



UNIVERSITY OF MARYLAND

CENTER FOR ENVIRONMENTAL SCIENCE



annual report 2009



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	ELI MOORE	RYAN WOODLAND			

Today, technological advancements are ubiquitous. From on-demand movies piped to our homes through fiber optic cables to smart phones perpetually at our side, technology makes the impossible possible and brings the far away near. And the environmental research field is no exception.

Environmental scientists are finding new ways to integrate these advancements into their research; taking advantage of this new set of tools that technology has forged. Not only have they helped us blaze new paths to a greater understanding of the natural world, they have also increased the productivity of our research enterprise.

At the University of Maryland Center for Environmental Science, our faculty's collective embrace of technology has elevated our work to a higher plain. Researchers can now feed billions of oyster larvae a balanced diet with a computer controlled automated algal production and feeding system, creating efficiencies that have contributed to record production of oyster spat destined for the Chesapeake Bay. Unmanned underwater gliders collect continuous current and water quality data as they "fly" preprogrammed courses along the mid-atlantic from New Jersey to Delaware, giving us new insights of the water masses and flows. And, the addition of the research vessel *Rachel*

*Carson* has improved our ability to track the pulse of the Bay through its state-of-the-art dynamic position system and smart scientific instruments.

While these recent advancements have helped propel the Center to new levels, the addition of the Baltimore-based Institute of Marine and Environmental Technology in 2010 will allow us to further expand our technology programs and capitalize on new, integrated research efforts. IMET will bring together the resources of UMCES,

University of Maryland, Baltimore County and University of Maryland, Baltimore to bring a new wealth of scientific collaboration to each of the partner institutions.

While technology has opened new doors to exploration and understanding, the drive and passion of UMCES scientists make these advancements possible. Locally, regionally and internationally, the Center's faculty has a well-earned reputation for developing sound

science to support environmental decision making. Now, by continuing to expand the reach of our environmental research programs through the integration of new technologies, UMCES will continue to set the pace of environmental research throughout Maryland, the region and the world.

Sincerely,  
*Dr. Donald F. Boesch, President*



University of Maryland  
CENTER FOR ENVIRONMENTAL SCIENCE

## 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.

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- Department of the Army
- Department of the Interior
- Department of the Navy
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Oceanic and Atmospheric Administration
- National Science Foundation

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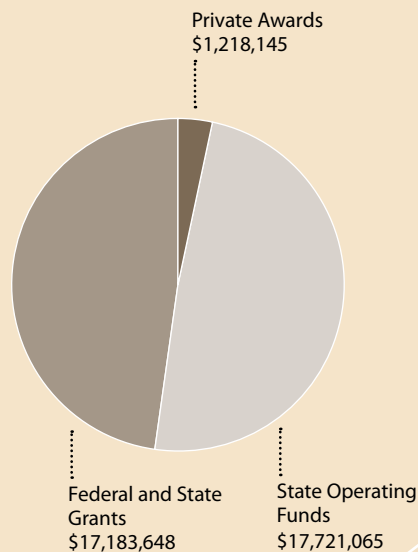
- Anne Arundel Department of Public Works
- Calvert County Board of Commissioners
- Dorchester Soil Conservation District
- Florida Department of Environmental Assessment
- Florida Fish and Wildlife Conservation Commission
- Maryland Department of Agriculture
- Maryland Department of the Environment
- Maryland Department of Natural Resources
- Maryland Department of Transportation
- Maryland Environmental Service
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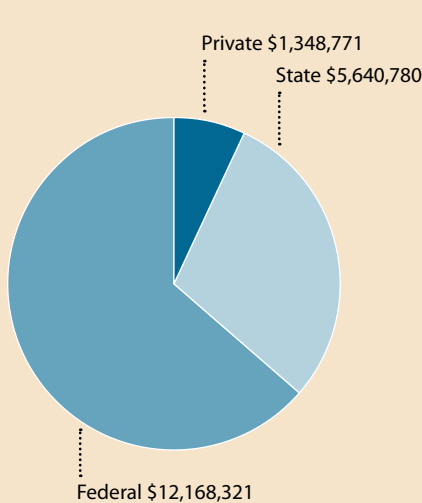
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- Shell Oil Corporation
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**2009 FINANCIALS**

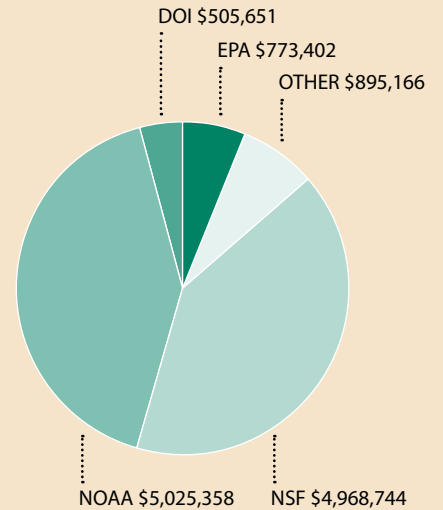
**EXPENDITURES**



**RESEARCH AWARDS**



**FEDERAL AWARDS BY AGENCY**





The University of Maryland Center for Environmental Science harnesses the power of science to transform the way society understands and manages the environment. By conducting cutting-edge research into today's most pressing environmental problems, the Center is developing new ideas to help guide our state, nation, and world toward a more environmentally sustainable future.

Comprised of the Appalachian Laboratory in the mountains of western Maryland, the Chesapeake Biological Laboratory at the mouth of the Patuxent River, the Horn Point Laboratory on the Eastern Shore, and the Maryland Sea Grant College located in College Park, the Center excels in bringing together interdisciplinary scientific studies in its pursuit of greater understanding about ecosystems and their natural processes.

Each laboratory is strategically focused on specific areas of research, education and scientific application, making the Center among the only institutions in the world to examine a large ecosystem—the Chesapeake Bay and its watershed—in its entirety.

As Maryland's premier research institution aimed at advancing scientific knowledge of the environment, UMCES is one of 13 institutions within the University System of Maryland. Providing professional research opportunities under the direct supervision of its leading faculty, UMCES annually supports more than one hundred exemplary graduate students through four collaborative programs—Marine Estuarine Environmental Sciences Graduate Program, Environmental Toxicology, Applied Ecology and Conservation Biology, and Wildlife/Fisheries Management.



UMCES researchers are respected the world over for their contributions to the global scientific community. These papers are sampled from more than 120 peer reviewed papers authored by the Center's scientists in 2009.



#### TRACKING GLOBAL COASTAL SEAGRASS LOSSES

In the first comprehensive global analysis of seagrass meadows, an international team of scientists warns that accelerating losses of seagrasses across the globe threaten the immediate health and long-term sustainability of coastal ecosystems. The team, which includes Drs. Tim Carruthers and Bill Dennison of the UMCES Integration and Application Network, found that 58 percent of the world's seagrass meadows are currently declining.

Researchers say the combination of growing urban centers, artificially hardened shorelines and declining natural resources has pushed coastal ecosystems out of balance. Globally, a seagrass meadow the size of a soccer field is lost every thirty minutes.

And that rate is accelerating: annual losses have grown from less than 1 percent before 1940 to 7 percent since 1990.

Based on more than 215 studies and 1,800 observations dating back to 1879, the assessment shows that seagrass meadows are disappearing at rates similar to coral reefs and tropical rainforests. Seagrass meadows serve as a key coastal habitat that is responsible for improving water quality as well as a refuge for juvenile fish and crabs.

Waycott, M., Duarte, C.M., Carruthers, T.J., Orth, R.J., Dennison, W.C., Olyarnik, S., Calladine, A., Fourqurean, J.W., Heck, K.L., Jr., Hughes, A.R., Kendrick, G.A., Kenworthy, W.J., Short, F.T., Williams, S.L. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. 2009. *Proceedings of the National Academy of Sciences*. 106:12377-81.



#### CHANGING PATTERNS IN ARCTIC RIVER BACTERIA

New research on bacterial communities in six large Arctic river ecosystems reveals predictable temporal patterns, suggesting that scientists could use these communities as markers for monitoring climate change in polar regions.

Using a DNA-fingerprinting technique, a team of researchers led by UMCES Horn Point Laboratory scientist Dr. Byron Crump has discovered that synchrony, seasonality and annual reassembly in planktonic bacterial communities occur on global scales. The team documented these patterns during a three-year, circumpolar study in the six largest rivers of the pan-arctic watershed.

Synchronous seasonal changes in communities across all six rivers indicate that hemisphere-scale variation in seasonal climate sets the pace of variation in microbial diversity. Moreover, these seasonal communities reassembled each year in all six rivers, suggesting a long-term, predictable succession in the composition of big river bacterial communities.

Divergence from this synchronous pattern may provide an early signal of climate change in some regions of the Arctic, and may result in changes to river microbial communities and their biogeochemical processes.

Crump, B.C., Peterson, B.J., Raymond, P.A., Amon, R.M., Rinehart, A., McClelland, J.W., Holmes, R.M. 2009. Circumpolar synchrony in big river bacterioplankton. *Proceedings of the National Academy of Sciences*. 106:21208-12.





### PROTECTING NEW ENGLAND FISHERIES FROM DECLINING STOCKS

A new analysis of federal fishery survey data raises concerns that weak enforcement combined with current economic hardship is leading to more widespread violations of fisheries regulations along the Northeastern coast. The extent of noncompliance threatens the success of new fisheries management measures put in place to protect and restore fish stocks.

Dr. Dennis King, an environmental economist at the UMCES Chesapeake Biological Laboratory, finds that the percent of total harvest taken illegally over the last two decades in the Northeast multispecies groundfish fishery (NEGF) has nearly doubled since

the 1980's and that the annual illegal harvest is now between 12 and 24 percent.

His work outlines how the existing enforcement system in the NEGF fishery does not significantly deter illegal fishing because economic gains from violating fishing regulations are nearly five times the economic value of expected penalties. The study finds that only one-third of violators are caught, and only one-third of those are actually prosecuted.

Dr. King recommends that a "smart compliance policy" be implemented which employs different types of enforcement strategies and penalties for frequent, occasional and possibly accidental violators. Specific recommendations include aggressive targeting of frequent violators and criminal penalties including the forfeiture of all fishing privileges for certain types of violations.

King, D.M., Sutinen, J.G. 2009. Rational noncompliance and the liquidation of Northeast groundfish resources. *Marine Policy*. 34:7-21.



### FORECASTING BIODIVERSITY LOSS FROM DEVELOPMENT

A new analysis of federal fishery survey data is raising concerns. While it's well understood that converting land from natural to urban or agricultural use degrades stream ecosystems and results in loss of biodiversity, graduate student Ryan Utz and his mentor Dr. Bob Hilderbrand from the UMCES Appalachian Laboratory have established thresholds for determining when specific types of development will likely have detrimental impacts.

By examining data collected throughout the State of Maryland, the researchers found both location and type of development play a role in degrading ecosystem health. As land is converted to urban use, about half the aquatic species are negatively impacted.

The team also found that negative impacts occurred at lower levels of urban development in upland areas, such as Maryland's Piedmont region, compared to the Coastal Plains of the Eastern Shore and Southern Maryland. This suggests that Piedmont aquatic biodiversity may be more vulnerable to urbanization.

The researchers expect that this new approach can be used to examine a variety of aquatic species and ecosystems for detecting stream stress and forecasting the loss of species as land cover changes.

Utz, R.M., Hilderbrand, R.H, Boward, D.M. 2009. Identifying regional differences in threshold responses of aquatic invertebrates to land cover gradients. *Ecological Indicators*. 9:556-567.

**UMCES TO LAUNCH INSTITUTE OF MARINE AND ENVIRONMENTAL TECHNOLOGY**

UMCES has expanded its environmental research mission into Baltimore’s Inner Harbor by establishing the Institute of Marine and Environmental Technology (IMET) in partnership with University of Maryland, Baltimore County and the University of Maryland, Baltimore. IMET aims to utilize the research, training and technology transfer capabilities of the partner institutions to conduct marine and environmental research and create technologies designed to foster the protection and restoration of coastal marine systems and their watersheds, through the sustainable use of their resources and improvement of human health. With six new faculty joining UMCES in February 2010, IMET will immediately expand the technological capabilities of the Center.

**GOVERNOR LEARNS ABOUT “TIPPING POINTS” ABOARD R/V RACHEL CARSON**

With the acceleration of Chesapeake Bay restoration efforts critical to the future of the nation’s largest estuary, Maryland Governor Martin O’Malley joined UMCES scientists aboard the research vessel *Rachel Carson* for a firsthand look at the health of the Bush River. The Center’s annual Chesapeake Bay Health Report Card provided insight into improving trends in some Bay tributaries, leading the Governor to ask why some rivers are beginning to improve while others continue to degrade. On board the *Rachel Carson*, researchers outlined current ecosystem conditions and provided insight into the additional steps, such as seagrass restoration, that could be taken to restore the Bay.



**RESEARCHERS RECEIVE PRESTIGIOUS INTERNATIONAL AWARDS**

Three UMCES researchers have been honored by the Coastal and Estuarine Research Federation (CERF) for their decades of scientific leadership.



Drs. Walter Boynton and Michael Kemp were honored with the Odum Lifetime Achievement Award, and Senior Faculty Research Assistant Carolyn Keefe received CERF’s Distinguished Service Award. The Odum Award is a fitting tribute for Drs. Boynton and Kemp, as the award honors both the excellent individual accomplishments and the combined contributions of these two scientists who have actively collaborated for over forty years.

**ASTRONAUT RICHARD ARNOLD KEYNOTES MEES COLLOQUIUM**



After his successful March 2009 mission to the International Space Station, NASA astronaut and UMCES Horn Point Laboratory alum Richard Arnold returned to talk to students and deliver the keynote address at the Marine Estuarine Environmental Science Graduate Program Colloquium. Born and raised in Maryland, Arnold earned his M.S. from the MEES program in 1992 under the guidance of Drs. Bill Dennison and Jeff Cornwell. Highlighting the event, Arnold presented the Center with an UMCES flag that travelled aboard Space Shuttle Discovery on his mission.

**SEA GRANT EXAMINES BALTIMORE HARBOR SEDIMENT QUALITY**

A new Sea Grant report reveals that sediments dredged from Baltimore Harbor shipping channels may be suitable for a number of innovative uses ranging from construction materials to non-agricultural soil amendments. Developed from a year-long review by an independent technical team, the report provides the Port of Baltimore, and citizen stakeholders with an objective approach



for handling and using sediments from the Harbor. *Sediment in Baltimore Harbor: Quality and Suitability for Innovative Reuse* is based on a review of available historical data and found that sediment taken from dredged channels is of sufficient quality for most of the innovative reuse options currently under consideration.

#### GATES HONORED WITH PRESIDENT'S AWARD FOR SCIENCE APPLICATION



UMCES Appalachian Laboratory researcher Dr. J. Edward Gates was honored with the President's Award for Science Application for his work detailing biodiversity throughout natural areas in western Maryland and the mid-Atlantic region. For more than three decades, Dr. Gates' research has provided regional leaders a solid scientific foundation for managing, conserving and protecting our natural areas. Gates' recent research has examined environmental issues throughout the region, including wildlife impacts at potential wind energy sites, the effects of cellular towers on birds and bats in the District of Columbia's Rock Creek Park, and how bats use western Maryland's abandoned mines as habitat.

#### HPL ENVIRONMENTAL INFORMATION CENTER FUNDED

Nearly \$2 million in federal investments have allowed UMCES to begin planning a new Environmental Information Center at the Horn Point Laboratory, replacing two buildings that burned down in 2007. The facility will be an important storage node of Chesapeake Bay data collected through research and monitoring programs supported by federal and state agencies, as well as from private non-profit groups. The management, storage and synthesis of these long-term data sets will provide researchers, students and the public better access to environmental information on Chesapeake Bay.

#### IAN REPORT CARD GIVES COASTAL BAYS ECOSYSTEM "C-PLUS"

Developed by UMCES Integration and Application Network (IAN) and the Maryland Coastal Bays Program, the inaugural Coastal Bays Report Card provided the first scientifically robust and geographically detailed assessment of the health of

this critical ecosystem. By combining multiple indicators of water quality and habitat health into a single score for six regions of the Coastal Bays, the analysis found distinct differences throughout the shallow bays behind Ocean City and Assateague, with southern regions such as Chincoteague Bay ranking higher than other regions.

#### HPL HATCHERY PRODUCES RECORD NUMBER OF OYSTER SPAT

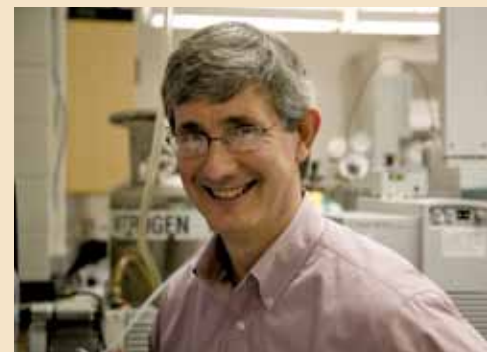
The Horn Point Laboratory oyster hatchery produced nearly 750 million oyster spat for Chesapeake Bay restoration in 2009, the most ever grown in one year at the facility. Record production levels and expanded partnerships with the Oyster Recovery Partnership and the Maryland Department of Natural Resources have fueled the growth of the State's oyster restoration programs, resulting in the revitalization of nearly 350 acres of oyster reefs, planted on 26 sites across the Bay and its rivers. The 2009 growing season eclipsed the previous record of nearly 600 million oyster spat set in 2008.

#### UMCES APPALACHIAN LABORATORY HONORS LOCAL ENVIRONMENTAL LEADER

The Appalachian Laboratory this year honored community leader Robert Miller of the George's Creek Watershed Association with the Richard A. Johnson Environmental Education Award. The award recognizes local citizens for their outstanding contributions to environmental education and was presented to Miller for introducing thousands of western Maryland's children and adults to the wonders of the natural world while encouraging them to take an active role in protecting the area's environmental future.

#### CBL SCIENTIST RECEIVES HIGHEST UNIVERSITY AWARD

For his pioneering research on the role of organic matter in the marine environment, researcher Dr. H. Rodger Harvey was awarded the University System of Maryland's highest honor, the Regents' Faculty Award for Excellence. Dr. Harvey's research focuses on identifying the sources and fate of organic carbon in the marine environment.



Using individual chemical structures to identify the source of the carbon—be it from marine life living in the upper ocean, terrestrial runoff carried by rivers, or other sources—and how it is transported and preserved, his research improves our understanding of the carbon cycle and its links to global climate change.

Earlier this year, the UMCES community—and the nation—lost a trusted friend and advisor who had spent a lifetime helping guide the way we communicate with one another. While many will remember **JODY POWELL** for his work as Press Secretary for President Jimmy Carter, the Center will always remember Jody as a passionate member of our Board of Visitors and friend of the UMCES Horn Point Laboratory.

Jody possessed a unique ability to bring together people from diverse back-grounds and unite them behind a greater ideal they could all support. As host, Jody, along with his wife Nan and longtime friends Frank and Nancy Moore, regularly welcomed UMCES

family and friends to their Eastern Shore farm, giving each attendee a special sense of warmth and camaraderie upon their arrival. As advisor, Jody helped the Center hone its communications efforts, making sure information about new scientific discoveries found its way to policymakers crafting environmentally-smart public policies.



In honoring a man who lived by words, finding the right words to describe Jody's generosity is difficult. Jody lived life to its fullest and made the lives around him richer. While we will miss his sage advice—always delivered with a plain-spoken sense of

greater wisdom—we will never forget the generosity in which it was given.

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### UMCES Center Administration

Post Office Box 775  
Cambridge, Maryland 21613  
410-228-9250  
410-228-3843 (fax)  
www.umces.edu

### Appalachian Laboratory

301 Braddock Road  
Frostburg, Maryland 21532  
301-689-7100  
301-689-7200 (fax)  
www.umces.edu/al

### Chesapeake Biological Laboratory

Post Office Box 38  
Solomons, Maryland 20688  
410-326-4281  
410-326-7302 (fax)  
www.umces.edu/cbl

### Horn Point Laboratory

Post Office Box 775  
Cambridge, Maryland 21613  
410-228-8200  
410-221-8490 (fax)  
www.umces.edu/hpl

### Institute of Marine and Environmental Technology

Columbus Center  
701 East Pratt Street  
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4321 Hartwick Road, Suite 300  
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CENTER FOR ENVIRONMENTAL SCIENCE

Globally eminent and locally relevant, the University of Maryland Center for Environmental Science is the University System of Maryland's premier environmental research institution.