

UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE



2015
ANNUAL
REPORT



Innovation for a better future



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

For 90 years, the University of Maryland Center for Environmental Science has led the way toward better management of Maryland's natural resources and restoration of the Chesapeake Bay. UMCES scientists provide sound advice to help state and national leaders manage the environment and prepare future scientists to meet the global challenges of the 20th century.

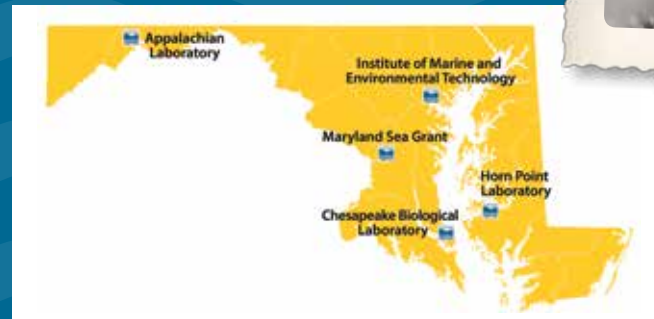


Above: UMCES founder Reginald Truitt at work at the Chesapeake Biological Laboratory.

Top right: Graduate student Lorie Staver surveys marshes on the Eastern Shore.

Right: David Nelson measures leaf chemistry with student Vanessa Cunningham in western Maryland.

Far right: The next generation of scientists studying crabs in the 1960s.



MESSAGE FROM THE PRESIDENT

For 90 years, the University of Maryland Center for Environmental Science has had a profound impact by making key discoveries and expanding broader understanding of our environment, and engaging with society and its government agencies to apply that knowledge to environmental protection and sustainable use of our natural resources.



President Donald Boesch

As the leading scientific institution focused on the Chesapeake Bay and its watershed, our scientists have a legacy of pioneering research and deep understanding that can inform how communities around the world restore degraded coastal ecosystems and polluted waterways.

UMCES science has directly improved the Bay's health by reducing nitrogen, phosphorous, and sediment pollution. It has empowered stream restoration and expanded key habitats such as riparian forests, seagrass beds, and oyster reefs. And, it is helping to sustain populations of striped bass and blue crabs for recreational and commercial uses.

It is a pivotal time for UMCES as emerging challenges, such as climate change, are affecting our environment. Like the globe as a whole, Maryland and the Chesapeake Bay are getting warmer and local sea levels are rising. UMCES is leading the effort to understand the regional impacts of a warming world on key environments, water resources, forests, fisheries, and risks of flooding.

Through continued innovation, UMCES scientists are at the forefront of understanding the links across the continuum of mountains to the sea. At its core, our research, education, and societal engagement significantly informs actions that can be taken to sustain our region's quality of life for generations yet to come. We invite you join us in this effort.

Dr. Donald F. Boesch
President

MISSION: The University of Maryland Center for Environmental Science has a unique statutory mandate to conduct a comprehensive scientific program to develop and apply predictive ecology for the improvement and preservation of Maryland's physical environment. This mission is accomplished through research, education, and public service.

LOOKING TO THE PAST—AND FUTURE— TO UNDERSTAND A CHANGING CLIMATE

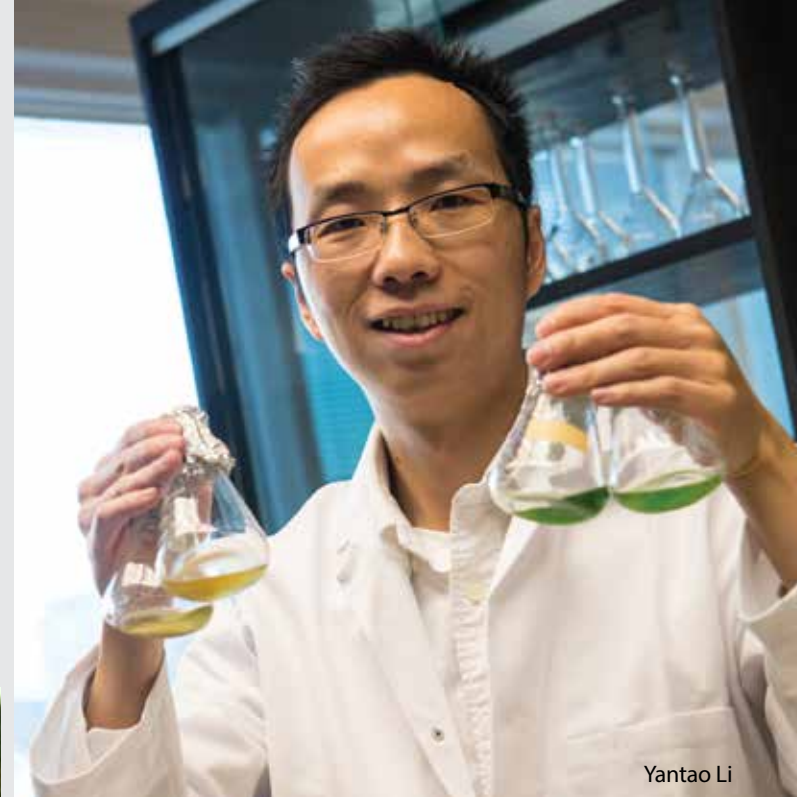
Since its founding, the University of Maryland Center for Environmental Science's work has led to groundbreaking discoveries that have changed the way we think about our environment. The pace continues today as cutting-edge research focuses on important issues—from turning algae into biofuel to predicting the impact of climate change—to provide a scientific foundation key to planning for our state and nation's future.

► By land or sea: Improving water quality and quality of life

Nitrogen fertilizers make it possible to feed more people in the world than ever before. However, too much of it can also harm the environment. **Eric Davidson** of the Appalachian Laboratory has been leading a national group of scientists, economists, sociologists, and agriculture experts in figuring out how to produce more abundant and nutritious food while minimizing pollution and giving farmers a chance to make a living. He calls it "Mo Fo Lo Po": more food, low pollution. In Maryland, **Tom Fisher** of the Horn Point Laboratory is working directly with farmers and residents on the Eastern Shore to measure the impacts of best management practices like cover crops and stream buffers on water quality. The People Land Water project is a five-year study meant to determine the effectiveness of such practices on agricultural and residential properties.



Eric Davidson



Yantao Li

▲ Exploring advances in alternative energy

UMCES scientists are leading the way in studying the impacts of energy sources on our environment. **Ed Gates** at the Appalachian Laboratory is monitoring how wind turbines in the mountains of Western Maryland are affecting bats and birds. **Helen Bailey** of the Chesapeake Biological Laboratory is using underwater microphones to figure out when whales, seals, and dolphins are traveling along the Atlantic coast to recommend the best times to construct wind farms to minimize impact on marine life. In the laboratory, **Yantao Li** is working with colleagues at the Institute of Marine and Environmental Technology to make the development of biofuel more efficient by identifying an oil-abundant strain of algae and perfecting an economical method to extract it for use.



Hali Kilbourne

▼ Keeping the Maryland in crabs, inside and out

Declines in the Chesapeake Bay blue crab stocks led Maryland to search for scientific answers and effective management responses in the mid 1990s. **Tom Miller** of the Chesapeake Biological Laboratory played a leading role in examining the condition of the Bay's blue crab population through laboratory, field, and modeling approaches, setting in motion actions that dramatically changed our understanding of blue crab population dynamics and led to successful Bay-wide changes in management. Today, **Sook Chung** at the Institute of Marine and Environmental Technology is looking at crabs from the inside out, examining how their genes and hormones impact how they reproduce and survive, potentially impacting a healthy stock in the future.



◀ Understand a changing climate

To understand how our climate is changing today and what could happen in the future, scientists like paleoclimatologist **Hali Kilbourne** at the Chesapeake Biological Laboratory turn to natural archives such as ancient corals to see how the Earth's climate has changed in the past. Corals keep a climate record in their fossilized skeletons that can be plugged into a model to help predict changes in the future. Meanwhile, **Matt Fitzpatrick** and his colleagues at the Appalachian Laboratory are taking a step into the future by peering into the genetic blueprint of living trees, and combining new modeling approaches with satellite imagery, to make predictions about how species will react to a quickly changing climate.

YEAR IN REVIEW

“HAD IT NOT BEEN FOR UMCES’ BANKS OF DATA, PROOF, AND EVIDENCE, THE BAY WOULD’VE DIED 20 YEARS AGO.”

—Former Maryland Senator and environmental activist Bernie Fowler



UMCES celebrated its **90th anniversary** this fall at an event that drew close to 200 Maryland policymakers, supporters, and friends. Those who lauded UMCES for its commitment to better management of Maryland’s natural resources and the protection and restoration of the Chesapeake Bay included Senator **Ben Cardin**, former Maryland Senator **Bernie Fowler**, former Maryland Governor **Harry Hughes**, and Maryland Cabinet Secretaries **Mark Belton** and **Ben Grumbles**.



A pioneer in the migration ecology of coastal fishes, **David Secor** explains in his new book how an explosion of digital-age technologies in the last four decades has allowed fisheries scientists to observe the underwater lives of fish in a whole new way. *Migration Ecology of Marine Fishes* was published by Johns Hopkins University Press.



An expert in coastal observing systems, **Mario Tamburri** of Chesapeake Biological Laboratory was honored with the **President’s Award for Excellence in Application of Science** for his leadership in applying innovative environmental sensor

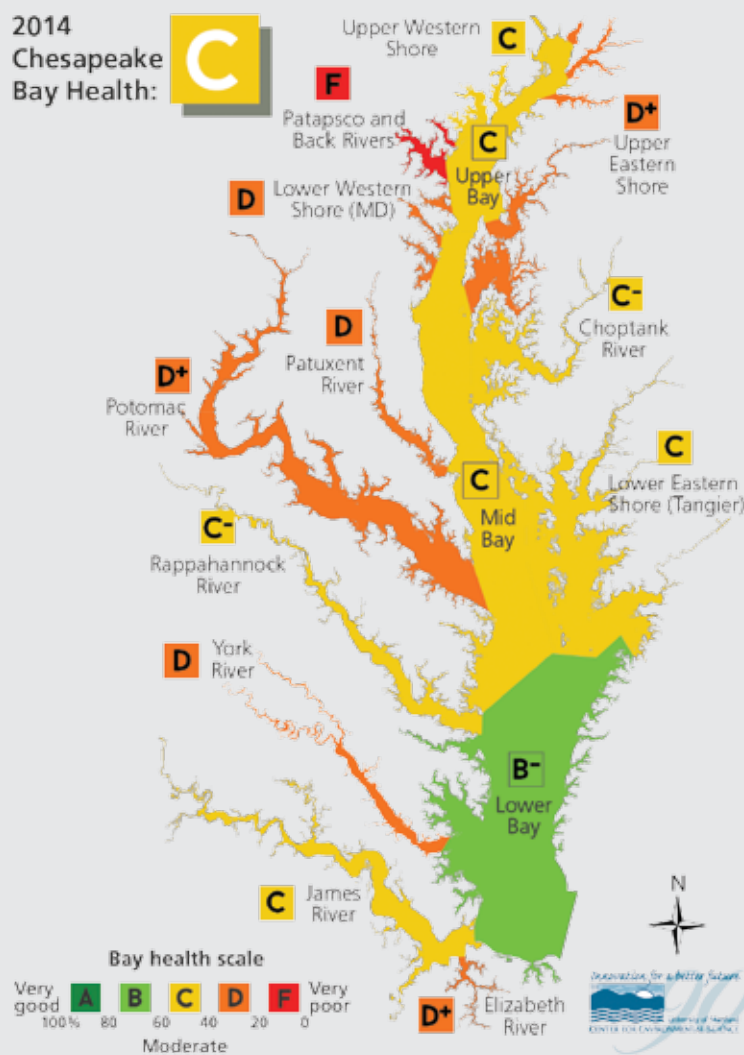


technologies and working to reduce the risk of invasive species through maritime transportation.

Maryland blue crab expert **Tom Miller** received the 2015 **USM Regents’ Faculty Award for Public Service**, the highest honor that the Board bestows to recognize exemplary faculty achievement. Miller has been at the epicenter of advancing scientifically informed decision-making leading to the sustainable use of marine resources, particularly the iconic Chesapeake Bay blue crab, while educating the next generation of environmental scientists.

The **overall health of Chesapeake Bay improved** in 2014 with significantly improving trends in total nitrogen and total phosphorus in the Bay. Overall, the tidal waters scored a ‘C,’ or moderate health. “Our investments in nutrient reduction over the last 20 years are reflected in Bay health,” said Bill Dennison, Vice President for Science Applications. “I am convinced that these positive trends indicate we are beginning to make a real difference in Bay health through our combined actions.”

2014 Chesapeake Bay Health Index



RESEARCH HIGHLIGHTS

Pollution control policies effective in improving downwind air quality



Emissions controls on coal-fired power plants are making a difference in reducing exposure of mercury to people, especially in western Maryland. A study of air quality at the Appalachian Laboratory found that levels of mercury in the air from power plant emissions

dropped more than half over a 10-year period, coinciding with stricter pollution controls.

“I was surprised when I first saw it,” said **Mark Castro**. “We’ve been measuring mercury for years. To see such a dramatic drop was exciting.”



Bacteria in marine sponges harvest phosphorus for the reef community

Scientists have known for years that sponges can filter water and gather nutrients from the ocean, making it appear crystal clear. For the first time researchers at the Institute of Marine and Environmental Technology have identified that bacteria on sponges are harvesting phosphorus from the water for the reef ecosystem to use for nourishment.

“Coral reefs are under huge threat around the world, so we need to understand reef systems very well,” said **Russell Hill**. “This is an important step forward in understanding how you can have such incredible biodiversity even though the surrounding water is low in phosphorus.”

Nutrient Challenge aims to improve monitoring technologies

The White House Office of Science and Technology Policy recognized efforts by the Alliance for Coastal Technologies (ACT), based at the Chesapeake Biological Laboratory, in accelerating the development and use of affordable, reliable, and accurate nutrient sensors through its national Nutrient Sensor Challenge.

“Nutrient pollution is the biggest cross-cutting environmental problem, and our inability to make measurements of nutrients in the water—technology is currently too expensive and hard to use—is the biggest limitation to solving that problem,” said ACT Executive Director **Mario Tamburri**.

Study shows harmful algal blooms in Chesapeake Bay are more frequent

A study of harmful algal blooms in the Chesapeake Bay and its tributaries showed a marked increase in the past 20 years. While algal blooms have long been of concern, this study from the Horn Point Laboratory is the first to document their increased frequency in the Bay and is a warning that more work is needed to reduce nutrient pollution entering the Bay’s waters.



“We need to pay more attention to reducing nitrogen. We’ve made some progress but still have efforts to go,” said **Pat Glibert**.



The University of Maryland Center for Environmental Science's second annual Commencement ceremony was held on May 1 in Annapolis. It featured **Holly A. Bamford '02**, Acting Assistant Secretary for Conservation and Management for the National Oceanic and Atmospheric Administration, as keynote speaker. She told graduates to "take the leap" toward challenges that will come. More than 80 graduate students are currently pursuing M.S. and Ph.D. degrees under the direction of UMCES faculty.

WE CONGRATULATE UMCES' 2015 GRADUATES:

DOCTOR OF PHILOSOPHY: **Javier Alvarez** (Dr. J. Sook Chung, IMET) • **Jennifer A. Bosch** (Dr. Michael Kemp, HPL) • **Jeanette Davis** (Dr. Russell Hill, IMET) • **Kathleen Gillespie** (Dr. Rose Jagus, IMET) • **David Kazyak** (Dr. Robert Hilderbrand, AL) • **Chieh-Lun Liu** (Drs. Rosemary Jagus/Allen Place, IMET) • **Ryan Powell** (Dr. Russell Hill, IMET) • **Kimberly Vest-Gardner** (Dr. Andrew Elmore, AL) • **Fan Zhang** (Dr. Russell Hill, IMET)

MASTER OF SCIENCE: **Katherine Bentley** (Dr. Patricia Glibert, HPL) • **Virginia M. Clark** (Dr. Matthew Fitzpatrick, AL) • **Emily Flowers** (Dr. Eric Schott, IMET) • **Jia Gao** (Dr. Lawrence Sanford, HPL) • **John Gardner** (Dr. Thomas Fisher, HPL) • **Lauren Gelesh** (Dr. Laura Lapham, CBL) • **Miriam Johnston** (Dr. Matthew Fitzpatrick, AL) • **Anthony Kaufman** (Dr. Thomas Miller, CBL) • **Andrew Keppel** (Dr. Elizabeth North, HPL) • **Courtney Pylant** (Drs. David Nelson and Steven Keller, AL) • **Jason Spires** (Dr. Elizabeth North, HPL) • **Andrea Sylvia** (Dr. Michael Willberg, CBL) • **Yuanyuan Xu** (Dr. Hali Kilbourne, CBL)

DID YOU KNOW? Congress recently passed IRA legislation that allows donors 70½ years or older to transfer up to \$100,000 to charity directly from your IRA savings each year as a tax-exempt distribution. This is retroactive to January 1, 2015, and it has no expiration date. If you made a gift directly from your IRA to UMCES at any point during 2015, or in the future, your contribution will qualify as a rollover gift.

Thanks for considering a gift of IRA shares to UMCES! Contact David Balcom at 410-234-8857 or dbalcom@umces.edu for details.

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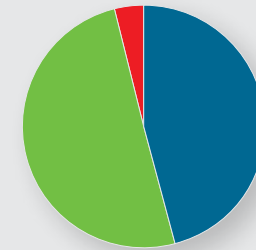
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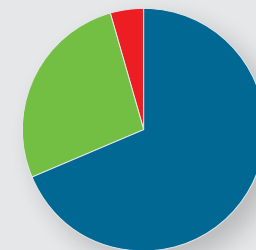
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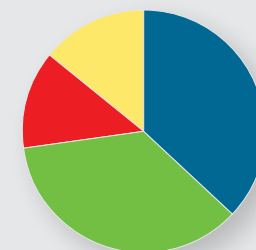
Expenditures

- State Appropriation: 44%
 - Contracts and Grants: 48%
 - Other: 8%
- \$47 million**



Research Awards

- Federal: 61%
 - State: 24%
 - Private/Other: 15%
- \$24.9 million**



Federal Awards by Agency

- National Oceanic and Atmospheric Administration: 37%
 - National Science Foundation: 36%
 - Environmental Protection Agency: 13%
 - Other: 14%
- \$15.2 million**

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"TAKE THE LEAP" TOWARD CHALLENGES THAT WILL COME

The University of Maryland Center for Environmental Science graduated the next generation of environmental leaders at its second annual commencement ceremony. This year, 19 students received joint degrees.



Professor Russell Hill of the Institute of Marine and Environmental Technology hoods his Ph.D. student Jeanette Davis.