



YEARS

University of Maryland Center for Environmental Science  
ANNUAL REPORT 2014

*Innovation for a better future*



University of Maryland  
CENTER FOR ENVIRONMENTAL SCIENCE

students

biology  
laboratory  
environmental  
scientists  
2015  
2015  
2015

The University of Maryland Center for Environmental Science (UMCES) is a globally eminent research and education institution informing how we protect our environment and sustain our natural resources. Scientists at a network of laboratories across the state investigate and respond to today's most pressing environmental challenges in the Chesapeake Bay and around the world.

A trusted scientific advisor to state and national leaders, our scientists provide unbiased research to inform public policy.

# LEADERSHIP



# EDUCATION

We train the next generation of environmental stewards.



We seek solutions that improve people's lives and our natural world.

# INNOVATION

Appalachian Laboratory

Institute of Marine and Environmental Technology

Maryland Sea Grant

Horn Point Laboratory

Chesapeake Biological Laboratory

**AT A GLANCE**  
**Year founded:** 1925  
**Research laboratories:** 4  
**Faculty members:** 100  
**Graduate students:** 80  
**Operating budget:** \$45.2 million  
**Value of grants awarded FY14:** \$20 million

## from the President

This year is a very special one for the University of Maryland Center for Environmental Science.

In 2015, we celebrate our 90<sup>th</sup> anniversary and reflect on the many contributions we have made to science. These contributions have lit the path toward better management of Maryland's natural resources and the protection and restoration of the Chesapeake and many of the world's great ecosystems. There is much to be proud of.

From our collaborative network of laboratories spanning the Allegheny Mountains to the Atlantic Ocean, our scientists continue to analyze changes in rivers and streams, monitor air quality, sample fish populations, and assess the impacts of climate change along our coastal communities.

UMCES has been the pacesetter of scientific research on the Chesapeake Bay and its watershed. When seagrasses dramatically disappeared in the 1970s, it was our scientists who first demonstrated that nutrient overenrichment was the primary cause. We worked hand-in-hand with the State of Maryland to develop a science-based blueprint for restoring the environmental and economic vitality of the beloved Chesapeake Bay.



President Donald Boesch

While our research has led to groundbreaking discoveries that have changed the way we think about the environment, it's our ability to effectively convey that information to decision makers that sets UMCES apart from its peers. Our leaders look to UMCES scientists for sound scientific research and reliable and relevant advice to achieve effective environmental and resource management outcomes.

Today, cutting-edge research is working to use waste streams to turn algae into biofuel, keep invasive species out of our nation's ports, forecast coastal flooding, and assess the impact of climate change on our forests. We are also preparing future scientists to meet the global environmental challenges of the 21<sup>st</sup> century as nearly 100 students work side-by-side with our world-renowned faculty.

We not only celebrate what UMCES has accomplished over the past 90 years but also what we are committed to do to provide the science our state, our country, and our planet will need over the next 90 years. Never before in the institution's history has the University of Maryland Center for Environmental Science's research been more important to the environmental future of Maryland, the region, and the world.

It's important to remember that while we're celebrating the past, we are really focusing on the future: we have to help finish the job of restoring the Chesapeake Bay, use our expertise to help the rest of the world address similar problems, and deal directly with the global environmental challenges of the 21<sup>st</sup> century.

I'm extraordinarily proud of our accomplishments and look forward to your ongoing reliance on and support of our work as we enter our next 90 years of finding solutions to our world's greatest environmental challenges.

A handwritten signature in black ink that reads "Donald Boesch". The signature is fluid and cursive, with a long horizontal stroke at the end.

**Dr. Donald F. Boesch**  
President

# of innovation

# 90 YEARS



Nearly a century ago, in a cramped fisherman's shack on Solomons Island, Reginald Truitt began studying the biology of oysters with a borrowed microscope.

His one-man operation became the Chesapeake Biological Laboratory—the first on the Chesapeake Bay to conduct research on fish, oysters, and blue crabs, and the founding lab of the University of Maryland Center for Environmental Science.

Today, we celebrate 90 years of solving problems that face our environment, in the Chesapeake Bay and around the world, while educating the scientists of tomorrow.

In **1925**, **Dr. Reginald Truitt** founded the Chesapeake Biological Laboratory in Solomons, an outgrowth of his research into managing the Bay's fisheries, to better understand factors causing a significant decline in oyster abundance in the Chesapeake Bay.

Since the **1930s**, UMCES researchers have been tracking changes in **Chesapeake Bay** water quality, including daily measurements from the Chesapeake Biological Laboratory pier in the Patuxent River. This type of long-term data collection, monitoring, and analysis is critical to improving our understanding of our natural world and helping us better understand how our environment is changing.



Since the **1940s**, UMCES scientists have been tracking the population of blue crabs and striped bass. The **Chesapeake Biological Laboratory** is recognized for its fundamental research on life cycles and ecology of Chesapeake fish and shellfish populations and for working with state and regional managers to improve the sustainability of fisheries.

# 1940s

In **1962**, the **Appalachian Laboratory** was founded in the mountains of western Maryland at the headwaters of the Chesapeake Bay watershed. Faculty there study the effects of land-use change on the freshwater and terrestrial ecosystems of the region, how the ecosystems function in the Chesapeake Bay watershed, and how human activities may influence their health and sustainability.



In **1973**, the **University of Maryland Center for Environmental Science** was created to link the mission and operations of the Appalachian Laboratory, the Chesapeake Biological Laboratory, and the Horn Point Laboratory. The new center was charged with a unique statutory mandate to “conduct a comprehensive program to develop and apply predictive ecology for Maryland to the improvement and preservation of the physical environment.”



▲ Since **1972**, the **Horn Point Laboratory**, along the Choptank River on the Eastern Shore, has advanced society’s understanding of the world’s estuarine and ocean ecosystems. Its faculty is widely respected for interdisciplinary programs in oceanography, water quality, restoration of seagrasses, marshes and shellfish, and for expertise in ecosystem modeling.

▲ The **oyster cultivation facility** opened in **1974** at Horn Point. One of the largest on the East Coast, it produces oyster larvae for use in research, restoration, aquaculture, and educational projects. State-of-the art advances have led to record-breaking numbers of spat-on-shell being used to help restore the Bay ecosystem.

▼ In the **1980s**, UMCES scientists made the **initial discovery** that the Bay was suffering from an excess of nutrients, particularly nitrogen and phosphorus, causing the increase in algae blooms that diminished seagrasses, depleted oxygen levels, and caused ‘dead zones.’ This led to a multi-state commitment to reduce nutrient inputs and evolved into a cornerstone issue for the Chesapeake Bay Program.



“While celebrating the past, we are really focusing on the future. . . we have to help finish the job of restoring the Chesapeake Bay, use our expertise to help the rest of the world address similar problems, and deal directly with the global environmental challenges of the 21<sup>st</sup> century.”

—UMCES President Donald Boesch

1981

In **1981**, UMCES’ first student graduated from the **Marine Estuarine Environmental Sciences** program, continuing a long line of master’s and doctoral students to be trained side-by-side with world renowned scientists to be the next generation of environmental leaders.



▲ Since the **1980s**, UMCES scientists have been studying **Maryland’s stream ecosystems**, including the impact of mining on stream health and the sustainability of brook trout.

In **1999**, **Maryland Sea Grant**, a state-wide program of the University System of Maryland, came under the administration of UMCES. This Congressionally mandated federal and state partnership supports research, education and outreach that address coastal and marine issues in Maryland, the region and beyond.

In **2002**, the **Integration and Application Network** was formed to assess progress on Chesapeake Bay restoration and update citizens on progress through annual report cards, websites, and publications now extending around the world.

**A few of the solutions based on UMCES science include. . .**

- Multi-state Chesapeake Bay restoration goals for nutrient reduction and the recovery of underwater grasses
- Management actions leading to rapid recovery of striped bass stocks
- Restoration of streams in western Maryland receiving acid mine drainage
- Reduction of agricultural runoff to reduce the risk of algae blooms
- Management steps to alleviate overfishing of blue crabs
- Enhancing oyster habitat for the benefit of habitat Chesapeake Bay restoration



▲ In **2009**, UMCES launched its state-of-the-art **research vessel Rachel Carson**, specifically designed to help understand and monitor the health of the Chesapeake Bay and its tidal rivers. It is used by a wide variety of academic, private and governmental agencies to research pivotal environmental issues and advance new technologies.

UMCES scientists joined with researchers from the University of Maryland, Baltimore County and the University of Maryland, Baltimore, in **2010** to create the **Institute of Marine and Environmental Technology** (IMET) in Baltimore. Scientists are engaged in cutting-edge research in microbiology, molecular genetic analysis and biotechnology to better understand human health, develop alternative energy, foster sustainable aquaculture, bioremediation, and restore critical coastal environments.

▼ Long involved in teaching and mentoring students, UMCES was authorized to **award joint graduate degrees** with the University of Maryland, College Park in **2014**. Graduate students go on to successful careers in government agencies, academic institutions, and non-governmental organizations.

2010

1999

2002

2014

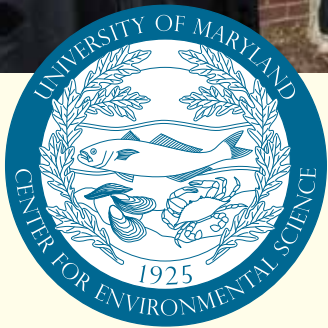


# YEAR in Review

A snapshot of news and research from laboratories across the state.

For the first time, the University of Maryland Center for Environmental Science awarded joint graduate degrees with the University of Maryland, College Park.

Every year, nearly 100 graduate students study and work alongside UMCES' world renowned scientists through the Marine Estuarine Environmental Sciences program. Graduates go on to find high-level employment in the public and private sectors, research, and environmental advocacy.



*Clockwise:*

*UMCES 2014 graduates Jessica Faux, Melinda Forsyth, Jenifer Bryan and Sarah Rains*

*Vice President for Education Ed Houde and President Don Boesch hood Jessica Faux*

*Don Boesch and Sarah Rains with advisor Michael Wilberg*



# YEAR in Review

A snapshot of news and research from laboratories across the state.

## People in the News

**Eric Davidson** joined the **Appalachian Laboratory** as its new director. An ecologist, soil scientist, and biogeochemist, he will lead a cadre of more than 30 faculty, research associates, staff, and post-doctoral fellows working to study terrestrial and freshwater ecosystems from western Maryland.



*Eric Davidson*

The University System of Maryland Board of Regents selected **Keith Eshleman** and **Andrew Elmore** of the Appalachian Laboratory to receive their **Regents' Faculty Award**, the highest honor that the Board bestows to recognize exemplary faculty achievement. This is the first time that two of UMCES' faculty members have been honored in the same year. Eshleman received the Award for Public Service for his leadership in preparing a landmark report on best management practices for fracking, and Elmore received the Award for Research/Scholarship/Creative Activity for his research on water resources and climate variability and his innovative work with satellite imagery.



*Keith Eshleman*



*Andrew Elmore*

**Jeffrey Cornwell** of the Horn Point Laboratory was honored with the **President's Award for Excellence in Application of Science**. An expert in sediments, water quality, and wetlands, he was recognized for his outstanding contributions to the understanding of nutrient cycling in the Chesapeake Bay, including his leadership in advising the Maryland Port Authority on the impacts of dredging, the role of oysters in removing nutrients from the water column, and the impact of sedimentation at Conowingo Dam.

In honor of outstanding contributions to environmental management in Western Maryland, the Appalachian Laboratory selected wildlife biologist, avid outdoorsman, and longtime champion of the natural world **Tom Mathews** as recipient of its **2014 Richard A. Johnson Environmental Education Award**.



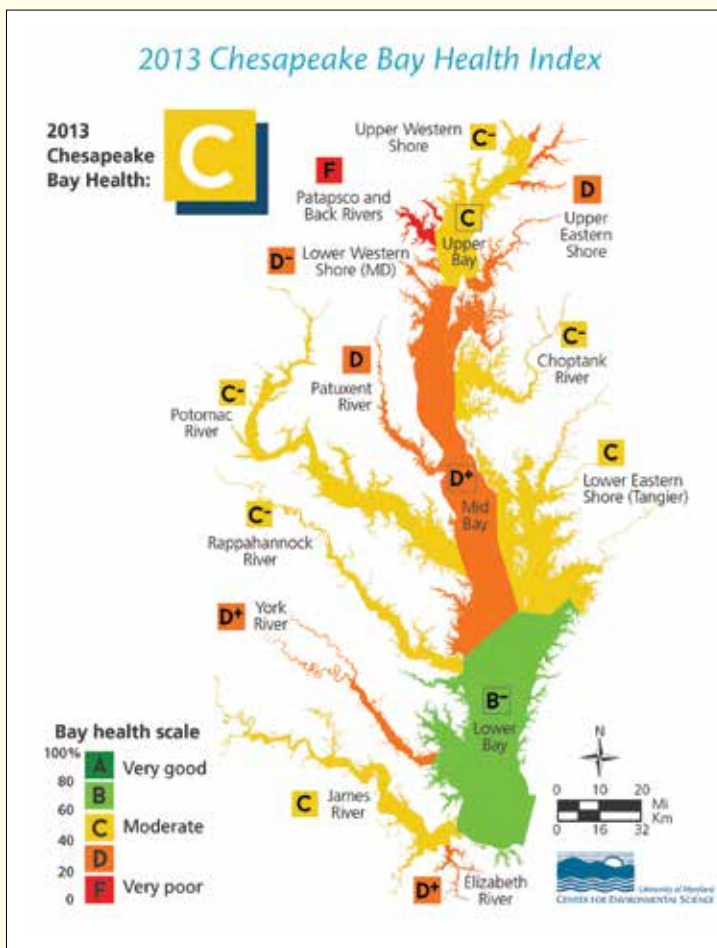
*Jeffrey Cornwell*



# News

The new **Environmental Statistics Collaborative** at the Chesapeake Biological Laboratory offers state-of-the-art education in environmental statistics to UMCES graduate students, as well as provides research expertise to faculty and offers consulting services to partners in the scientific and natural resource management community.

**Chesapeake health holds steady** in 2013 despite a year of above average rainfall and record heat, according to the annual report card on the Chesapeake Bay produced by UMCES' Integration and Application Network. Stormwater runoff proved to be an important factor in the overall grade of 'C,' nearly the same as last year.



The Institute of Marine and Environmental Technology (IMET) won \$500,000 in a **global challenge to find innovative ways to capture carbon** from the atmosphere. Algae from the Chesapeake Bay could be key to reducing greenhouse gas emissions from power plants.

## In memory of Dr. Evamaria Koch



On March 13, 2014, the UMCES community lost a friend and faculty member with the passing of Dr. Evamaria Koch. She will be remembered for her devotion to both underwater seagrasses and motherhood.

Dr. Koch's area of expertise was seagrass ecology, but her interest was more than academic. She loved scuba diving and swimming through waving meadows of seagrasses, talking about seagrasses and visiting seagrasses in different parts of the world. She carried out her research with great energy, enthusiasm, and insight and was a founding member of the World Seagrass Association. She and her students made many important advances in our understanding of seagrasses, especially interactions between seagrass beds and their physical and sedimentary environments.

She joined the Horn Point Laboratory in 1995 as an Assistant Professor and was promoted to Associate Professor in 2001. She was an active member of the Scientific and Technical Analysis Committee for the Maryland Coastal Bays Program and of the Chesapeake Bay Program's Submerged Aquatic Vegetation (SAV) Workgroup. She was also a key contributor to the Submerged Aquatic Vegetation Technical Syntheses, which have helped to guide SAV restoration efforts in Chesapeake Bay. Her unique contribution in both Chincoteague and Chesapeake Bays was to provide a hydrodynamical and sedimentological perspective on SAV ecology.

Her greatest calling in life, however, was as a mother. She was fiercely determined to be a mom and was blessed to be able to adopt her daughter Olga Koch-Eilers, who became the light of her life and the center of her world.

She was a conscientious practicing environmentalist and a rigorous experimental scientist. She was a single mom who held down a demanding job and cared for her mother at the same time. More than all of her accomplishments, she was an integral and active member of multiple communities of scientists, mothers, family members, and friends. She will be sorely missed by all who knew her.

# RESEARCH HIGHLIGHTS

## Underwater grass comeback bodes well for Chesapeake

The Susquehanna Flats, a large bed of underwater grasses near the mouth of the Susquehanna River, virtually disappeared from the upper Chesapeake Bay after Tropical Storm Agnes more than 40 years ago. However, the grasses mysteriously began to come back in the early 2000s. Today, the bed is one of the biggest and healthiest in the Bay, spanning some 20 square miles. A new study by scientists at the Horn Point Laboratory explores what's behind this major comeback.

"Our broader motivation lies in the idea that the methods and models used here can be applied elsewhere to explore similar plant bed dynamics around the world," said **Michael Kemp**.



## Key hormone makes it possible for female crabs to mate and care for their young

Those two crooked beady eyes peeking out of the shell do more than just help blue crabs spot food in the murky waters of the Chesapeake Bay. They also produce important hormones responsible for the growth and development of a crab from an adolescent into a full-fledged adult.

Scientists at the Institute of Marine and Environmental Technology recently discovered a new hormone in those eyestalks responsible for forming body parts that make it possible for female crabs to mate and raise young.

"This is the first definitive evidence for the presence of a female-specific hormone in crabs that regulates the development of structures essential for mating and caring for their eggs," said **Sook Chung**.

## Would offshore wind farm construction impact marine mammals?

Growth in offshore wind generation is expected to play a major role in meeting carbon reduction targets around the world, but the impact of construction noise on marine species is yet unknown.

"Pile-driving during the construction of offshore wind farms produces an incredible amount of noise," said **Helen Bailey**. "This is potentially harmful to marine species and has been of greatest concern to marine mammal species, such as protected populations of seals, dolphins and whales."

A group of scientists at the Chesapeake Biological Laboratory have developed a method to assess the potential impacts of offshore wind farm construction on marine mammal populations, particularly the noise made while driving piles into the seabed to install wind turbine foundations.



## New approach can predict how trees will respond to climate change

When scientists talk about the consequences of climate change, it can mean more than how we human beings will be impacted by higher temperatures, rising seas and serious storms. Plants and trees are also impacted by the changes, but they can't move out of the way.

"When climate changes, organisms have three choices: migrate, adapt, or go extinct," said **Matt Fitzpatrick**. "We're bringing the ability to quantify that adaptation piece that had largely been missing up to this point."

Researchers at the Appalachian Laboratory have developed a new tool to overcome a major challenge of predicting how organisms may respond to climate change.

# Graduate

# Program

## GETTING OUT IN THE FIELD

From day one, UMCES students immerse themselves in field research and laboratory experiments, training side-by-side with renowned faculty mentors. UMCES places an emphasis on hands-on research, in addition to time spent in a classroom. Through this unique approach, students connect their experiences and passion for environmental science to a greater good.

"My research in restoration ecology is conducted on Poplar Island, Maryland. It's a restoration site on the Eastern Shore in Talbot County, and a placement site for dredged material from the shipping channels of the upper bay. We're studying the development of the marshes at Poplar Island to improve methods for making created marshes more sustainable and to learn how they function and respond to stresses like sea level rise and nutrient enrichment."

—**Lorie Staver**, Horn Point Laboratory



"Sponges, whose skeletons are made out of silica, are believed to be the winners of tropical coral reef ecosystems in a more acidified ocean. I am looking at how sponges make their glass skeleton with carbon dioxide concentrations predicted for the end of the century to understand whether they are at an advantage over calcifying organisms like corals."

—**Jan Vicente**, Institute of Marine and Environmental Technology



"I am studying the effects of winter temperature on the growth and survival of juvenile Atlantic menhaden. This fish species uses the Chesapeake Bay as a nursery area. We can use otoliths (ear stones) and fish length to obtain ages, hatch dates, and growth rates of juveniles, which tells us about their growth and survival in the Bay."

—**Alex Atkinson**, Chesapeake Biological Laboratory

"This machine will tell us how the leaf chemistry is changing through the growing season so we can relate it to when leaves start changing colors, a measure that we see in remote sensing images. With field observations we're limited to a very small area of what we can sample, with remote sensing you can sample the entire world, you just have to know what your seeing in those images."

—**Vanessa Cunningham**, Appalachian Laboratory



# Contributors

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# Charlie Monk, UMCES Board Chair

UMCES is delighted to welcome Charles O. Monk, II as the third Chair of the UMCES Board of Visitors. Monk is managing partner of the Baltimore office of Saul Ewing, a national law firm with offices in 11 U.S. cities. He handles complex, high-stakes litigation primarily for companies facing crises or involved in transactions that will reshape their business. For more than 40 years, both private and public sector organizations have called upon him for guidance on critical legal, policy, and regulatory matters.

He has served on the UMCES Board of Visitors for the past six years and succeeds Ron Kreitner, who has generously served as Chair since 2009.

"In many ways, UMCES is the best kept secret in Maryland," said Monk. "I have come to understand and respect the scientific integrity and critical thinking on important environmental matters that UMCES brings to the people of Maryland. I very much look forward to helping to enhance UMCES' impact and visibility over the next three years."

An avid sailor, Charlie is devoted to improving the health of the Chesapeake Bay and ensuring that Maryland's environment is preserved for decades to come.



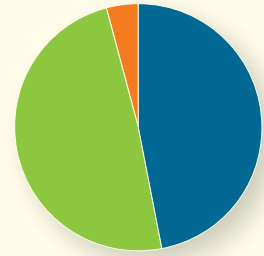
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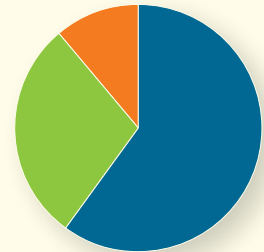
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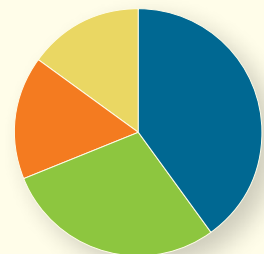
## Expenditures

- State Appropriation: 47%
  - Contracts and Grants: 49%
  - Other: 4%
- \$43.8 million**



## Research Awards

- Federal: 60%
  - State: 29%
  - Private: 11%
- \$23.3 million**



## Federal Awards by Agency

- National Oceanic and Atmospheric Administration: 40%
  - National Science Foundation: 29%
  - Environmental Protection Agency: 16%
  - Other: 15%
- \$14 million**

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UNMCES

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