shellfish collected by DMR for toxins, including saxitoxin, which is produced by a species of the dinoflagellate *Alexandrium* (top).

**ABOVE** Tandy Center researchers gather with stakeholders for a harmful algae bloom monitoring workshop in Namibia, an example of global work that has spun out of the toxin monitoring and forecasting efforts here in Maine.

**RIGHT** DMR scientists capture an image of a sea urchin during their monitoring survey, which provided valuable, long-term data for a collaborative project on kelp forests.

## FORECASTING A COMPLEX FUTURE

With the emergence of new computational tools, these collaborative projects have evolved from monitoring the present state of the ocean to predicting how it may look in the future.

Archer and Record, who directs the Tandy Center for Ocean Forecasting, have worked with DMR on a shellfish closure forecast based on the immense amount of toxin data BAS has collected since 2014. The machine learning-based model predicts whether toxicity levels may be high enough to warrant a closure on a weekly timescale. The tool is publicly available online and, though it isn't used for regulatory decisions, it can help shellfish harvesters make more granular operational choices.

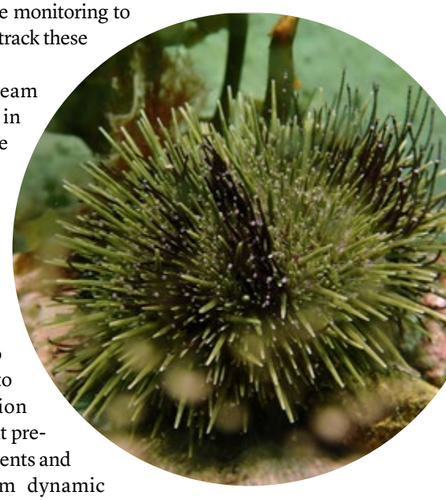
"There are existing models that predict the abundance of potentially-toxic algae that give a broad indication of what might happen in the coming year," Archer explained. "We're actually predicting shellfish toxicity directly, which is more useful from a management perspective."

Record adds that the effort has sparked other projects and been a springboard for international collaborations. There's also been growing interest from neighboring states to send their shellfish samples to Bigelow Laboratory and create similar forecasting tools.

"It's been a great learning process, thinking about what information people need and want," he said. "We're constantly improving to make sure what we're providing is as useful and usable as possible."

Record — on the recommendation, in fact, of a DMR colleague — is also part of the North Atlantic Right Whale Take Reduction Team, a multidisciplinary group of scientists, fishermen, officials, and conservationists providing recommendations on right whale management.

One of the challenges, he explains, is that historically there was minimal data on the movements of these endangered whales in Maine waters so models that underpinned management in the area were marred by uncertainty. To fix that, DMR has received an influx of funding in the last decade for intensive monitoring to fill data gaps and better track these behemoths.



Record and his team are deeply involved in that effort. They're using tools like acoustics to better understand the movement of the whales' favorite prey and then incorporating that information into better habitat models. The goal is to turn the new data into actionable information with real-time tools that predict right whale movements and can potentially inform dynamic management.

"There are a million things you *could* forecast, but they're not all equally useful," he added. "Partnering with resource managers helps us use our skills to answer the questions people are asking, and address the challenges they're facing, here and now."

## LOOKING AHEAD

With all this recent progress, researchers at both organizations felt it was time to get everyone in a room together to keep momentum going. In November, Bigelow Laboratory hosted a joint symposium with DMR that provided space for scientists at both institutions to share recent discoveries and new ideas and get to know each other better.

"In the last decade, both institutions have grown in terms of their size and scientific capacity, and the Gulf of Maine has rapidly changed," Rasher said. "We thought it



Photos, left to right: Catie Cleveland, Gabe Souza, Peter Countway

Photos, left to right: Bigelow Laboratory, Heather Glon

was the right time to get everyone on the same page about the state of our science and what data are available, to then define the most pressing questions for this region and how we can tackle them together."

At the end of the symposium, there was great enthusiasm to hold future gatherings and continue building trust and fostering new ideas. Since then, new projects, like the sea urchin work, have started to develop, and researchers at both organizations have continued meeting.

"As someone with established partnerships at Bigelow, I appreciated the opportunity to learn about what other scientists there are doing and consider new ways DMR scientists can collaborate," Glon said. "At the end of the day, we all share similar goals in marine science, and we've seen how much more effective it is to work together to achieve those objectives."

**'AT THE END OF THE DAY, WE ALL SHARE SIMILAR GOALS IN MARINE SCIENCE, AND WE'VE SEEN HOW MUCH MORE EFFECTIVE IT IS TO WORK TOGETHER TO ACHIEVE THOSE OBJECTIVES.'**

**LEFT** Various fish species swim off Cashes Ledge through some of the healthy kelp forest that remains in the Gulf of Maine.

**ABOVE** Senior Research Scientist Doug Rasher welcomes scientists to the Bigelow-DMR Collaborative Symposium in November 2025.

Photos, left to right: Brian Skerry, Alex Seise



Q&A

# A Conversation on the Science Enterprise

**WITH BIGELOW LABORATORY CEO AND PRESIDENT DEBORAH BRONK**

### Q: WHY IS FEDERALLY SUPPORTED SCIENCE SO VALUABLE?

**A:** You can't overstate the benefits to our society that government-supported science has made possible. Look around your car and home. Use your phone. Think about the recent mission to the moon. All of those things started in a research lab funded in-part by the government. Or consider the human genome project, which I think has had the largest impact on people's lives of any recent advance. It's the future of medicine — medicine that doesn't treat but cures. It cost $3.8 billion dollars, but, in 2011, experts estimated it had already generated almost $800 billion in economic output. That's a 14:1 return on investment!

All of the money that companies put into science also relies on federal funding. Apple, for example, could never have invested 30 years in the technology development and behavioral science that made their products possible. For that, you need basic research. Federally funded research has created this vast encyclopedia of knowledge that a company like Apple can then package into something new and valuable.

For our field, the pivotal moment was World War II. From advances in sonar to coastal mapping for the Normandy landings, we would not have won that war without oceanographers. After that, the government said we're going to continue to invest in this because it can keep the country safe and help it prosper.

The United States has been a leader in the global study of the ocean ever since, and we spearheaded many of the big international research programs. We were the main driver behind the Argo program, for example, which is an amazing thing. There are now 4,000 floats, moving through the ocean with the currents, measuring temperature and salinity. It's incredible how ignorant we were about large-scale ocean processes before it! And with 30 or so countries involved, it's been huge for science diplomacy.

### Q: HOW HAS THE SCIENCE LANDSCAPE CHANGED IN THE U.S. IN RECENT YEARS?

**A:** I would say our leadership has been waning for 20 years. Take the decline in our research fleet. We've gone from 34 to 16 ships. We don't have research icebreakers in the Southern Ocean or Arctic anymore. We don't have a deep-ocean drilling ship. So many research expeditions, historically, wouldn't have been possible without American support, but, these days, we're hitching rides on other countries' ships. That makes it harder to go to sea. It slows down the pace of discovery, and it erodes science diplomacy. Knowledge of the ocean is going to be critical to future geopolitical conflicts, so it also reduces our ability to protect ourselves.

There are immediate concerns around funding as well. We actually have robust science agencies right now based on the latest congressional budget, but the money isn't flowing out to scientists. As an institution, we're down 90% in federal funding compared to last year, and it's not because we're getting more proposals rejected!

What I'm most worried about, though, is people. Part of the reason we have been such a scientific powerhouse is that the best and brightest from around the world wanted to come here, and they brought with them passion, experience, and knowledge. If you want to solve big problems or make big discoveries, you need all those perspectives.

We are not the premier destination for scientists anymore. And we've lost thousands of researchers to other countries, taking their ideas with them. That loss scares me.

### Q: HOW HAS BIGELOW LABORATORY RESPONDED TO THIS NEW REALITY?

**A:** Bigelow's greatest asset is our people, and my priority is keeping our research teams together. Fortunately, we've always been nimble and able to rise to challenges.

One of our main efforts is to expand non-federal revenue sources. We're increasing fee-for-service activities, which are specialized analyses we sell to outside clients. We're also going after more commercial-type research, which would be a source of revenue for us and help the state develop its blue economy.

We're also, frankly, calling on our supporters more than ever. Federal funding was always more geared toward basic research, and our donors enabled us to think about applications. Now, in many ways, the situation is reversed. We are, in our DNA, a research institution, and our success depends on keeping that core of our organization strong. So, we're asking our supporters to help protect basic research and sustain our scientists' deep well of bold ideas.

We don't want to just weather this storm. We want to come out of it stronger than ever.

# NEW TECHNOLOGY FOR OCEAN DISCOVERY

**IMAGES FROM THE OCEAN'S VAST MIDWATER** reflect some of the unique adaptations that animals have to help them thrive in this dark, high-pressure environment. Sailing aboard the state-of-the-art R/V *Falkor (too),* scientists were able to observe, image, and, in some cases, capture samples of many of these strange creatures.

**THE DESIGNING THE FUTURE EXPEDITIONS** through Schmidt Ocean Institute, including the most recent cruise in the South Atlantic, allow scientists to test and refine technological advances in robotics and underwater imaging that are enabling new research on fragile marine life in the deep sea.

**AS THE ARTEMIS II** crew celebrated a successful return from their groundbreaking mission to the moon, a team of scientists, engineers, and artists were preparing for a mission of their own to an environment only slightly less extreme — and certainly no less mysterious.

In April, as part of Schmidt Ocean Institute's Designing the Future 3 expedition, Bigelow Laboratory senior research scientists John Burns and David Fields spent two weeks in the South Atlantic studying the diversity of the ocean's vast midwater region. The creatures there are some of the planet's weirdest — with long, gelatinous bodies that make them well suited for their dark, high-pressure home but difficult to study.

Funded by the Sasakawa Peace Foundation Ocean Shot program, Burns and a team of collaborators have been designing genomic techniques and new robotic and imaging technology to study these fragile, understudied members of the animal kingdom. They can take 3D images from the ROV of transparent animals, for example, that capture their external and internal structures and provide precise physical measurements. The ultimate goal is to create tools to sample these animals non-invasively.

"The technology we're developing is opening up this ecosystem to scientific exploration," Burns said. "If this cruise is any early indication, the discoveries made in this realm are going to be really exciting."

Over the course of two weeks, they stumbled upon a lanternfish, which brightly lit up the black expanse the moment the ROV turned its lights off. They found delicate animals that may be 100s of years old. They tracked tiny crustaceans whose refined senses and strong swimming skills allowed them to evade the ROV. And they observed the peaceful fall of "marine snow," the steady stream of organic material sinking from the surface that helps sustain all of this life.

Alongside a second Ocean Shot-funded team, which included Fields, the multidisciplinary and international cohort of researchers combined some of this new tech with chemical and genomic data, traditional net surveying techniques, and behavioral studies. The samples collected and the in-situ observations made on this expedition are going to illuminate how animals live and move through this environment.

"It really does feel like you're exploring space," Fields said. "The ship, the people, the science that's going on — it's all just amazing and an incredible privilege to be part of."

*Hear all about the expedition at Café Sci this summer!*
*Learn more on page 6.*

Photos: Alex Ingle/ROV SuBastian, Schmidt Ocean Institute

# PROFILE **Howard Adams** Blue Planet Circle Member

**‘I just love the idea of having so many different science backgrounds in one place to allow for that cross fertilization and exchange of ideas.’**

The ocean has been a constant through Howard Adams’s life. His parents met on the water sailing in Rhode Island. During the war, the family relocated to Maine while his father worked in the ship yards in Bath and South Portland. And, growing up, the rocky shores of Cape Elizabeth were his playground. One of Howard’s earliest memories, in fact, was watching them pull the submarine nets in at the South Portland harbor.

“Growing up, the ocean was always just right there,” he said.

That love of the ocean is what motivated him to make a life in California after receiving his PhD in organic chemistry from the University of Colorado.

“I grew to love the mountains while I was in Colorado, but I missed the ocean,” he said. “I chose California because it was the best place to get both.”

That love of the ocean also served as his North Star during his career as an industrial chemist in the oil industry. He worked for many years pushing sustainability within the company and recalls circulating humpback whale songs to fire his team up while searching for a substitute for sperm whale oil, a widely used machine lubricant at the time.

Howard raised his children in California in much the way he was raised, camping and tide pooling along the coast. Today, Howard still lives in the Bay Area, though he remains deeply tied to Maine.

His family retains a cabin on Sebago Lake where they regularly go in the summer. And much of his finances are still managed by the Portland-based financial firm HM Payson.

It was through HM Payson, actually, that Howard was first introduced to Bigelow Laboratory. The firm has sponsored the institute’s Café Sci series for years, and, during the pandemic, they shared recordings of the presentations with clients.

“This is a really cool operation,” Howard recalled thinking while listening to the talks and getting excited about this ocean science lab that had sprung up in his childhood backyard. Since then, he’s been a regular supporter of the lab’s work. This year, he became an inaugural member of the Blue Planet Circle, Bigelow Laboratory’s new giving society for people looking to engage deeply with the institute’s science.

“I just love the idea of having so many different science backgrounds in one place to allow for that cross fertilization and exchange of ideas,” he said. “I understand, from my own career as a scientist, that that’s key.”

He continues to be a regular virtual attendee of Café Sci and the monthly webinars the institute hosts for donors. For Howard, whose daughter is a science teacher, that effort to share science broadly and the education programs are among the most inspiring and important elements of Bigelow Laboratory.

“Every one of those presentations are so educational as someone who likes learning and staying on the cutting-edge of science,” he said. “It’s a big part of what attracted me to Bigelow. Those talks really help me understand and appreciate what my contribution is supporting.”

That support is motivated by his own curiosity but also his deep concerns about the environment having witnessed the oceans rapidly decline over his lifetime. His big question these days is whether the abundant plankton at the base of the food chain can adapt as ocean temperatures and acidity rise at an unprecedented rate. He’s comforted, he says, knowing Bigelow Laboratory has the tools to help answer that question and provide early warning advice for a changing climate.

But his support is also motivated by his family. His sister, Jane, lives on Mount Desert Island, and Howard gives all of his gifts in honor of his father who always had the Maine coast on his mind.

He said, “This is just a nice way to reminisce and honor that.”



# SCIENCE SNAP

**THE INAUGURAL** North Atlantic Blue Biotech summit, co-hosted by Bigelow Laboratory, brought over 200 investors, corporate leaders, scientists, entrepreneurs, and policymakers to Portland, Maine, this spring to highlight market opportunities in ocean-based biotechnology. The full-day event represented the culmination of the first-of-its-kind blue biotech innovation studio. Designed by global investment firm Hatch Blue and supported by the Maine Technology Institute, the studio brought 10 teams from around the world to Bigelow Laboratory for a hands-on “boot camp” to accelerate the application of marine resources into high-value businesses and commercial opportunities. Both events are part of the institute’s multi-year strategy to position Maine as a national leader in blue biotechnology.


Photo: Kerry Thurlow

# FIELD NOTES
## Antarctica

**BEN TWINING,** Senior Research Scientist

Humans have spread across most of the Earth, building extensive communities and using our planet's resources. But Antarctica, by agreement of the 57 countries that have signed the Antarctic Treaty, is designated as a natural reserve, devoted to peace, science, and international cooperation. Mining is prohibited, and there are strict rules on waste disposal. Each signatory has agreed to place on hold any territorial claims and actively collaborate on fisheries management and conservation. In a moment of armed conflicts and receding international collaboration, the Antarctic Treaty stands out as a vestige from a different time.

I had the privilege of visiting Antarctica and the Southern Ocean for research this past January and February, the peak of austral summer. I joined 34 other scientists on the Royal Research Ship *Sir David Attenborough* (the 'SDA') for a UK-funded project called "Iron-Man" studying the role of iron and manganese as trace nutrients that control phytoplankton growth in the frigid waters surrounding the continent. We think these metals influence how much carbon dioxide the oceans take up globally, but they aren't yet incorporated into climate models. That omission might explain why models are incorrectly predicting increased Southern Ocean productivity — even as we observe it declining — in response to rising temperatures.

The science team included many chemists, like me, measuring various forms of iron and manganese, as well as phytoplankton and zooplankton biologists, physicists, and atmospheric chemists to measure metals entering the ocean with wind-blown dust. It was a mix of long-time colleagues and scientists I hadn't met before, graduate students on their first research expedition and old hands with years of cruise experience. We hailed from countries spanning four continents. This multidisciplinary and international collaboration honors the Antarctic Treaty and reflects one of my favorite aspects of field-going research.

The ship also blew me away. Launched in 2018, the SDA is over 400 feet long and almost 100 feet wide, with space for two helicopters (although none were onboard, allowing us to convert the hangar into a gym). It can travel 22,000 miles — nearly the circumference of Earth — and break one-meter-thick ice. The U.S. doesn't have an Antarctic research vessel anymore, so it was invigorating to sail on such a state-of-the-art ship.

The SDA is operated by the British Antarctic Survey to support its dual mission of conducting polar science and providing an active UK presence in the Antarctic. The latter objective gave us an opportunity to visit the British research base Rothera (my first time setting foot on the continent after nine previous cruises to the Southern Ocean!). While I'm familiar with the logistics of months-long ocean expeditions, it was eye-opening to see how Rothera operates, supporting more than 150 staff in the summer and about 30 over the long, isolating Antarctic winter. All trash and research waste — even deconstructed building material — must be shipped off the continent, for example.

Rothera also hosts a fleet of aircraft and a 900-meter gravel runway to support remote field camps deep on the continent. For me, the runway provided space to accumulate some non-treadmill miles towards the friendly "Iron-Man Triathlon" that some of us used to pass the time. Icebergs, glaciers, Adelie penguins, and a Weddell seal asleep on the runway all helped to distract me during a 12-km run.

The West Antarctic Peninsula is one of the most beautiful regions on Earth. It's also one of the fastest warming, with most glaciers and ice shelves in retreat. The breathtaking scenery provided daily inspiration toward our goal of improving our ability to forecast future changes in the Southern Ocean. It is only through such crucial experimentation that we will improve global models of ocean and climate behavior and understand how these environments respond to human activities. Even the Antarctic Treaty cannot protect Antarctica from the steady march of climate change.



# GIVING Secure Your Legacy

## YOUR LEGACY. OUR SHARED FUTURE.

**AT BIGELOW LABORATORY** our scientists are advancing solutions that protect our planet and inspire the next generation of discovery. A legacy gift is a powerful way to ensure our work continues — not just today, but decades from now. You can make a meaningful impact through:

**BEQUESTS**
Include Bigelow Laboratory in your will

**BENEFICIARY DESIGNATION**
Name Bigelow Laboratory as beneficiary of your Donor-Advised Fund, IRA or other retirement fund, or life insurance policy

**TRUSTS & ANNUITIES**
Provide sustained support while securing your income

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