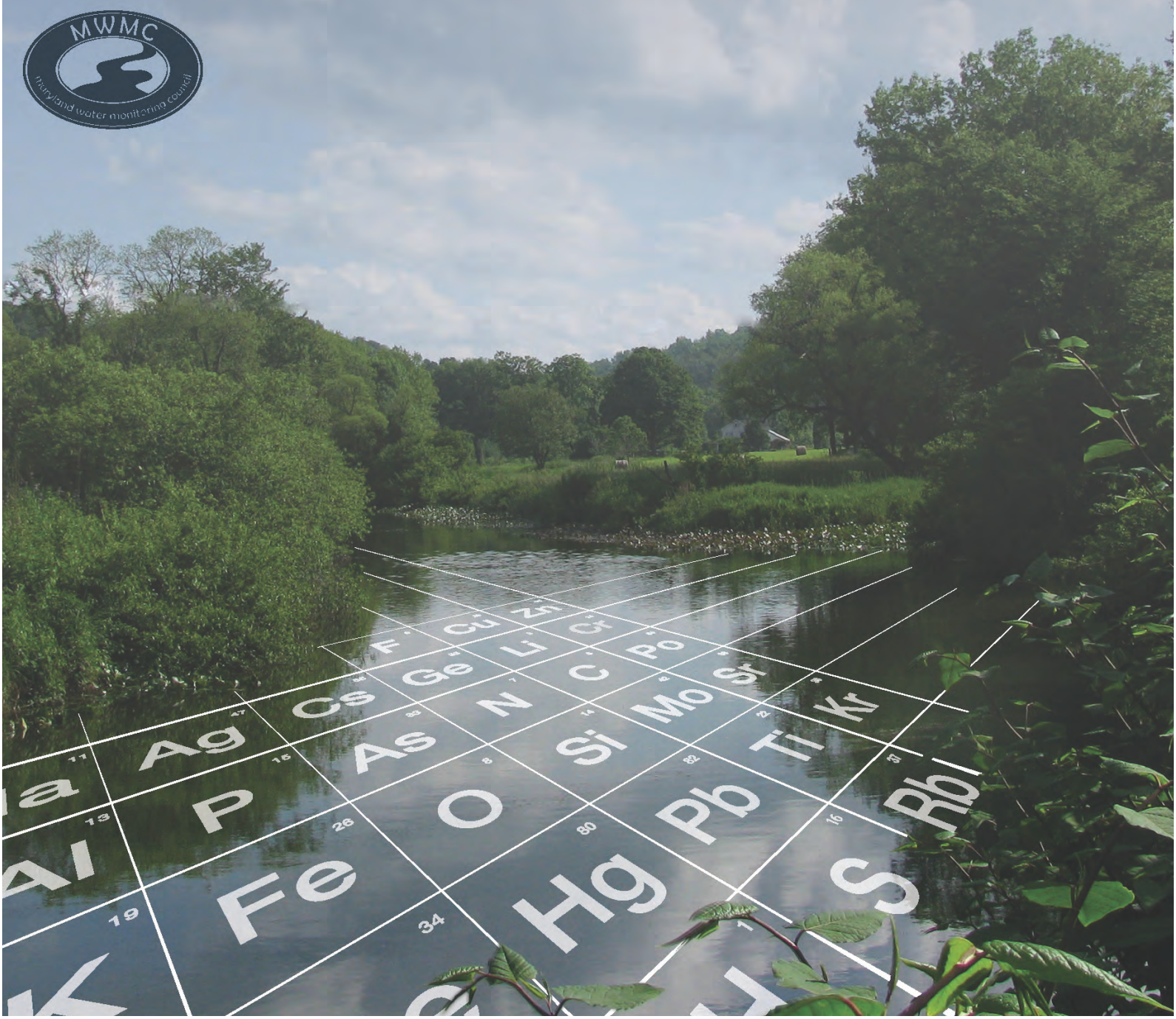
Maryland Water Monitoring Council

What Else is in Your Water?
From Arsenic to Zinc

18th Annual Conference
December 6, 2012
Maritime Institute
North Linthicum, MD



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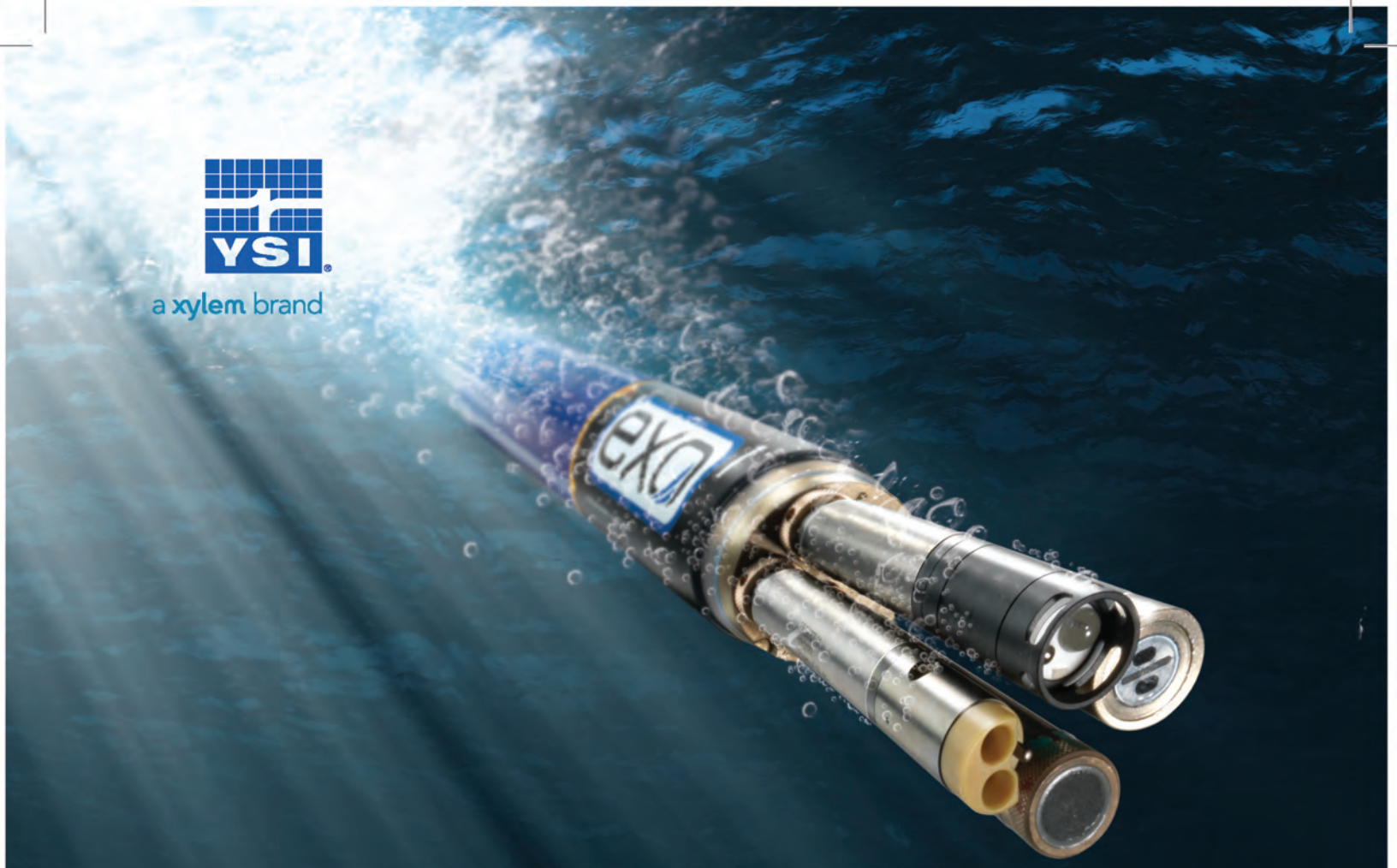

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MARYLAND WATER MONITORING COUNCIL

18th Annual Conference

December 6, 2012

Welcome to the 18th Annual Conference of the Maryland Water Monitoring Council

Last year the annual conference focused on the Chesapeake Bay TMDL and the need to reduce nutrient and sediment loads. This year we focus on

What Else Is in Your Water? From Arsenic to Zinc

For 17 years, the MWMC annual conference has attempted to capture the latest issues and move water monitoring to the forefront in resolving them. Even so, we have not been able to address all water quality issues of importance in Maryland. Today we give equal time to those overlooked contaminants and stressors, especially those that affect our health. We hope that the attendees today will find themselves talking about new water quality topics and how water monitoring can be part of the solution.

What You Will Hear

We are fortunate this year to have two plenary speakers who can speak directly to these issues:

- **Dr. Cliff Mitchell**, Director of Environmental Health Coordination and Preventive Medicine/Public Health Residency Programs, Maryland Department of Health and Mental Hygiene, will provide the state perspective
- **Bob Perciasepe**, Maryland's own and now Deputy Administrator, U.S. Environmental Protection Agency, will provide the federal perspective

Our 16 current sessions and 32 posters will expand on the "What Else Is in Your Water" theme with following invited and contributed presentations:

- Sessions on bacteria, mercury, road salt, harmful algal blooms, and Bay contaminants
- Sessions on historical stressors like land use and emerging stressors like Marcellus Shale gas hydrofracking
- Sessions on headwater streams, groundwater, and fish tumors
- Sessions on citizen efforts, prevention strategies, and environmental information
- Poster topics ranging from Acidification to Zinc with bacteria, fish passage, microplastics, stormwater, and new technologies in between

Continuing this year, we will be awarding the **Carl Weber Award** as a way to recognize the extraordinary contributions that Dr. Carl Weber made to the field of water monitoring. The Council presents this award in Carl's name as a lasting reminder of the affection and respect that we hold for Carl and his work, and to inspire others to emulate his passion, dedication, and good humor. Additional information on Carl and his contributions to water monitoring in Maryland can be found elsewhere in this program and on the MWMC's website.

What You Can Do

Finally, the MWMC is only as successful as the sum of the individuals who participate in Council activities. The MWMC continues today as an effective statewide collaborative body because of the many contributed hours that individuals and organizations have donated to furthering the Council's goal of serving as a vehicle for the effective collection, interpretation, and dissemination of environmental data related to issues, policies, and resource management objectives involving water monitoring. We encourage you to strengthen the MWMC by getting involved, communicating your needs to us, and using the Council to enhance your water monitoring programs, resource management, and environmental stewardship initiatives.

What does it take to be a member of the MWMC? It takes only a willingness to collaborate with others outside of your organization. As a member of the Maryland water monitoring/management community you can set the agenda for the Council's activities. Talk with a MWMC member at today's conference at the MWMC table or in the halls and find out how the Council can help you help enhance water monitoring through the Council. To learn more about the MWMC, go to **www.marylandwatermonitoring.org**.

The Annual Conference is a "green" conference. The Maritime Institute has partnered with us to provide on-site recycling, motion-activated lighting in the hallways, and washable tableware for our breaks.

Let's make this a great conference.

Mark Southerland
Chair, Maryland Water Monitoring Council

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Program design - Katherine Hanna
Cover design - Luke Roberson

The Carl S. Weber Award

For Vision and Leadership in Monitoring Maryland's Waters

Our vision for monitoring in Maryland…

The MWMC envisions a time when monitoring methods, programs, projects, and data are the product of collaboration and comparability among agencies and organizations. The resulting information will be accessible for use by all stakeholders and will facilitate sound decision-making in environmental management and protection.

Dr. Carl S. Weber. Among many other things, Carl was one of the founding Board members serving a term on the MWMC Board in the mid-1990s representing the academic community. Today we honor Carl's life and work and celebrate the qualities that made him such an important part of the Maryland monitoring community with the annual presentation of the Carl S. Weber Award. Beginning in 2007, the Award has been presented annually to an individual involved in water monitoring in Maryland who exhibits the spirit, vision and leadership so exemplified by Carl. One person can make a difference!

Carl was a founding member of the University of Maryland-Baltimore County (UMBC) Biological Sciences Department and taught there for nearly 40 years. Although his training was in biochemistry, he developed an interest in stream ecology in the 1980s and became a self taught aquatic biologist, eventually creating and teaching extremely popular courses on stream and river ecology at UMBC. Carl used Herbert Run, a Patapsco tributary that flows through UMBC, as a living classroom for his students that spurred research and restoration activities on the stream. In 2002, Carl won the UMBC 2002 Alumni Association Award for Mentoring. Many of the students Carl taught and mentored went on to internships and careers in the environmental protection field. Carl was instrumental in bringing the National Science Foundation's Long-Term Ecological Research Network to UMBC through the Baltimore Ecosystem Study. He also served as the first chair of the Patapsco Tributary Team.

Carl's entry into the monitoring world began when he got involved with the Friends of Gwynns Falls/Leakin Park in his home watershed. In 1989, he took on an amazing volunteer task—leading a unique and innovative new project for Maryland Save Our Streams and Baltimore County. "Project Heartbeat" was the first program in the United States to train volunteers to collect and analyze benthic macroinvertebrates and to assess physical habitat using EPA's 1989 Rapid Bioassessment Protocol. Carl jumped right in and became involved in every aspect of the program. Over a 10 year period, thousands of volunteers were trained to collect benthic samples and identify them to the taxonomic family level in a controlled lab setting. Through Carl, UMBC provided lab space and equipment, and for several years, Carl taught and supervised all the lab volunteers to ID 200-300 samples a year. He chaired both the community steering committee and the technical advisory committee, building a bridge among volunteers, watershed organizations, academia, the County, the State, EPA, and other stakeholders—all represented on these committees.

For years, Carl performed all the lab quality control and data analysis for Heartbeat. He co-authored Project Heartbeat's Quality Assurance Project Plan, the first of its kind for a volunteer biological monitoring program. In the 1990s, Project Heartbeat had a profound impact on volunteer water monitoring, environmental education, and watershed collaboration— not only in Maryland, but across the country. Because of this program, Baltimore County has a quality baseline data set on the health of its streams spanning more than 10 years. Project Heartbeat maintained a high level of scientific credibility and the program contributed to advances made in stream assessment and analysis methods within the Maryland Department of Natural Resources and the Maryland Department of Environment. Certainly the road to DNR's "Streamwaders" program was paved, in part, by Project Heartbeat's success. No one person is more responsible for any of these accomplishments than Carl Weber.

Through this award, we celebrate Carl's life and work by acknowledging others who share his generous spirit, his commitment to Maryland's waters, his vision for collaboration, and his leadership in advancing monitoring and assessment.

Previous Winners

2011 - Bill Stack
2010 - Sally G. Horner
2009 - Peter Bergstrom
2008 - Ron Klauda
2007 - Susan "Abby" Markowitz and Dr. Paul Massicot

2012 Carl Weber Award Nominees

Bonnie Bick
- Mattawoman Watershed Society - Co-founder
- Chapman Forest Foundation - President
- Smarter Growth Alliance for Charles County - Founding member
- Campaign to Reinvest in the Heart of Oxon Hill - Co-founder

Charlie Conklin
- Alliance for the Chesapeake Bay - Former Chair
- Gunpowder Valley Conservancy - Former Chair
- Upper Western Shore Tributary Strategies Team - Former Chair
- RestoreCorps - Former Head

Paul Kazyak
- Maryland Biological Stream Survey - Former Leader
- Maryland Trust Fund Restoration - Leader
- EPA's Highland Action Program - Former Maryland Liaison

2012 Annual Conference Planning Committee

Dan Boward	Maryland Department of Natural Resources (Chair)
Kevin Brittingham	Baltimore County Department of Environmental Protection and Sustainability
Clark Howells	Baltimore City Department of Public Works
Ron Klauda	Maryland Department of Natural Resources
Tom Parham	Maryland Department of Natural Resources
Mike Pieper	KCI Technologies, Inc.
Charlie Poukish	Maryland Department of the Environment
Matt Stover	Maryland Department of the Environment

Plus additional thanks to:

Katherine Hanna	Maryland Department of Natural Resources (MWMC Co-Web Master and Graphics Support)
Luke Roberson	Maryland Department of Natural Resources (MWMC Co-Web Master and Graphics Support)
Charlie Poukish	Maryland Department of the Environment (Vendor Coordinator)
Joanne Alewine and Donna Klein	Maryland Department of Natural Resources (Conference preparation and registration table)

Milestones and Memorials by the Numbers: 30, 40, 92, and 95

By Ron Klauda

As 2012 slips away, four events of relevance to water monitoring and environmental protection are worth noting (no, I won't be talking about Hurricane Sandy---too much about 'her' already).

40: On October 18, 1972, 40 years ago, Congress enacted the Clean Water Act. The CWA is the primary federal law governing water pollution (with the exception of groundwater contamination dealt with elsewhere). The 1972 CWA was a significant expansion of the Federal Water Pollution Control Amendments of 1948, the first major U.S. law to address water pollution. The objective of the CWA is to restore the chemical, physical, and biological integrity of the Nation's waters. The CWA introduced the National Pollutant Discharge Elimination System (NPDES). From the 1972 CWA also flowed water quality standards and criteria, designated uses, a three-tiered anti-degradation policy, section 301 permits, section 303(d) lists of impaired waters, TMDLs, section 305(b) reports, section 404 permits, and more---topics that most if not all of us here today deal with regularly, or at least often.

50: *Silent Spring*, the book written by Rachel Carson that was published on September 27, 1962—50 years ago—is widely credited with helping to launch the environmental movement. At the suggestion of her literary agent, Carson agreed to *Silent Spring* as the title for her controversial (at the time) but very important book. Carson viewed this title as a metaphor for the entire book, suggesting a bleak future for the whole natural world, rather than the title for one of her book's chapters about the absence of bird song. Carson's main argument in *Silent Spring* is that pesticides are more properly termed "biocides", because their effects are rarely limited to the target pests. About the book, Carson scholar H. Patricia Hynes said, "*Silent Spring* altered the balance of power in the world. No one since would be able to sell pollution as the necessary underside of progress so easily or uncritically." Rachel Carson was born on May 27, 1907, in Springdale, Pennsylvania. In 1932, she received a M.A. degree in Zoology from Johns Hopkins University. Carson has been called the mother of the modern environmental movement, and once said, "It is a wholesome and necessary thing for us to turn again to the earth and in the contemplation of her beauties to know the sense of wonder and humility." After a career with the U.S. Bureau of Fisheries and the U.S. Fish and Wildlife Service, Rachel Carson died on April 14, 1964, at her home in Silver Spring, Maryland, at age 56. An elementary school in Gaithersburg is named in her honor. A 50th Anniversary Edition of *Silent Spring* is available now and contains an after word by E.O. Wilson.

92: Russell Train, an important conservationist, Republican lawyer, former tax court judge, and EPA Administrator under Presidents Nixon and Ford, who also played a vital role in launching the Chesapeake Bay restoration efforts, died on September 17, 2012, at age 92. During his tenure with the Ford administration, Train helped create such landmark environmental laws as the Endangered Species Act and the Clean Air Act. Train is widely considered to be the father of the National Environmental Policy Act (NEPA) of 1969, the cornerstone of all modern federal environmental legislation. He had an entrepreneur's instinct for non-profit success, marked by his leadership and influence with the Conservation Foundation and the World Wildlife Fund. Train joined with Ian McHarg, a professor of landscape ecology at the University of Pennsylvania, to produce *Design with Nature*, seminal 1969 book that incorporated the principles of ecology into landscape construction. In announcing the start of the state-federal Chesapeake Bay Program Partnership in 1983, Train referred to the Bay as "a very troubled estuary" and warned that without action "the Bay would be in very bad trouble in a few years." Karl Blankenship wrote in the October 2012 issue of the Bay Journal, that Russell Train's passion for the environment was an influence at "a time when bipartisan majorities in Washington could still come together to address environmental problems. It seems very long ago, now."

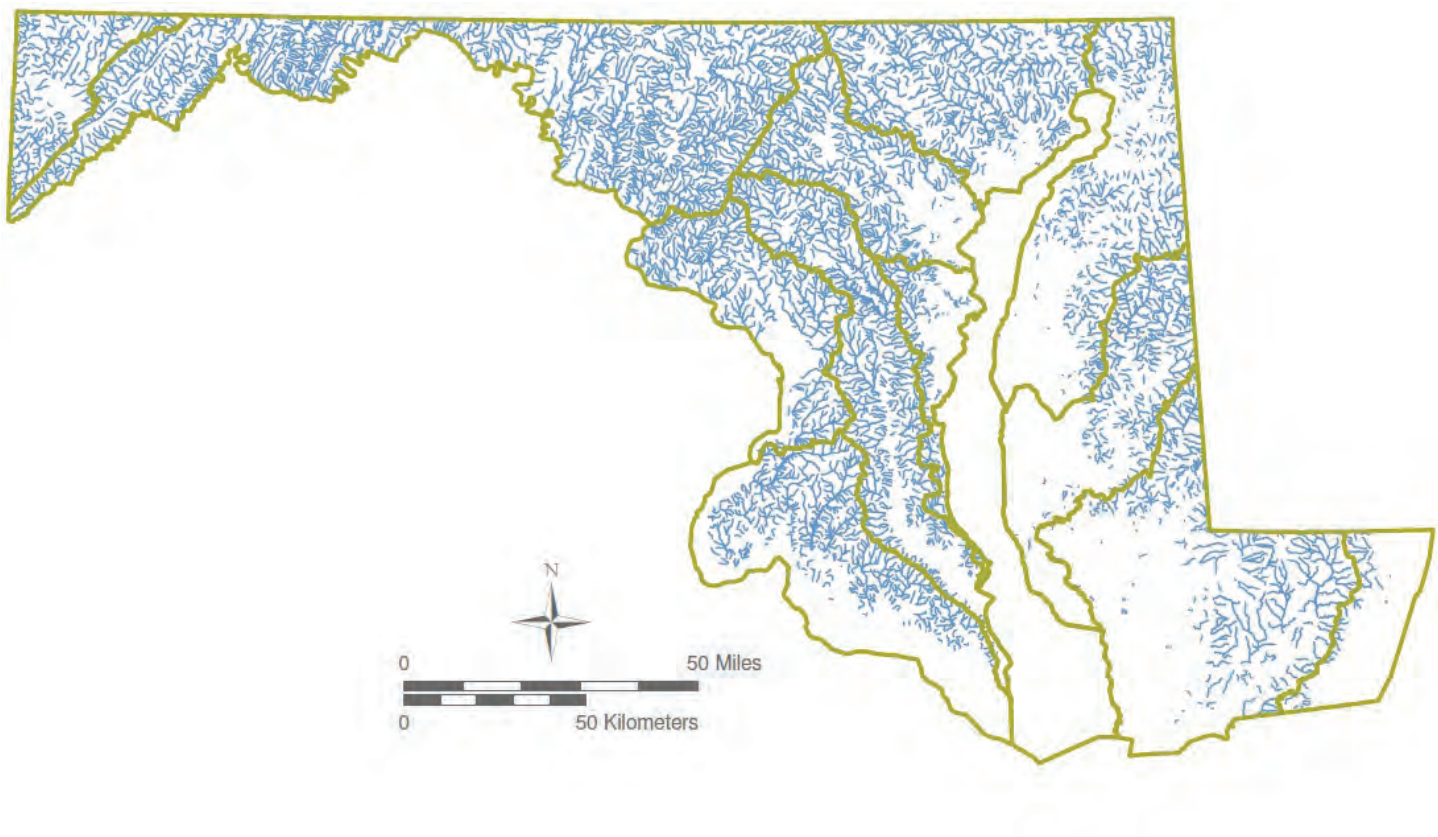
95: Less than two weeks after one 'giant' in the environmental world passed (Russell Train), Barry Commoner died in New York City. He was 95. Commoner was a scientist (biology) and teacher who wasn't afraid to make some noise. His ability to explain complex ecological crises and advocate radical solutions made him a pillar of the environmental movement in the late 1960s and 1970s. Described in 1970, the year of the first Earth Day, by Time magazine as the "Paul Revere of ecology", Commoner followed Rachel Carson as America's most prominent environmentalist. He viewed the environmental crisis as a symptom of a fundamentally flawed economic and social system. Commoner argued that corporate greed, misguided government priorities, and the misuse of technology accounted for the undermining of "the finely sculpted fit between life and its surroundings."

He connected the environmental crisis to the problems of poverty, injustice, racism, public health, national security, and war. Commoner's "big picture" perspectives were described in his 1971 book *The Closing Circle*, in what he called the "four laws of ecology", that were catchy enough back then to show up on T-shirts:

1. Everything is connected to everything else.
2. Everything must go somewhere.
3. Nature knows best.
4. There is no such thing as a free lunch.

This book also helped introduce the idea of sustainability. Commoner was headstrong but humorous. When Ralph Nader called him in 2007 to wish him a happy 90th birthday, Commoner replied, "It happens." That same year, in an interview with the New York Times, Commoner remained the relentless radical: "I think that most of the 'greening' that we see so much of now has failed to look back on arguments such as my own---that action has to be taken on what's produced and how it's produced. That's unfortunate, but I'm an eternal optimist, and I think eventually people will come around." About Commoner, Stephen Jay Gould, the noted Harvard paleontologist and evolutionary biologist, said, "Although he has been branded by many as a maverick, I regard him as right and compassionate on nearly every major issue."

On the 'shoulders' of these (and other) significant people and laws, we all stand.



MARYLAND WATER MONITORING COUNCIL
18th Annual Conference Agenda
Thursday, December 6, 2012

WHAT ELSE IS IN YOUR WATER? FROM ARSENIC TO ZINC

7:30 Registration/Poster Set-up/Continental Breakfast

Morning Plenary Session (8:30-10:00) in the Auditorium

8:30 Chairman's Call to Order – Mark Southerland; Chairman, MWMC Board of Directors

8:40 Dr. Cliff Mitchell - Maryland Department of Health and Mental Hygeine - WHERE DO WE GO FROM HERE: WATER QUALITY MONITORING, PUBLIC HEALTH, AND THE ERA OF CONSTRAINTS

9:15 Bob Perciasepe – US Environmental Protection Agency – THE CLEAN WATER ACT TURNS 40: THE PROGRESS WE'VE MADE AND THE PATH FOR THE FUTURE

9:45 Carl S. Weber Award – Mark Southerland and Cathy Weber

10:00 Break/Poster Session – Authors present

10:30 – 12:00 Concurrent Session 1

A-111/113	Bridge Room	Classroom 2	Auditorium	A-307	A-304
Bacteria: Forecasting, Source Tracking, and Oyster Stew - Matt Stover (MDE) Billy Evans (MDE) - *Tidal Dispersion Dynamics of Receiving Waters from a Storm Water Discharge Pipe and Its Potential Influence on Water Quality at Betterton Beach, Kent County, Maryland* John Jacobs (NOAA) - *Modeling and Forecasting the Distribution of Vibrio spp. in Chesapeake Bay* Bob Jonas (G. Mason U.) and Leila Hamdan (US Naval RL) - *Bacterial Soup for the Chesapeake Or Is It Oyster Stew?*	**Don't Cut Off the Headwaters to Spite the Watershed - Doug Redmond (M-NCCPC)** Doug Redmond (M-NCCPC) - *Headwater Streams: Why Should We Care?* Matt Fitzpatrick (U. of MD) - *Mapping the Distribution of Stream Biodiversity in Maryland* Mark Southerland (Versar) - *Headwater Biota as Indicators of Stormwater Solutions*	**Treat This, Measure That: Controlling and Monitoring Pollution Sources - Mike Peiper (KCI)** David Gleason (U. of MD) - *Effective Stormwater Treatment Using Recycled Material Media* Alex Haptemariam (Greenhorne and O'Mara) - *Indian Creek Daylighting and CSO Abatement* Allison O'Hanlon (MDE) - *Watershed-based Monitoring Network Design for Chloride and Sulfate in the Patapsco Lower North Branch*	**Chesapeake Bay Contaminants - Charlie Poukish (MDE)** Greg Allen (EPA) and Scott Phillips (USGS) - *Toxic Contaminants in Chesapeake Bay and its Watershed* Vicki Blazer (USGS) - *Endocrine Disruption and Fish Health in Chesapeake Bay Tributaries* Luke Iwanowicz (USGS) - *Application of In Vitro and In Vivo Assays to Identify Waters Impacted by Endocrine Active Chemicals*	**Recognizing Stressed-Out Streams- Sue Veith (St. Mary's Co.)** Diana Muller (South River Federation) - *How Low Can It Go? The Story of Dissolved Oxygen in the face of Environmental Vulnerability in Small Tribs of the Chesapeake Bay* Kevin Coyne (WV DEP) - *Determining How Much Algae is too Much Algae in West Virginia Streams* Farah Abi-Akar (MDE) - *Biological Stressor Identification Process: Addressing Maryland's Non-tidal Biological Impairments*	**Citizens Unite to Improve and Protect our Waters - Sonja Schmitz (CCBC)** Paul Hlavinka (Muddy Br. Alliance) and Leah Miller (IWLA) - *Engaging Citizens in Water Quality* Rich Maranto (Friends of Fred. Co.) - *Want Clean Streams? There's An App For That!* Bonnie Bick and Jim Long (Mattawoman Watershed Assn.) - *Citizen Ichthyoplankton Surveys of Mattawoman Creek: Watching Land-use Impacts in "Real Time"*

12:00 – 1:30 Lunch

1:30 -- 3:00 Concurrent Session 2

A-111/113	Bridge Room	Classroom 2	Auditorium	A-307	A-304
Rubbing Salt in the Wound - Kevin Brittingham (Balto. Co. DEPS) Joel Snodgrass (Towson U.) - *Road Deicers: From the Road to the Chesapeake Bay* Russ Yurek (SHA) - *Maryland Statewide Salt Management Plan, Best Practices for Snow and Ice Control* Kevin Koepenick (Balto. Co. DEPS) - *Observed Impacts of Chlorides in Baltimore County*	**An Ounce of Prevention: Keeping our Watersheds Healthy - Christine Conn (MDNR)** Christine Conn (MDNR) - *GreenPrint: Conserving Healthy Watersheds* Margaret McGinty (MDNR) - *Developing Management Strategies to Conserve High Priority Fisheries Habitat* Tony Redman (MDNR) - *Mattawoman Watershed Ecosytem Management Plan*	**Fish Tumors as an Environmental Indicator for the Chesapeake Bay - Tom Parham (MDNR)** Fred Pinkney (USFWS) - *Liver and Skin Tumors in Brown Bullheads in Chesapeake Bay Tributaries: 1992 through 2011* Wolfgang Vogelbein (VIMS) - *Chemical Exposure and Cancer in the Mummichog: Using Histopathology and Sediment Chemistry to Measure Remediation Success* Geoffrey Smith (PA Fish and Boat Comm.) - *Wide-scale Mortality of Young-Of-Year Smallmouth Bass Micropterus dolomieu in the Susquehanna River Basin, Pennsylvania*	**Marcellus Shale, Natural Gas, Water Quality, and People - Ron Klauda and Paul Kazyak (MDNR)** Patrick Hammond (MDE) - *Is Methane in Drinking Water Wells Due to Hydraulic Fracturing of the Marcellus Shale?* Minh Phung T. Pham (MGS) - *Well Water Methane Study in Maryland Appalachian Plateau* Diane McLaughlin (PSU) - *Social and Economic Impacts of Marcellus Shale Development in Pennsylvania: Lessons Learned from Early Studies*	**Land Use Change and Water Quality - Andy Becker (MDNR)** Peter Claggett (USGS) - *Population Growth, Land Use Change, and Water Quality in the Chesapeake Bay Watershed* Quentin Stubbs (USGS) - *Methods for Estimating the Impact of Impervious Surfaces on Streamflow in the Chesapeake Bay Watershed* Scott Stranko (MDNR) - *Brook Trout Declines with Land Cover and Temperature Changes in Maryland*	**Mercury: It's Not Just for Breakfast Anymore - John Sherwell (MDNR)** Tim Rule (MDE) - *Mercury TMDLs: Integrating Science, Monitoring and Regulation* Cindy Gilmour (SERC) - *Watershed Monitoring for Hg and MeHg at the Smithsonian Environmental Research Center* Andrew Heyes (CBL) - *A Young-Of-the-Year (YOY) Predatory Fish Study to Assess Trends in Atmospheric Hg Deposition in Maryland*

3:00 – 3:30 Break/Poster Session – Authors present

3:30 -- 4:30 Concurrent Session 3

A-111/113	Bridge Room	Classroom 2	Auditorium		
New Public Access Tools for Toxics and Other Environmental Information - Wayne Davis (EPA) Carey Johnston (EPA) - *Better Public Access to Point Source Wastewater Pollutant Discharge Information* Charles Kovatch (EPA) - *What's New in Water Tools*	**Harmful Algal Blooms - Charlie Poukish (MDE)** Chris Luckett (MDE) - *Algae Blooms and their Association with Fish Kills in Maryland Waters* Cathy Wazniak (MDNR) - *Protecting Human Health Through Monitoring of Algal Toxins in Maryland*	**Outreach and Education for Better Water Quality - Tom Parham (MDNR)** Lindsay Hollister (Jug Bay) - *Comparative Stream Study and Landowner Outreach in Three Small Adjacent Coastal Plain Watersheds* Jonathan Kellogg (UMCES/EcoCheck) - *Across Tributaries, Citizen Scientists Report on Frequency, and Abundance, of Potentially Harmful Bacteria*	**Groundwater - Dave Bolton (MGS)** Jeff Raffensperger (USGS) - *Geochemistry and Age-Dating of Groundwater in the Upper Patapsco Aquifer, Maryland Coastal Plain* Dave Drummond (MGS) – *Arsenic Distribution and Occurrence in Groundwater from Coastal Plain Aquifers in Maryland*		

4:30 Adjourn - SOCIAL IN THE LOUNGE

Posters

Note: Only Primary Authors are Listed

Conditions in the Patapsco River Following Removal of Simkins and Union Dams: Are They Suitable for Reintroduction of Eastern Elliptio?
Matt Ashton (Maryland DNR)

Surface Mining Impacts at the Gene Level
Kaylene Charles (USGS)

Rognel Heights Storm Water Outfall Water Year 2011
Dan Dillon (Cary Institute of Ecosystem Studies)

Updates to the U.S. Geological Survey StreamStats Web Application for Maryland
Ed Doheny (USGS)

TMDL Compliance Planning at the Maryland Port Administration
Bill Frost (KCI Technologies, Inc.)

Analysis of Private Well Water Quality and Well Owner Education Program in Maryland: A Pilot Project
Rachel Goldstein (University of Maryland)

Preventing Point Source Pollution in an Urban MS4: Status of the Cecil County Illicit Discharge Detection and Elimination Program
Elizabeth Gomez (EA Engineering, Science and Technology)

Chesapeake Bay FieldScope
Allison Gramolini (National Geographic Society)

Rare, Threatened, and Endangered Odonate Fauna of Two Watersheds in the Lower Potomac River Drainage, Maryland
Patrick Graves (Maryland DNR)

Urban Stressors for Pesticide Endangered Species Assessments: Should Recent Nutrient TMDLs and Laws be Considered?
Sandra Haefner (Environmental & Turf Services, Inc.)

Forest Harvesting Best Management Practices in Maryland
Anne Hairston-Strang (Maryland DNR)

Patapsco River Dam Removal Study: Assessing Changes in American Eel Distribution and Abundance
William Harbold (Maryland DNR)

Suspended Sediment Export from Parkers Creek Watershed; a Heavily Forested Area with a Tidally Influenced Creek
Lora Harris (Chesapeake Biological Laboratory)

What is in Stormwater Runoff? Results from 500 Storms
Tom Jones (Versar, Inc.)

Continuous Conductivity Monitoring in Maryland
Michael Kashiwagi (Maryland DNR)

Responses of Stream Fish Assemblages to the Removal of Simkins Dam in the Patapsco River, Maryland
Jay Kilian (Maryland DNR)

Zinc in Drinking Water: the Connection to Learned Fear
Gretchen Knaack (George Mason University)

Factors Influencing Blooms of *Sphaerotilus natans* in the Lower Jones Falls
Robert Levery (Univ. of Baltimore) - STUDENT POSTER

Monitoring Acidification and Carbonate Chemistry Dynamics in Chesapeake Bay and Other Coastal Ecosystems
A. Whitman Miller (SERC)

Using DNA Barcoding to Identify Hydropsyche Species in the Patapsco Lower North Branch Watershed
Damaris Ngantche (Comm. College Baltimore Co.) - STUDENT POSTER

Quantifying Microplastics in the Chesapeake Bay
Ana Perez Reyes (University of Maryland College Park) - STUDENT POSTER

Using Benthic Macroinvertebrates for the Identification and Conservation of Coldwater Lotic Habitats in Maryland
Tony Prochaska (Maryland DNR)

Utilization of New Technology with the Maryland Biological Stream Survey
Luke Roberson (Maryland DNR)

Evaluation of Groundwater Nitrate Levels at a Conservation-Managed Coastal Plain Farm in the Choptank River Watershed, Talbot County, MD
Timothy Rosen (Midshore Riverkeeper Conservancy)

Seasonal Changes of In-stream Nutrient Removal in St. Mary's Run
Shelby Servais (Mount Saint Mary's University) - STUDENT POSTER

A Powerful New Tool for Visualizing Water and Habitat Quality Data
Brian R. Smith (Maryland DNR)

An Overview of Ecological Monitoring Associated With Patapsco Dam Removal
Scott Stranko (Maryland DNR)

Regenerative Stream Conveyance (RSC) as an Approach to Restoration of Ecosystem Services
Doug Streaker (Biohabitats, Inc.)

Fish Passage Program & Patapsco River Restoration
Jim Thompson (Maryland DNR)

Technologies Used to Conduct a Spatially Intensive Survey of Stream Temperature
Charles Walker (USGS)

Nanticoke River 2011 Report Card: Community Outreach
Beth Wasden (Nanticoke Watershed Alliance)

Maryland Stream Waders: Get Out, Get Wet, Get Involved!
Sara Weglein (Maryland DNR)

MARYLAND WATER MONITORING COUNCIL

18th Annual Conference

December 6, 2012

SPEAKER ABSTRACTS

(Listed alphabetically by lead speaker's last name)

Biological Stressor Identification Process: Addressing Maryland's Non-tidal Biological Impairments

Farah Abi-Akar
Maryland Department of the Environment
fabi-akar@mde.state.md.us

Coauthor: Lee Currey

The condition of biological communities in Maryland waters is not only an important indicator of water quality, but also a driver of water quality regulation. Aquatic biology can dictate watersheds' impairment listings, which in turn can trigger a requirement to create Total Maximum Daily Loads (TMDLs) for impaired watersheds. TMDLs serve the unique and important role of improving instream water quality by affecting both point and non-point sources. Since each TMDL addresses one pollutant or stressor, the question arises: Which TMDL(s) should be created to restore biological conditions? Or, which stressors, if any, are the ones impacting biology? To quantitatively parse out cause and effect, the Maryland Department of Environment (MDE) uses case-vs.-control statistics to systematically compare potential stressors to biological integrity. This process, the Biological Stressor Identification (BSID), singles out possible stressor(s) in each watershed, thus directing the choice of TMDL development and serving as the first step in improving biological integrity. Using Round 3 data from the Department of Natural Resource's Maryland Biological Stream Survey, MDE is in the final stages of updating the BSID from its last run on Round 2 data. Combining both sampling rounds make the results more robust. Categories of potential stressors include sediment, water chemistry, and habitat characteristics, as well as an analysis on land use. This presentation reviews the BSID process and highlights results from the most recent analysis.

Farah is a Natural Resource Planner for the Maryland Department of the Environment in Baltimore. Her main focus is Biological Stressor Identification data analysis within the Total Maximum Daily Load Development Program. She holds a dual Masters from Indiana University at Bloomington in Environmental Science and Public Affairs, focusing in chemistry, toxicology, and risk assessment as well as environmental and natural resource policy. She completed her B.S. at the University of Illinois at Urbana-Champaign.

Toxic Contaminants in Chesapeake Bay and its Watershed

Greg Allen and Scott Phillips
EPA/USGS
allen.greg@epa.gov

Coauthors: Mike Focazio, Jamie Mitchell, Fred Pinkney

Toxic contaminants have adverse effects on fish and wildlife in portions of the Chesapeake Bay and its watershed. In 2010, the President's Chesapeake Bay Executive Order (EO 13508) Strategy directed Federal agencies to prepare a report summarizing information on the extent and severity of toxic contamination in the Bay and its watershed. The report relied on available information from State integrated water-quality assessment reports (which listed impairments to aquatic life due to toxic contaminants), reports of Federal and State-supported studies, and results of investigations in scientific journals to assess the state of the knowledge about toxic contaminants. Findings from this report will be used by the CBP partnership (during 2013) to consider new goals for reducing toxic contaminants and to develop strategies (by 2015) to carry out the goals. This report also identifies future research and monitoring activities needed to improve the understanding of the occurrence and effects of toxic contaminants in the Chesapeake Bay and its watershed.

Greg Allen is an environmental scientist in EPA's Chesapeake Bay Program Office. Scott Phillips is a senior manager and coordinator of the USGS Chesapeake Bay office.

Citizen Icthyoplankton Surveys of Mattawoman Creek: Watching Land-use Impacts in "Real Time"

Bonnie Bick
Mattawoman Watershed Society
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Coauthors: Jim Long and volunteers

For over two decades, the forested watershed of Mattawoman Creek has experienced rapid urbanization instigated by a new wastewater treatment plant, built at a time when land speculation associated with the proposed Outer Beltway ran high. This was also a time when the quality of Mattawoman's freshwater-tidal estuary could be described as "near to ideal" by fisheries managers. Despite many warnings by resource protection agencies of the need to control growth enabled by the plant, impervious cover passed the 10% mark during the post-millennium decade. Simultaneously, the health of the estuarine fish community began a serious decline, including a decline in abundance of anadromous fish. To assess the condition of the nontidal river, the Maryland Fisheries Service enlisted citizens to collect icthyoplankton and to measure water quality parameters during spring spawning runs. When combined with previous data, a precipitous decline was revealed in the usage of fluvial habitat by river herring, with deicing agents implicated as a contributing cause. We will discuss our volunteer icthyoplankton work, and our efforts to use these results, and those of an interagency Task Force that examined land-use in Charles County, to influence the revision Charles County's comprehensive plan.

Bonnie Bick has been an environmental activist in Maryland for more than twenty years. Her work on issues affecting the Potomac River and Mattawoman Creek are exemplified by the successful campaign to save Chapman Forest. More recently, her efforts with the Mattawoman Watershed Society helped save a thousand additional acres when DNR purchased the Preserve at Greenspring. Presently she is working to instigate Smart Growth solutions to save Mattawoman by protecting its forested watershed.

Endocrine Disruption and Fish Health in Chesapeake Bay Tributaries

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Coauthors: Luke Iwanowicz, David Alvarez, John Young and Dana Kolpin

In 2003-2005, while investigating fish kills of centrarchids in the Potomac River (South Branch, WV; South and North Fork Shenandoah, VA) a high prevalence of intersex or testicular oocytes was demonstrated in smallmouth bass (SMB). Subsequent adult fish mortalities in the Monocacy River and young-of-year SMB mortality in the Susquehanna have been documented as has a concurrent high prevalence of intersex adult SMB in these Chesapeake tributaries. Studies were initiated to examine causes and contributing factors of both the reproductive endocrine disruption and the fish kills. Numerous bacterial pathogens, a viral pathogen and a variety of parasites are associated with the fish kills, although none consistently, indicating immunosuppression. Both plasma vitellogenin and testicular oocytes in male SMB suggest exposure to estrogenic/antiestrogenic chemical contaminants. The co-occurrence of immunosuppressed fish and males with a high prevalence of testicular oocytes suggests complex mixtures of chemicals are adversely affecting certain sensitive species through multiple pathways. Discrete and integrative water samples, sediment and fish tissue analyses have demonstrated the presence of many chemicals, including known endocrine disruptors. Studies, including landuse analyses, to understand sources and pathways of exposure for these chemicals have identified wastewater treatment effluent and agricultural sources as contributing factors.

Vicki Blazer is a research fishery biologist with the USGS National Fish Health Research Laboratory in Kearneysville, WV. She is leading research programs using fish health as an indicator of ecosystem heath in both the Chesapeake Bay and Great Lakes watersheds. These programs are collaborative and integrative with various aspects of biology, landuse and chemical analyses.

Population Growth, Land Use Change, and Water Quality in the Chesapeake Bay Watershed

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Over the past 60 years, the population of the Chesapeake Bay Watershed has more than doubled, increasing steadily from 8 million in 1950 to approximately 17.4 million in 2010. Given these trends and current projections, the watershed population may plausibly exceed 20 million by the year 2030. Additional people mean additional impervious surface, turf grass, septic systems, sewer connections, and the loss of forest and farmland to development. How might these changes impact water quality? How can land use planning and land conservation minimize such impacts? These questions will be discussed along with historic land cover trends, projected future urban growth, and their relevance to the long-term maintenance of water quality in the Chesapeake Bay.

Mr. Peter Claggett is a Geographer with the U.S. Geological Survey's Eastern Geographic Science Center. Mr. Claggett has received Master degrees in Geography and Environmental Science from Miami University of Ohio and a B.A. in Environmental Science from the University of California at Berkeley. Mr. Claggett started his career as a Peace Corps volunteer followed by positions with the U.S. Environmental Protection Agency and Canaan Valley Institute. For the past ten years, Mr. Claggett has worked for the U.S. Geological Survey where he conducts research on land change characterization, analysis and modeling in the Chesapeake Bay watershed.

GreenPrint: Conserving Healthy Watersheds

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Conserving healthy watersheds is a preventative, cost effective approach to reduce impacts to aquatic systems caused by nonpoint source pollution and associated contaminants. Across the nation, and here, in Maryland, more attention is being given to the economic, social and environmental benefits of preventing degradation of healthy watersheds. It is true that conversion of natural lands to developed uses can bring economic benefits to certain sectors. However, the overall costs associated with lost ecosystem services and higher restoration needs are often times not considered in these decisions. This presentation provides an overview of the economic benefits of healthy watersheds and introduces the Department of Natural Resources' updated GreenPrint interactive mapping tool as a means to identify and protect these areas. GreenPrint provides the scientifically based, data driven justification for strategic and targeted land conservation based on the premise that the protection of the State's most ecologically valuable lands and waters must be of the highest priority. Implementation of GreenPrint conservation guidance through various state and federal programs and planning efforts will also be discussed.

Dr. Christine Conn has worked for the Maryland Department of Natural Resources since 2000 and is currently with the Office for a Sustainable Future. She works with agency biologists and land conservation specialists across the department to pull together the scientific basis for identifying land conservation priorities. She develops strategies for communicating and implementing these priorities through GreenPrint and other conservation based efforts.

Determining How Much Algae is too Much Algae in West Virginia Streams

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While there is much discussion on the impacts of increased nutrients on the aquatic community, there is little information available on the impacts to recreational uses. In West Virginia, there are numerous large rivers impacted by filamentous algae during the summer recreational season, which are often attributed to excessive nutrients. Biological data on these rivers is not showing significant impacts to the aquatic community that would warrant listing as impaired, and many of these rivers contain some of the best recreational fishing in the state. Conversely, WV DEP has received many complaints from citizens that recreational uses are being impacted by the excessive algae. In 2007, DEP initiated efforts to better understand and address excessive algae in the state. Part of that effort identified the need to better understand what levels of algae are deemed excessive and would impact recreational activities. In 2011, DEP initiated a statewide public opinion survey to determine what levels of filamentous algae would impact recreation in state rivers. The firm Responsive Management was contracted to develop and implement the survey and working with DEP, was able to get responses from over a thousand state residents. The results of the survey showed that levels of filamentous algae cover greater than 25-30% impacted recreational uses. DEP was able to get a significant amount of demographic information concerning recreational stream use in the state which will be discussed in detail. The presentation will also discuss how the findings will be utilized in the nutrient criteria development process.

Kevin Coyne is an Assistant Director with the West Virginia Department of Environmental Protection, Division of Water and Waste Management and manages the state Water Quality Standards Program. Prior to joining the WVDEP, Kevin was a Senior Scientist with Larry Walker Associates, Inc. based out of Ventura County, California. Kevin also worked for the Maryland Department of the Environment and Department of Natural Resources. Kevin has a B.S. in Wildlife and Fisheries Management from Frostburg State University and a Masters of Public Administration from California State University - Northridge.

Arsenic Distribution and Occurrence in Groundwater from Coastal Plain Aquifers in Maryland

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Arsenic concentrations exceed the US EPA maximum contaminant level (10 à3BCg/L) in ground water from two coastal plain aquifers in some areas of eastern Maryland. A study was conducted to determine the distribution of dissolved arsenic in the Aquia and Piney Point-Nanjemoy aquifers, and to investigate the reasons for spatial and depth distribution of ground water with elevated arsenic concentrations. About 250 wells were sampled for arsenic and major ions to establish geochemical factors associated with the occurrence of elevated arsenic concentrations. About 3,000 additional arsenic analyses were obtained from county health departments, and 200 analyses from the Maryland Department of the Environment (MDE) to supplement data collected as part of this study. As a follow-up study, 21 wells screened in the Aquia and Piney Point aquifers were sampled for trace elements and other key constituents to determine possible chemical controls on the occurrence of arsenic in groundwater. The distribution of elevated arsenic concentrations in both the Aquia and Piney Point-Nanjemoy aquifers shows a similar pattern. Elevated concentrations in each aquifer form a band that approximately parallels strike, and extends from the Eastern Shore, beneath Chesapeake Bay, and into Southern Maryland. The distribution of arsenic and the age of water in the Aquia and Piney Point-Nanjemoy aquifers indicate that arsenic is derived from a natural source within the aquifers, rather than anthropogenic contamination. Possible geologic and geochemical factors affecting arsenic concentrations in ground water are discussed.

David D. Drummond received his Bachelors Degree in Geochemistry from the University of Colorado at Boulder in 1977, and his Masters Degree in Geology from the George Washington University in 1987. He has worked at the Maryland Geological Survey since 1978 in the Hydrogeology Program. His research includes hydrostratigraphy, ground-water flow and contamination, and water-supply evaluation of the Coastal Plain aquifers in Maryland. Mr. Drummond has developed digital computer models to simulate ground-water flow, solute transport, and particle tracking, and has used a GIS extensively to analyze hydrogeologic data.

Tidal Dispersion Dynamics of Receiving Waters From a Storm Water Discharge Pipe and It's Potential Influence on Water Quality at Betterton Beach, Kent County, Maryland

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Periodically the Kent County Health Department, in collaboration with MDE, issues swimming advisories to the public at Betterton Beach, MD based on elevated enterococci levels. Therefore, a collaborative study effort between the MDE and the United States Food and Drug Administration was established to determine the potential influence the discharge from a nearby storm water pipe may have on the water quality at the bathing beach. The latest technological advances in fluorometric procedures were utilized to inoculate and tag the storm water pipe's discharge with Rhodamine WT dye in order to define the tidal exchange and dilution characteristics of the receiving waters. Using a WET Labs tracking submersible fluorometer towed behind a research vessel, in conjunction with software known as RAFT-MAP, real-time data capture was utilized to outline the movement of the dye plume as it diluted and dispersed through tidal cycles. In addition, a submersible fluorometer was moored to a pier throughout the study period, just northeast of the discharge zone to potentially capture released dye. Periodically, vertical profiles were taken to determine if current dynamics and/or density variations had caused the dye to reach depths other than the surface. Based on fluorometric analysis, it does not appear the storm water discharge would have a negative impact on the water quality at Betterton Beach. The large population of gulls observed on the beach, along with dog waste is possible sources of bacterial loading that might explain periodic swimming advisories at Betterton Beach.

William "Billy" Evans is an Environmental Program Manager with the Maryland Department of the Environment. He oversees scientists who are responsible for the monitoring of Maryland's shellfish growing waters, who also inspect properties for point and non-point pollution sources that may potentially impact shellfish growing waters and monitor Maryland's public drinking water systems for various contaminates. Billy has a Bachelor of Science degree in Marine Biology from the University of North Carolina at Wilmington and a Master of Science degree in Environmental Management from the University of Maryland.

Mapping the Distribution of Stream Biodiversity in Maryland

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Biotic inventories of stream communities, such as the Maryland Biological Stream Survey, routinely are used to inform management of aquatic ecosystems. However, the coverage of biotic inventories is typically sparse relative to the extent of the area of management concern and therefore planning often relies on extrapolation of biological attributes to entire watersheds or on some other, usually environment-based, stream classification scheme. The extent to which such extrapolations act as reliable surrogates for biological composition has been questioned. In this talk, we will discuss ongoing research to produce a biologically-optimized stream classification for Maryland at the level of 10-meter stream reaches. Our approach combines new spatial analysis techniques, high-resolution maps of Maryland streams (including locations of buried stream segments), and advanced statistical modeling to produce comprehensive maps of the distribution of biodiversity in Maryland streams and to estimate how 40 years of urbanization have affected stream biodiversity. Our methods incorporate both local and landscape-scale characteristics of individual stream reaches as well as the role of stream connectivity in determining community composition. The major goal of the project is to develop spatial predictions of aquatic communities that best discriminate stream reaches with similar biological characteristics and which can be used to inform the protection and restoration of streams in the context of ongoing urbanization.

Matt Fitzpatrick is Assistant Professor at the University of Maryland Center for Environmental Science, Appalachian Laboratory, where he studies the impacts of global change on biodiversity. His research focuses on the development of methods to predict the spread of invasive species and the response of species to climate change.

Watershed monitoring for Hg and MeHg at the Smithsonian Environmental Research Center

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Since 2007, we have conducted flow-weighted total Hg and methylmercury (MeHg) monitoring of three experimental watersheds at the Smithsonian Environmental Research Center (SERC). Our goals are to study the controls on Hg transport and MeHg production in coastal plain watersheds, and to evaluate changes in response to decreased Hg deposition. The three watersheds were chosen from the larger set of SERC long-term research watersheds to represent different land-use patterns and nutrient loading rates.

Total Hg and MeHg yields varied substantially among the three SERC catchments. Fluxes of filterable Hg and MeHg per unit area were greatest from the entirely forested, low nitrate catchment and lowest from agricultural watershed. By contrast fluxes of particulate Hg were highest from the agricultural watershed. In wet years, total Hg fluxes from SERC watersheds are equivalent to more than50% of atmospheric wet deposition.

We observed strong, episodic MeHg production each spring (and also during high-flow storm events), which was repeated across watersheds and years. MeHg release coincided with development of anoxia in riparian groundwater. We used stream transects and riparian piezometers to tie these spring MeHg pulses with the development of anaerobic microbial processes in the riparian zone as soils warmed and become water-saturated. Although wetlands are generally thought of as the primary zones of MeHg production in watersheds, shallow riparian groundwaters very close to the stream appear to play that role in SERC Coastal Plain watersheds.

Cynthia Gilmour is a senior scientist at the Smithsonian Environmental Research Center. Her doctorate is from the MEES program at UMD. She is a biogeochemist with research interests in the microbial ecology of trace metal cycling, particularly mercury.

Effective Stormwater Treatment Using Recycled Material Media

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Increasingly stringent stormwater permitting requirements demand that engineers create effective, inexpensive new treatments for nonpoint-source pollutants. This research project evaluates the efficacy of a byproduct-based treatment to remove heavy metals from stormwater runoff. To create this treatment, the recycled media: compost, steel slag, and sand, are mixed together, wrapped and sealed in filter cloth to create a porous mat. These mats can then be deployed to intercept roof or parking lot runoff at sites with metal contamination concerns, removing metals as stormwater runoff percolates through them. A field-scale prototype is currently being tested in Prince George's County, MD, at a building where structural lead and copper have caused environmental concerns. Analyzing influent and effluent pH, TSS, and concentrations of total and dissolved lead, copper, zinc, and phosphorous from stormwater samples allows the major variables controlling treatment efficacy to be evaluated. As of September 2012, 20 storms have been sampled to date. Efficient metals removals have been consistently observed in all seasons, storms depths and durations. Inexpensive and easily deployed, these mats could stand alone as a specialized treatment for sites with ongoing metal contamination issues or serve as a pre-treatment to extend the lifetime of permanent stormwater treatment facilities.

David Gleason is a graduate research assistant for Dr. Allen Davis at the University of Maryland, College Park. His research focuses primarily on stormwater treatment, especially in the Chesapeake Bay watershed.

Is Methane in Drinking Water Wells Due to Hydraulic Fracturing of the Marcellus Shale?

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About 20-40,000 gas-wells may have been completed in the last 10 years using unconventional drilling and fracturing techniques developed in the early 1990's. There have been several thousand papers published in the petroleum literature about hydraulic fracturing in oil and gas reservoirs, but few have been conducted to determine what the impacts to drinking water wells have been as a result of these fracturing procedures. A recent university study investigated the potential contamination of private wells near Dimock, Pennsylvania, due to directional drilling and hydraulic stimulation of gas wells in the Marcellus Formation. They found high methane levels within 1 km of active gas production wells, but no evidence of contamination by fluids used during fracturing procedures, which they indicated were from the Marcellus Shale and most likely due to leaky gas-well casings, also suggesting a possible a hydraulic connection between deep formations and shallow aquifers. A follow-on petroleum industry study collected water samples from over 1700 wells in Susquehanna County. They found a correlation between methane concentrations and surface topography; in that dissolved gas levels were highest in lowland areas. Using carbon/hydrogen isotope ratios, they concluded that the methane gases of the house wells in the University study originated in Upper/Middle Devonian formations, above the Marcellus Shale. The results of these studies, along with information from supporting investigations that the authors cited and other sources, will be discussed at the water monitoring conference.

The presenter has 25 years of experience as a hydrogeologist at the Maryland Department of the Environment, specializing in aquifer test analysis, estimating the reliable yields of wells and evaluating the impacts of groundwater withdrawals, in fractured rock aquifers. He had six years experience as an oil & gas exploration geologist, primarily in the area of offshore Texas waters. His Master's Thesis was in geochemistry and experimental petrology.

Indian Creek Daylighting and CSO Abatement

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Indian Creek in Philadelphia, Pennsylvania was experiencing eroding and undercut banks, a scoured streambed and excessive silt deposits, and the water body received significant point source discharges. The city and the Philadelphia Corps of Engineers hired Greenhorne & O'Mara to design the stream restoration and combined sewer outflow (CSO) abatement solutions. Restoration design was achieved by modifying the confluence between Indian Creek's east and west branches to daylight the 700-ft section of the latter branch, which flowed through a culvert. To reduce point source discharges, thus improving the creek's water quality and reducing local flood risk, the culvert's use was converted to storing and conveying CSO discharges to a treatment facility during wet weather. Aging infrastructure, the need for extensive excavation, and balancing ideal solutions with cost realities were project challenges. The project received a Top Storm Water Project Award from Storm Water Solutions Magazine.

Mr. Haptemariam is a Senior Project Manager with 19 years of experience in water resources engineering with an emphasis on stormwater management including the design, inspection, maintenance, implementation and documentation of water resources related elements, including the National Pollutant Discharge Elimination System Municipal Separate Storm Sewer permit. He is a registered engineer, and is familiar with federal, state, and local stormwater management regulations. He has completed Rosgen training courses levels I through IV and is also a Certified Floodplain Manager.

A Young-Of-the-Year (YOY) Predatory Fish Study to Assess Trends in Atmospheric Hg Deposition in Maryland

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Coauthors: Cynthia C. Gilmour, Tony Prochaska, John Sherwell

Controls on mercury (Hg) emissions from power utilities located in the State of Maryland were implemented in 2010. These regulations are part of the State's response to elevated levels of methylmercury (MeHg) in fish and other animals, and the associated risks to people and wildlife. To assess the degree and impact of the expected Hg emission reductions over the long term, wet Hg deposition has been monitored as part of the NADP program since 2004, and we have developed a standardized young-of-the-year (YOY) predatory fish monitoring program to assess changes in Hg bioaccumulation. Micropterus salmoides (largemouth bass), for freshwaters, and Morone americana (white perch), for the tidal Chesapeake, were chosen as sentinel species. This project began in 2008 and utilizes the existing Maryland Department of Natural Resources YOY fish collection and monitoring program. Hg deposition, measured in precipitation, shows signs of decreasing but variations in precipitation amount greatly influence interannual Hg load. Using YOY fish as sentinels of change appears promising. Changes in Hg concentrations over time are apparent but the response among sites has not been uniform. This result was not unexpected, as many factors other than Hg deposition can influence Hg concentrations in fish. Some of the selected sites will likely prove to be less suited for the long term goal of assessing the regional response to changes in Hg load. However, these sites are not less important, and will be used to identify factors responsible for the delayed response.

Andrew Heyes is an Associate Research Professor at the Chesapeake Biological Laboratory of the University of Maryland Center for Environmental Science. He received his PhD from McGill University in 1996, and his dissertation was focused on mercury cycling in reservoirs and was conducted at the Experimental Lakes Area, Canada. The study Hg cycling in the environment remains an important component of his research.

Engaging Citizens in Water Quality

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Coauthor: Leah Miller

Small watershed groups can make a difference in local water quality. In our Muddy Branch watershed, we believe in a progression of activities that engage citizens, first through acts of stewardship (such as picking up trash), then learning (such as water monitoring), then to action (hopefully by using rain barrels or rain gardens). We believe that only when they have reached this point will they make good advocates to reach others. We will present this approach and an overview of our monitoring activities.

Mr. Hlavinka has a Masters in Environmental Engineering from the University of Maryland and works in the environmental field. As an avid sailor, he has a personal interest in the health of the Chesapeake Bay. He has been active in many environmental organizations including Chesapeake Bay Foundation and Chesapeake Water Environment Association. He has also served in leadership with several churches and is very excited to work with several faith based groups within the watershed.

Ms. Miller is the Clean Water Program Director for the Izaak Walton League of America. Ms. Miller supervises staff, raises funds, and manages the day to day operations of conservation and education projects including Save Our Streams, Protect Our Wetlands, Creek Freaks and Project Watershed. She coordinates and teaches workshops on biological monitoring, stream restoration and wetland ecology and conservation. She has co-authored the League's Handbook for Stream Enhancement and Stewardship and Handbook for Wetlands Conservation and Sustainability, managed two national wetland conferences, and coordinated two Webcast series, Wetland-Friendly Backyards and Alternative Practices for Highway Stormwater Management. She also coordinated the Clean Boats Campaign, a nation-wide public awareness effort to stop the spread of aquatic invasive species. Ms. Miller has a B.A. in Political Science and Organismal Biology from Yale University. Originally from Ardsley, New York.

Comparative Stream Study and Landowner Outreach in Three Small Adjacent Coastal Plain Watersheds

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In 2009 the Jug Bay Wetlands Sanctuary began a Stream Watershed Study. We initiated this study to assess the current health of three small Patuxent River tributaries with the ultimate goal of working with adjacent landowners to improve stream health over time. Located in southern Anne Arundel County, the stream watersheds reflect the varying land use patterns of the area. The largest watershed, Galloway Creek, covers 1396 acres, has a reach of 3.3 miles, and is the most urbanized with 22% of the watershed under impervious surfaces. The Two Run Branch watershed covers 846 acres, has a reach of 2.5 miles, and reflects a typical suburban setting. Pindell Branch is the smallest watershed at 513 acres and a reach of 1.5 miles. There are only eight residences in this watershed but all headwaters are in agricultural fields and row crops constitute 16% of the watershed.

To develop a baseline of data, we regularly test the following parameters: water chemistry, nutrient and sediment loading, fish and macroinvertebrate diversity, and bacteria levels. The preliminary findings have helped us refine the study; the investigation has led to the discovery of species not previously recorded, and we have observed seasonal and permanent changes to the stream beds over time. As we learn more about the stream watersheds we are refining outreach techniques to work with our neighbors to improve the health of the streams.

Lindsay Hollister has served as Volunteer Coordinator and Naturalist for the Jug Bay Wetlands Sanctuary since 2004 and part-time Stewardship Coordinator for the Chesapeake Bay National Estuarine Research Reserve since 2009. She was also part of the first class of the Anne Arundel County Watershed Stewards Academy. She leads and coordinates outdoor education, ecological research, and stewardship projects on the Patuxent River as a county and state government employee and a community Master Watershed Steward.

Application of In Vitro and In Vivo Assays to Identify Waters Impacted by Endocrine Active Chemicals

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Coauthors: Vicki Blazer, Dan Gorelick, Marnie Halpern, Diana Stavreva, Gordon Hagar

Chemical analysis is a robust, and highly specific means of monitoring known chemicals in environmental waters. Such analyses have been useful for the quantification of bioactive chemicals in the environment. Two significant drawbacks to such analyses are 1) high cost and 2) only known chemicals can be measured. The application of in vitro and in vivo bioassays for endocrine active chemicals provides an unbiased means of assessing cumulative bioactivity of a water samples. We have been implementing bioassay screening as a cost-effective means of assessing environmental water samples for endocrine active compounds including estrogens, androgens and glucocorticoids. These screening tools have been used on environmental water samples within the Chesapeake Bay Watershed and have facilitated the identification land-uses associated with the contribution of such chemicals. The bioassays are also showing promise as a means of prioritizing analytical R&D. The assays are highly complementary to chemical analyses and are useful reconnaissance tools. Here we will discuss how these assays work, their limitations, and demonstrate their application for screening environmental water samples from the Chesapeake Bay Watershed.

Dr. Iwanowicz is a research biologist at the USGS, Leetown Science Center, Fish Health Branch located in Leetown, WV. His research interests included infectious and non-infectious diseases if fishes. Current research includes endocrine disruption in the Chesapeake Bay Watershed and other national location. His work focuses on fish physiology, immune responses, infectious disease and the application of molecular and cell-based tools to assess fish health and screen environmental water samples.

Modeling and Forecasting the Distribution of Vibrio spp. in Chesapeake Bay

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Coauthors: Christopher Brown, Rita Colwell, David Green, Raleigh Hood, Wen Long, Guillaume Constantin de Magny, Bala Krishna Prasad Mathukumalli, Raghuram Murtug

The estuarine bacteria Vibrio cholerae, V. vulnificus, and V. parahaemolyticus are capable of causing severe and occasionally life threatening infections in humans. While 50-60 cases are reported annually in the Chesapeake region, few efforts have focused on understanding the distribution of these opportunistic pathogens on a scale relevant to regional management. To address this concern, a partnership was established to enhance monitoring capabilities, model the distribution of these species, and develop ecological forecasts. Through collaboration with Maryland and Virginia water quality monitoring programs, Vibrio spp. are enumerated using quantitative PCR and linked directly to the associated water quality data. ChesROMS, a regional adaptation of the Rutgers Ocean Modeling System, is used to force empirical models derived from these large data sets. Nowcasts, 3-day, 14-day, and seasonal forecasts are provided through restricted access to state and county health officials for use in education and decision making. Models are also being used to evaluate other scenarios, such as regional climate change. Finally, monitoring efforts are continuous allowing for validation of empirical models, evaluation of forecast model skill, and tuning over time.

Dr. Jacobs is a Research Fisheries Biologist with NOAA's National Ocean Service in Oxford, Maryland. He obtained his BS degree at St. Mary's College of Maryland, and Masters and PhD at the University of Maryland (UMCES). His current research is focused on the development and application of ecological forecasts for fish and human pathogenic bacteria.

Better Public Access to Point Source Wastewater Pollutant Discharge Information

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This presentation will provide an overview of the DMR Pollutant Loading Tool and its potential uses for the general public and water quality professionals (http://www.epa.gov/pollutantdischarges). This new online tool can help you determine who is discharging, what pollutants they are discharging and how much, and where they are discharging in US waterways. The tool calculates pollutant discharges to surface waters based on facility compliance monitoring data, submitted on forms called DMRs, from 2007 through 2010. Totals appear as pounds per year and as toxic-weighted pounds per year to account for variations in toxicity among pollutants. The tool ranks dischargers, industries, and watersheds and presents "top ten" lists to help you determine which discharges are important, which facilities and industries are producing these discharges, and which watersheds are impacted. The tool also includes wastewater pollutant discharge data from EPA's Toxics Release Inventory (TRI), also for 2007 through 2010. Finally, users can easily create trend charts and other searches to better identify facilities with the most pollutant loading discharges and any pollutant loading discharges over their permit limits.

Carey Johnston has seventeen years experience with U.S. Environmental Protection Agency in the fields of site remediation and wastewater pollution control. Mr. Johnston works in the Office of Enforcement and Compliance Assurance and is working on a proposed rulemaking to change the current paper-based reporting system for the Clean Water Act NPDES permit program to an electronic system. He is also the lead developer for the DMR Pollutant Loading Tool, which is a new tool designed to help you determine who is discharging, what pollutants they are discharging and how much, and where they are discharging. Mr. Johnston has a B.S degree in mechanical engineering from the University of Virginia and a M.S. degree in environmental engineering from Virginia Tech. Mr. Johnston is also a licensed Professional Engineer in the Commonwealth of Virginia.

Bacterial Soup for the Chesapeake or is it Oyster Stew?

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Coauthor: Dr. Leila Hamdan

So what else is in YOUR water? Is your water the Chesapeake? If it is, then there are lots and lots of bacteria in YOUR water. There are also high concentrations of dissolved organic matter, like carbohydrates and amino acids, that these bacteria love to eat. These bacteria are not "indicator organisms" or virulent pathogens, although some of both are, of course, present as well. Rather they are simply saprophytes just trying to make a living. When compared with other estuaries, bacteria in the Chesapeake are living freely in the water column, not attached to detrital particles, and there are often ten times as many as in other estuaries. What drives these anomalies? Our data suggest that phytoplankton production in situ results in large amounts of dissolved, microbially labile organics in the water column. That "bacterial food" drives high levels of bacterial secondary production and accumulation of bacterial biomass. Water column bacteria alone can consume oxygen sufficiently fast as to create anoxic conditions in less than a week in the absence of reaeration, e.g. beneath the pycnocline. Why would the Chesapeake system differ from others? One aspect of the Chesapeake is the massive loss of filter feeding oysters historically. It seems possible that loss of filter feeders, along with nutrient enrichment, resulted in this disrupted ecosystem. If oysters were returned, would bacterial abundance decline and would there be less dissolved organics? Some earlier data from aquaculture sites suggest such ecosystem improvements. So oysters in YOUR water may be really valuable.

Dr. Robert Jonas is the Chair of the Department of Environmental Science and Policy at George Mason University. He is a microbial ecologist and ecotoxicologist having earned his PhD at the University of North Carolina, Department of Environmental Sciences and Engineering and has done post-doctoral work at the Chesapeake Biological Laboratory. His research focuses mainly on estuarine and oceanic systems. Currently he has research projects investigating the interactions of nutrient enrichment, phytoplankton production and bacterioplankton proliferation in the Chesapeake Bay and adjacent tributaries and the ecosystem effect of restoring oysters as filter feeders in subestuaries of the Bay. He also works on microbiological aspects of diseases of reef building corals using culture dependent and molecular techniques to investigate bacterial diversity in these stressed communities. He teaches courses in environmental microbiology, microbial ecology, environmental toxicology and general environmental science and policy at the graduate level, and microbiology and studies of the environment at the undergraduate level.

Across Tributaries, Citizen Scientists Report on Frequency, and Abundance, of Potentially Harmful Bacteria

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Bay citizens are often concerned about the effect that swimming in the local waters may have on their health and look to the state and local organizations for guidance. Fecal coliform bacteria may be present at local beaches in abundance depending on proximity to sources (e.g. septic systems, animal waste, degrading soils) and recent weather conditions. If ingested, humans and animals may become sick. Recently, watershed organizations began collecting water samples for the purpose of testing for these bacteria according to state and federal guidelines. Water samples are collected weekly or biweekly by several organizations and compared against Enterococcus threshold of 104 MPN per 100 ml. Monitoring results are often communicated on organization websites and included in annual report cards. Since bacteria concentrations are spatially heterogeneous, it is recommended that communication of monitoring is separate from other indicators with its own geographic representation. Comparing monitoring sites between tributaries, an unusual number of sites within the Nanticoke River failed to meet the threshold on average despite this being the most natural system considered.

Jonathan Kellogg is a Science Integrator with EcoCheck, an UMCES-NOAA partnership dedicated to communicating the science of Chesapeake Bay Health. He comes from the University of Washington in Seattle where he earned a PhD in Marine Geology.

Observed Impacts of Chlorides in Baltimore County

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Over the last 3 decades there has been an observed gradual increase in chloride concentrations in Baltimore County streams, reservoirs and domestic water supplies. This presentation will provide an overview what is currently known about the nature and extent of chloride contamination, the potential sources of chlorides to the environment, and the current strategies available to manage the problem.

Kevin Koepenick earned his B.S in Geology from Virginia Tech and an M.S in Geosciences from Penn State. He worked as an environmental consultant for 5 years before coming to Baltimore County where he has supervised the Ground Water Management section for the past 16 years.

What's New in Water Tools

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There are a number of new tools from which are available to state and county governments and watershed groups to share and display information. The first tool is the Water Quality Portal. The Portal was launched in May 2012, and it provides one location for people to query data from both EPA STORET and USGS NWIS and receive it in one format. The second tool is the Water Quality Exchange template. The updated template enables data owners to use a MS Excel spreadsheet to populate data in the WQX format. Once data is in WQX, the data can be submitted to EPA STORET or shared on the Exchange Network with other data partners for use in models or analyses. The third tool is the How's My Waterway mobile application. The app will help people quickly find plain-English information on the condition of their local waters using a smart phone, tablet, or desktop computer. Through these tools, data owners and data users will be better able to share information, compile data for analyses, and display data on multiple formats. The fourth tool is NEPmap. NEPmap is an interactive web application that allows viewers to better ascertain the context and geographic scope of habitat protection and restoration as conducted by the 28 National Estuary Program (NEP) sites within the context of their watersheds and surrounding landscapes.

Charles Kovatch is the Team Leader for the U.S. EPA's WQX/STORET Team. The Team serves to assist federal, state, local, and tribal agencies, universities, and watershed groups with their WQX water data submissions to the STORET data warehouse and make the data available for analysis. Mr. Kovatch has an MBA from the University of Maryland, an MS from the University of South Carolina, and a BS from Indiana University of Pennsylvania.

Algae Booms and their Association with Fish Kills in Maryland Waters

Chris Luckett
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This talk dissects Maryland fish kill data documented by MDE since 1984. It discusses the role algae, in general, has played in fish kills over the last 29 years. Harmful algae blooms occur as a result of excess nutrients in the environment (primarily nitrogen and phosphorus). We will present the species we see associated with fish kills, and the mechanisms that cause it to be harmful to fish. Included: direct and indirect results of eutrophication, and toxic algae. There will also be a couple case histories discussed, including the May-June 2012 fish kill in the Baltimore Inner Harbor and surrounding areas.

Chris received his BS in Marine Biology from Southampton College, Long Island, NY, in 1985. For the next 15 years, he worked as a coastal ecologist at the Smithsonian Institutions, Marine Systems Laboratory, making living models of various coastal ecosystems and researching the controlled culture of attached algae to remove nutrients and other pollutants from water. In 2000 he came to Maryland Department of the Environment. Chris investigates fish kills and algae blooms, conducts fish and benthic community assessments in fresh and estuarine water, samples fish tissue for contaminants, and is involved in various other special projects involving aquatic biology, ecology, and pollution control.

Want Clean Streams? There's An App For That!

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The project Friends of Frederick County has developed with our partners begins with citizen outreach to engage a group of volunteers willing monitor the watershed in Frederick County. A citizen volunteer uses a smart phone app to photograph and give basic information about a problem at a Frederick County stream site. The user calls up the app, takes a few photos (their phone records the latitude and longitude), answers a few questions and sends the record to the ESRI ArcGIS database where the record is displayed in real time on a map. Along with our partners, Chesapeake Commons and RiverKeepers we review and grade each record, determine a course of action, and most importantly we track and report all necessary follow-up to a record.

Richard Maranto is Board Treasurer of Friends of Frederick County and President of RAM Digital, a software development company that develops applications for government and private industry. He is the co-founder of Citizens for the Preservation of Middletown Valley (CPMV), a local organization that advocates for responsible land use in historic Middletown Valley. Rich is also a renewable energy advocate and blogger. He runs the non-profit blog site MdGoesGreen.org, holds monthly local sustainability gatherings called Green Drinks and produces two local solar and green home tours.

Developing Management Strategies to Conserve High Priority Fisheries Habitat

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Coauthor: Jim Uphoff

The Fisheries Habitat and Ecosystem Program are evaluating impacts of stressors to fish habitat and fish populations. This work has identified thresholds of impervious surface associated with various stressors that degrade water quality and fishing opportunity. Impacts of stressors result in increased consumption advisories related to PCB in fish tissue, increased hypoxia, loss in reproduction, declines in larval feeding efficiency and reduced spawning habitat occupation. When these impacts compound in a watershed or region, fisheries managers have few options in managing sustainable populations. In response to these observations, we have applied impervious surface thresholds to develop management priorities for watersheds in Maryland. Because many of these losses are difficult to address with traditional fisheries management tools, we are promoting conservation of high priority watersheds. We understand that conserving productive habitat is more effective in sustaining fish production, than trying to restore production in compromised habitats. This presentation will review the results of studies focused on understanding habitat impacts on fisheries and demonstrate how we are developing management strategies to support conservation of key habitats.

Margaret McGinty has been blessed with the opportunity to work as a Fisheries Biologist for the Maryland Department of Natural Resources for more than two decades, focusing on evaluating stressors to water quality and fish habitat. She presently works in the Fisheries Habitat and Ecosystem Program, which is engaged in assessing the impacts of land use change on fish habitat and applying results to promote effective landscape management in Maryland and the Chesapeake Bay Region.

Social and Economic Impacts of Marcellus Shale Development in Pennsylvania: Lessons Learned from Early Studies

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Extraction of the natural gas from the Marcellus Shale began in earnest in PA in 2007. Communities near the most active exploration, drilling and staging areas experience changes that range from increased traffic and housing costs to rising demand for services, full hotels and motels and increased work opportunities. These changes are beneficial for some and make life more difficult for others. This presentation will highlight commonly identified socioeconomic changes associated with Marcellus Shale development in Pennsylvania. Evidence is based on published research, and preliminary findings from research projects in various stages of completion. The impacts of Marcellus Shale development on communities and families change depending on the stage and pace of development, and vary with the size of the community and proximity to drilling and staging areas. Identifying possible impacts ahead of development could provide the opportunity to work with local leaders and the gas industry to minimize problems and maximize the opportunities associated with natural gas development.

Diane K. McLaughlin is Professor of Rural Sociology and Demography and Associate Head in the Department of Agricultural Economics, Sociology and Education at The Pennsylvania State University. Her research examines how community conditions and change affect individual and family well-being. Ongoing research projects include impacts of Marcellus Shale development on community and family well-being; factors influencing rural youth educational, occupational and residential aspirations; and the well-being of rural children. Prior research has examined the correlates of inequality and poverty among rural populations.

How Low Can It Go? The Story of Dissolved Oxygen in the face of Environmental Vulnerability in Small Tribs of the Chesapeake Bay

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Coauthor: Andrew Muller, Ph.D.

Small sub-estuaries of the Chesapeake Bay such as the South and Severn Rivers in Maryland exhibited significant water quality vulnerability with respect to water quality indicators during the Spring-Summer season of 2011 and 2012. Several climatic fluctuations caused mainly by the strong La Nina created multiple situations in which the water quality either significantly degraded or improved for either punctuated or extended durations. Weekly vertical profiles of water quality parameters revealed that the Ash Wednesday storm created significantly reduced salinity gradients leading to arrested circulation, huge sediment loads and early onset hypoxic. Severe hypoxia and anoxia continued into the summer season, salinity values remained low causing these tributaries to act like stagnant ponds. In contrast, Hurricane Irene occurred during ebb tide leading to a blowout event in which the South and Severn Rivers exported better water quality into the Bay. This event was followed by Tropical Storm Lee which decreased salinity values, increased turbidity and the hypoxic-anoxic events returned. As of today salinity values are still lower than normal and the La Nina pattern continues. This suggests a very mild winter with a wet spring and the high probability of extensive hypoxia-anoxia for another season, leaving this estuary vulnerable to climate changes.

Diana grew up in Tumwater, WA on lower Puget Sound; her family camped for weeks on end, fished, and grew vegetable gardens (organically). By the time she entered high school, she became an activist for the Straits of Juan De Fuca and Puget Sound. In college she made use of her own boat to collect water samples and oiled seabirds from oil spills. After graduating from The Evergreen State College, WA with a degree in Chemistry and Marine Science, Diana moved to the East Coast to work with the Chesapeake Bay Long Term Monitoring Project. Since that time she has worked her way up through laboratory and field sampling to management and environmental law. She has been to and sampled most of the Chesapeake Bay Watershed, from the Susquehanna River to the Bay mouth. Diana brings with her 20 years of valuable experience in riverine and estuarine water quality, ecology, microbiology, and environmental law. Diana and her family moved to the South River Watershed in Selby-on-the-Bay a little over a year ago, and immediately began a water quality monitoring program in Selby Bay. Being a RIVERKEEPER® is a more than a job for Diana; it is a lifestyle. It is her mission to provide cleaner waterways for the generations to come. She earned her Captain's license in 2011.

Watershed-based Monitoring Network Design for Chloride and Sulfate in the Patapsco Lower North Branch

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In 2009, the Maryland Department of the Environment (MDE) developed a biological stressor identification (BSID) process, to address Category 5 biological impairment listings. The BSID process is currently adding many new pollutant specific Category 5 impairment listings to the Maryland Integrated Report. Recently, the BSID process has identified elevated concentrations of chlorides (Cl-) and sulfates (SO4) as potential cause(s) of biological impairment in watersheds throughout the State of Maryland. These watersheds are typically associated with urban areas and/or major transportation routes. Run off from roads and urban land uses cause an increase in contaminant loads from nonpoint sources by delivering an array of inorganic pollutants, including Cl- and SO4, to surface waters. Discharges of inorganic compounds are very intermittent; concentrations vary widely depending on the time of year as well as a variety of other factors may influence their impact on aquatic life. Addressing these new Cl- and SO4 Category 5 listings will be a critical focus of MDE's TMDL program over the next several years. A key component to addressing these new listings is to have sufficient water quality data for TMDL and/or Water Quality Analysis (WQA) development. A pilot study was developed for the Patapsco Lower North Branch watershed to aid MDE in determining the spatial and temporal extent of these impairments in the watershed.

Allison O'Hanlon graduated from St. Mary's College of Maryland in 1987. She started her career as a Biologist with the Academy of Natural Sciences of Philadelphia. In 1989 she started work as a Natural Resource Biologist with the Maryland Department of the Environment. Allison was appointed Section Head of the newly formed Biological Stressor Identification Section in 2009.

Well Water Methane Study in Maryland Appalachian Plateau

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A study was conducted to determine the occurrence and distribution of dissolved methane in well waters of the Appalachian Plateau Province of Maryland. Methane is a colorless, odorless, flammable gas that can occur naturally in well water. Prior to this study, no quantitative assessment has been performed in this region to identify the possible range of dissolved methane concentrations. Fifty wells were selected based on topographic setting (i.e. valley versus hilltop/hillside), underlying geology (i.e. coal versus non-coal), and spatial distribution. Untreated well-water samples were collected in 40-mL glass vials and then analyzed by a private laboratory for dissolved methane, propane, ethane, and ethene concentrations. Other water-quality parameters measured in the field included alkalinity, chloride, pH, specific conductance, dissolved oxygen, temperature and hardness. Preliminary results from this study indicate that approximately half of the wells have detectable (>1 microgram per liter) dissolved methane with the maximum being 8,550 micrograms per liter. Among the 50 wells, only three wells had dissolved methane concentrations in excess of 1 milligram per liter. Most of the higher- concentration methane detections were from wells located in coal basins while most of the methane detections from wells located in non-coal basins were found in valleys. This study will help guide future evaluation of groundwater methane in the region, which will provide a basis for monitoring for long-term changes in groundwater methane concentrations.

Phung received her B.S. degree in environmental geology in 2006 and M.S. degree in hydrogeology in 2009 from Clemson University. Her master's thesis involved constructed wetlands and water reuse. She has worked with stable isotopes, mainly helium in groundwater and gas samples. Since January of 2012, she has been with the Maryland Geological Survey in Baltimore, MD as a geologist working on various water-related projects including the methane well water study in western Maryland.

Liver and Skin Tumors in Brown Bullheads in Chesapeake Bay Tributaries: 1992 through 2011

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Coauthors: John C. Harshbarger, Michael A. Rutter

Fish tumor surveys have been used for many years as a monitoring tool in freshwater, estuarine, and marine habitats. In North America, the brown bullhead (Ameiurus nebulosus) has been the most frequently used freshwater species. This is attributable to its bottom-dwelling nature leading to contaminant exposure, propensity to develop liver and highly visible orocutaneous tumors, and small home range. It is commonly found in estuaries at salinities up to about 8 parts per thousand. Since 1992, the U.S. Fish and Wildlife Service has conducted bullhead tumor surveys of Chesapeake Bay tributaries. The goal has been to evaluate habitat quality near National Wildlife Refuges and in areas that are home to trust resources such as anadromous fish. Liver tumors are clearly linked with exposure to sediments contaminated with polynuclear aromatic hydrocarbons (PAHs). We highlight the results of surveys in the South River which has had multiple surveys with skin tumor prevalence ranging from 19% to 58%. We did not find evidence of an association between skin tumors and PAHs in biomarker studies or through analysis of sediment contaminant data. We present the results of logistic regression analyses on a 20 year data base of 1403 bullheads. Sex and length are significant covariates for both skin and liver tumors, with females higher than males and length believed to be a surrogate for age. We evaluate the use of bullhead tumors as an environmental indicator using EPA's six criteria and conclude that liver tumors meet all criteria whereas skin tumors do not.

Fred Pinkney has been a biologist in the Environmental Contaminants Program at the U.S. Fish and Wildlife Service, Chesapeake Bay Field Office since 1993. In addition to fish tumors, he has collaborated on studies of amphibian abnormalities, yellow perch reproductive problems, and endocrine disruption in bass.

Geochemistry and Age-Dating of Groundwater in the Upper Patapsco Aquifer, Maryland Coastal Plain

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Coauthors: L. Niel Plummer, Andrew G. Hunt, Jack R. Eggleston, David C. Andreasen

Estimates of groundwater age can be used to recognize those parts of aquifer systems where development of water-management tools could aid in the sustainable utilization of the groundwater resource, and to identify those parts of aquifers that are non-renewable on human timescales. As part of an ongoing investigation of Maryland's Coastal Plain water resources being conducted by the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Department of the Environment we interpret groundwater age from measurements of the concentrations of a suite of environmental tracers in parts of the upper Patapsco aquifer of the Atlantic Coastal Plain of Maryland, which is increasingly being utilized for freshwater supply, but for which there have been no previous measurements to estimate groundwater age. The production wells sampled in this investigation are screened in the upper Patapsco aquifer along two transects that are roughly aligned downdip through the central and southern portions of the Maryland Coastal Plain. Results of this study indicate that groundwater age increases downdip in the upper Patapsco aquifer. Most of the ages range from modern to about 500,000 years, with one sample at 117 km downgradient from the recharge area dated by radiogenic helium accumulation at more than one million years. Low recharge temperatures (typically 5--7 degrees C) indicate that recharge occurred predominantly during glacial periods when coastal heads were lowest due to low sea-level stand.

Jeff Raffensperger is a hydrologist with the USGS MD-DE-DC Water Science Center. He received his Bachelor's degree in Geology from the University of Maryland in 1985, his Masters degree in Hydrogeology from Louisiana State University in 1988, and his Ph.D. in Hydrogeology from The Johns Hopkins University in 1993. Jeff has worked for the USGS MD-DE-DC Water Science Center since 1999. He has been involved with several projects studying hydrologic processes and modeling.

Mattawoman Watershed Ecosystem Management Plan

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Coauthors: Christine Conn, Jim Uphoff, Margaret McGinty

The cumulative impacts of development in watersheds, over time, is quite well documented. Stream health indicators decline when impervious surface within watersheds increase. Losses in Ecosystem resources cannot simply be offset by application of best management practices or measures to mitigate the impacts of development. Mitigation can reduce the degree of damage, but the limits of technology will nevertheless result in sustained adverse impacts to the watershed.

This workshop will summarize the findings in a report which outlines the scientific basis for concluding that the current designation of most of the remaining undeveloped areas within the Mattawoman watershed as a Development District virtually assures continuing and dramatic watershed ecosystem deterioration. This report was initiated by the Maryland Department of Natural Resources (MDNR) in conjunction with other state and federal agency partners in collaboration with the Charles County Planning Department. It was prepared within a timeframe designed to inform the Charles County comprehensive planning process.

This report evaluates likely changes in the watershed that can be expected given the current County land use management and regulatory framework (zoning). A number of reforms to the current County regulatory framework are proposed for consideration

This project was informed by the notion that it is more cost effective to prevent, rather than retroactively mitigate impacts associated with growth in impervious surfaces as a result of over-development in a Watershed. Put more simply, "an ounce of prevention or protection is worth far more than a pound of well-intentioned restoration cures or fixes".

Tony Redman has over 30 years combined public and private practice experience in planning and land use management. He has served as Deputy Director of Planning in Kent County, Maryland and Director of Planning in Talbot County, Maryland. He established Redman/Johnston Associates, Ltd., in October 1985. During over 20 years in private practice he served as a consultant to the Maryland Chesapeake Bay Critical Area Commission, the EPA Chesapeake Bay Program and to numerous local governments throughout the Mid-Atlantic Region.

Tony currently works at the Maryland Dept. of Natural Resources where he coordinates reviews of Development projects and preparation of Watershed Ecosystem Management Plans. He also supports development of stream restoration policy and review standards, and manages special projects on an as needed basis.

Headwater Streams - Why Should We Care?

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Headwater streams are the smallest streams in a watershed, but are the most abundant - comprising 80% or more of the stream miles in some systems. They may be perennial, intermittent, or ephemeral, and although the flow regime will affect how each stream functions, all make important contributions to their larger downstream systems. Much of the "action" takes place in headwater streams - processing of nutrients, production of macroinvertebrates, etc. - due in part to their high surface to volume ratio and intimate contact with the hyporheic zone. Regulatory protection of these streams may be limited or lacking altogether due to their omission from larger scale maps and a lack of understanding of their contributions to the overall hydrology and ecology of their larger river systems.

Doug Redmond is a Natural Resources Manager with the Department of Parks' Park Planning and Stewardship Division. As Section Leader for the Resources Analysis Section, he is responsible for aquatic resource management, compliance with the Department's MS4 (NPDES) permit, and environmental impact analysis for projects on M-NCPPC parkland in Montgomery County. Mr. Redmond has a Master of Science degree in Marine-Estuarine Environmental Science from the University of Maryland, College Park.

Mercury TMDL - Integrating Science, Monitoring and Regulation

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In Maryland, numerous impoundments are impaired by methylmercury in edible tissues of high trophic level (T-4) fish, such as largemouth bass. The Maryland Department of the Environment (MDE) is required under Section 303(d) of the federal Clean Water Act to develop Total Maximum Daily Loads (TMDLs) for impairing substances, and to determine reductions whereby the water bodies in question meet their designated uses. The largest source of mercury in Maryland by far is atmospheric deposition, originating from electrical generating units (EGUs) and other combustion sources within and outside the State. MDE develops mercury TMDLs using an approved "Principle of Proportionality" method developed and used first by Minnesota and other states. MDE uses an air model (CALPUFF) to estimate atmospheric deposition, determining proportionate reductions based on the difference between observed and allowable concentrations of total mercury in T-4 fish. In 2007, Maryland passed the Healthy Air Act (HAA), which requires Hg emissions to be reduced by 90% at the State's largest coal-fired EGUs by 2013. The HAA has the potential to account for a substantial portion of the reduction required under some TMDLs. However, Maryland is a small, 'downwind' state, and regional or federal efforts are also needed. MDE co-sponsors (with MD DNR) an ongoing Young-of-the-Year study to measure trends in mercury concentrations in young T-4 fish, which should be reflective of the response to changes in Hg deposition far sooner than would be evident in adult fish.

Timothy Rule holds a Bachelors degree in Biology from the College of Wooster and a Masters degree in Marine-Estuarine-Environmental Science from the University of Maryland. He has been with the Maryland Department of the Environment, primarily in the TMDL program, for sixteen years. His areas of expertise include eutrophication issues in freshwater and estuarine areas, mercury in fish tissue, and various issues regarding lake and reservoir management. He also taught Environmental Science at the Maryland Institute College of Art for ten years.

Wide-scale Mortality of Young-Of-Year Smallmouth Bass Micropterus dolomieu in the Susquehanna River Basin, Pennsylvania

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Coauthors: Vicki Blazer, Heather Walsh, Luke Iwanowicz

Beginning in 2005, wide-scale, disease-related mortality has been affecting recruitment of young-of-year smallmouth bass at the Susquehanna River and a number of its tributaries. Pathological analysis of the fish have documented several bacterial infections, severe myxozoan and trematode parasite infection, as well a the presence of Largemouth Bass Virus. Outbreaks are believed to be a result of immune suppression in response to numerous water quality stressors that are present in this system. These include secondary effects of eutrophication such as widely variable dissolved oxygen concentrations and pH as well endocrine disruption as a result of contaminants.

Geoff is the Susquehanna River Biologist for the Pennsylvania Fish and Boat Commission in Harrisburg, PA. He holds a BS in Biology from Lycoming College and an MS in Biological Sciences from Marshall University in WV. Geoff has spent most of his career working on large rivers; primarily in the Atlantic and Ohio drainages.

Road Deicers: From the Road to the Chesapeake Bay

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Coauthors: Ryan Casey, Steve Lev, David Ownby

States in the Mid-Atlantic region account for about 1/3 of the 10 to 20 million tons of road salts applied to roads as deicers during winter months in the United States. Because road salts, primarily sodium chloride (NaCl), readily dissociate into to their respective ions in water and are relatively conservative in the environment, they have the potential to travel easily through ground and surface water systems where they may pose a risk to human health and aquatic life. In this talk I will trace road salts from their source, road surfaces, through modern storm water treatment facilities, into ground waters and ultimately streams that discharge to the Chesapeake Bay. Intensive monitoring of two stormwater management ponds indicated that surface waters in these ponds reached Cl concentrations in excess of 10,000 mg/L. The ground water under the stormwater ponds can also exhibit similar concentrations of Cl. The establishment and monitoring of a set of shallow groundwater piezometers in the riparian zone between two stormwater management ponds and the adjacent stream indicated extensive ground water contamination by Cl down gradient of the stormwater ponds. In hot spots of contamination within the riparian zone, Cl concentrations in shallow ground water exceeded 2000 mg/L and remained elevated year round. In the adjacent stream, Cl concentrations below the contaminated riparian zone were from 2 to 10 times higher downstream, suggesting substantial loading of Cl from the riparian zone to the stream even outside the winter months.

Dr. Joel W. Snodgrass has BS in biology (Guilford College), MS in zoology (University of Central Florida), and PhD in ecology (University of Georgia). He is currently the Chairperson of the Department of Biological Science at Towson University. Drs. Casey, Lev, Ownby and Snodgrass are the core faculty of the Urban Environmental Biogeochemistry Laboratory (UEBL), a recently opened, $2 million facility at Towson University.

Headwater Biota as Indicators of Stormwater Solutions

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National, state, and local stream monitoring over recent decades has greatly improved our understanding of watershed conditions and our planning for watershed restoration. At the same time, effective restoration of streams ecosystems remains elusive. I believe the lack of protection of our smallest streams (the headwaters) is the most important gap in our watershed protection strategies. Headwater streams have been overlooked largely because they do not appear on the map scales used for stream assessments and land use planning. They are also often ephemeral or intermittent and therefore believed to be of lower value. In contrast, recent studies provide strong evidence that headwater streams are important for runoff attenuation and nutrient processing. The new requirements for Environmental Site Design (ESD) practices that infiltrate stormwater may be an attempt to replace the functions of headwater streams. If bioswales and other ESD practices become pervasive in the landscape, I believe their success should be measured by the condition of downstream biological communities. To establish context for this approach, I analyzed benthic macroinvertebrate, fish, and salamander data from hundreds of Maryland Biological Stream Survey (MBSS) sites on first-order streams (based on 1:100,000-scale stream network map). Each site was characterized based on the length of headwater (zero-order) streams draining to each site (zero-order streams appear on more detailed maps but not the 1:100,000-scale map). Stream conditions were compared between MBSS sites that drained catchments with few or no zero-order streams versus those sites draining various lengths of zero-order streams. The presence of intact headwaters, as demonstrated by healthy downstream biological communities, should be a guidepost for new-generation stormwater solutions.

Mark Southerland, Ph.D., PMP, CSE, is the Director of Ecological Sciences and Applications for Versar, Inc., and has been supporting federal, state, and local water quality programs since 1988. He was the lead author of the EPA national program guidance on biological criteria and has been the lead consultant on the Maryland Biological Stream Survey for the Maryland Department of Natural Resources (DNR) since 1993. He also supports the impaired waters, stressor identification, and TMDL programs for the Maryland Department of the Environment (MDE). Mark currently serves as chair of the Maryland Water Monitoring Board and is a founding original member of the Howard County Environmental Sustainability Board.

Brook Trout Declines with Land Cover and Temperature Changes in Maryland

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We examined the influence of landscape alteration and in situ stream habitat variables on brook trout by using a landscape-scale, space-for-time substitution analysis and a smaller data set that tracked long-term changes in land use over time. Forested land cover within a catchment was the overall best landscape-scale predictor of brook trout occurrence at a given site; measures of impervious land cover and urbanization were also important predictors. Brook trout were almost never found in watersheds where impervious land cover exceeded 4%, as assessed from the 2001 National Land Cover Dataset (2001 NLCD); the single exception was in a stream that displayed consistently low water temperatures. Landscape scale analyses indicated that increases in water temperature and erosion were associated with increasing percentages of urbanization and imperviousness and decreasing percentage of forested land cover. Three of six brook trout populations that were followed over time were extirpated within the last 15 years (between 990 and 2005), coinciding with increases in urbanization and impervious land cover. At these sites, water temperatures were substantially greater than at the three sites with extant brook trout. Land use amounts derived from high-resolution aerial photography showed substantially greater amounts of urbanization and particularly impervious land cover than did amounts derived from the 2001 NLCD. The differences in measured land cover between imagery types warrant caution when stating upper threshold limits of land cover, because use of imagery methods interchangeably may produce inconsistent results. Our findings suggest that brook trout are very sensitive to landscape alterations in Maryland and disappear at low levels of impervious land cover regardless of the specific mechanism involved.

Scott Stranko has worked as a biologist at the Maryland Department of Natural Resources on the Maryland Biological Stream Survey since 1994.

Methods for Estimating the Impact of Impervious Surfaces on Streamflow in the Chesapeake Bay Watershed

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Coauthor: Peter Claggett

There is no debate that urbanization has fueled an increase in impervious surface (IS) land cover in the Chesapeake Bay region. Research has demonstrated that as watersheds become more developed with impervious surfaces, streamflow becomes "flashy" as evidenced by higher and shorter duration peak flows in response to precipitation events. However, other factors impact streamflow responses to precipitation events including: watershed dimensions, topography, geology, soils and vegetation, and structures in the stream channel. Moreover, recent studies have shown that impervious surfaces that are hydrologically connected to streams via proximity or storm drains disproportionately impact streamflow responses to storm events. The objective of this study is to evaluate the impact of impervious surface connectivity on streamflow response to moderate storm events throughout the Chesapeake Bay watershed with the ultimate goal of developing impervious surface weighting factors that can be used to better calibrate regional-scale watershed models. This study will examine a variety of metrics for assessing streamflow response to storm events including the Richards-Baker flashiness index and flow duration curves. After evaluating general relationships and trends, outliers will be examined to identify other important factors impacting streamflow responses to storm events.

Quentin Stubbs currently serves as a Land Use Analyst (Intern/SCEP) in the EGSC - Chesapeake Bay Program Office in Annapolis, MD. His research in CBPO focuses on analyzing the impacts of land use land cover change, urbanization, and coastal development on hydrogeomorphological conditions in the Chesapeake Bay Watershed. His current workload includes designing a research strategy to analyze the impact impervious surface development on stream flow; conducting quality assurance and quality control evaluations for a cutting edge remote sensing, GIS software tool; and, serving on a Steering Committee for the Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC). He is currently a doctoral student in the Geography Department at the University of Maryland - College Park. He has earned a MPA from Columbia University in Environmental Science and Policy as well as BBA in International Business from Mercer University.

Chemical Exposure and Cancer in the Mummichog: Using Histopathology and Sediment Chemistry to Measure Remediation Success

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The mummichog, Fundulus heteroclitus, inhabits estuaries from Nova Scotia, Canada to northern Florida. Local sub-populations however, are thought to be non-migratory, making them effective bioindicators of local environmental integrity. Surveys of mummichogs in Virginia and Maryland have identified high prevalences of liver and other cancers in some estuaries, particularly those that are chemically contaminated. In the Elizabeth River, Virginia, these pathologies track a sediment-PAH gradient, with highest tumor prevalences occurring in fish inhabiting creosote-contaminated sites. In contrast, liver lesions are at background levels in the more residential stretches of the river. We have conducted long-term laboratory exposures of mummichogs using 1) creosote-contaminated sediments, 2) reference sediments amended with specific PAHs of known and suspected carcinogenic potential and 3) a commercial fish feed amended with similar PAHs at concentrations based on measured levels in gut contents of mummichogs living in our most severely contaminated sites. A continuous year-long flow-through exposure conducted in an environmentally realistic fashion resulted in the development of altered hepatocellular foci and hepatic neoplasms, providing the first direct experimental evidence supporting a chemical etiology for liver carcinogenesis in wild fishes. The mummichog was recently adopted by the Virginia DEQ, the Elizabeth River Project and The Living River Trust to monitor environmental integrity and to measure environmental recovery following sediment remediation projects currently underway within the river. Preliminary findings suggest that using mummichog liver histopathology in conjunction with sediment chemical analyses will provide a critical tool for setting mitigation goals and assessing sediment remediation success in the future.

Dr. Vogelbein is a Professor of Marine Science in the Dept. of Environmental and Aquatic Animal Health, at the Virginia Institute of Marine Science, The College of William and Mary. He received his Ph. D. in Veterinary Medical Sciences from the LSU School of Veterinary Medicine and currently conducts research on diseases of aquatic animals. He currently has funded research projects investigating the relationship between PAH exposure and cancer in fishes, the epizootic of mycobacteriosis affecting Chesapeake Bay striped bass, and emergence of the toxic HAB species, Alexandrium monilatum in the southern Chesapeake Bay.

Protecting Human Health through Monitoring of Algal Toxins in MD

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Some algal species can produce chemicals that are toxic to humans. Two groups of concern regarding human health in Maryland include bluegreen algae, specifically Microcystis aeruginosa, and dinoflagellates such as Dinophysis acuminata. Microcystis can produce the liver toxin microcystin. Microcystis is only harmful through direct contact, either through skin contact or ingestion of water containing the algae and toxins. Direct detection of microcystins was first documented in MD in 2000, although there were reported human health cases in 1930s and 1970s, plus a history of blooms. Since then, no contact advisories have been put in place each year when toxin levels exceed World Health Organization thresholds. Neurotoxins, produced by other species of bluegreen algae, have also been documented at low levels in MD. Dinophysis produces toxins that are accumulated in shellfish and can lead to diarrhetic shellfish poisoning (DSP) if contaminated seafood is ingested. DSP is an emerging issue in the U.S, with the first shellfish harvest closures in 2008 (Texas) and the first human illnesses in 2011 (Washington State). In2002, the Potomac River was closed as a precaution during a significant Dinophysis bloom. Blooms have occurred in the Coastal Bays (2002, 2005, 2006, 2009, 2010, 2012), and in 2010 DSP toxins were detected. Toxin levels in Coastal Bays shellfish (ribbed mussels) were first tested in 2012, and exceeded the guidance level of 16 µg/100g OA- equivalents in the St. Martin River (a non-shellfish harvesting area). New management actions are needed to monitor shellfish for DSP in Maryland.

Ms. Wazniak is an environmental program manager for the Department of Natural Resources where she has worked for 15 years. She currently directs Coastal Bays water quality, phytoplankton and harmful algal bloom monitoring programs for the State.

Maryland Statewide Salt Management Plan, Best Practices for Snow and Ice Control

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The Maryland State Legislature passed two bills in 2010, House Bill 0903 and Senate Bill 0775 that required the establishment of a Statewide Salt Management Plan (SMP). The legislature tasked the Maryland State Highway Administration (SHA) in conjunction with the Maryland Department of the Environment with developing a road salt management best practices guidance document by October 1, 2011, for use by local jurisdictions and the state to minimize the adverse environmental impacts of road salt runoff in the state. These Best Practices for Salt Management cover the use of salt from its delivery, storage and handling at salt storage locations to its placement on highways during winter storms and to post storm cleanup operations. SHA met this directive by posting the SMP on its website in October 2011. The goal of the document is to provide a framework for highway agencies to deliver safe, efficient roadway systems during winter storms in a cost effective manner while recognizing their obligation to do so in the most environmentally sensitive manner practicable. This presentation will provide an overview of the SMP. It will also highlight some of the key areas of salt management and how SHA addresses them. Some of topics discussed will be levels of service, materials, state and hired equipment, winter operations strategies, training, data collection, and post-storm and post-winter analysis.

Russ Yurek has had a distinguished 35 year career with the Maryland State Highway Administration (SHA). Russ began his career as a maintenance worker, and worked various levels within a maintenance shop. He was the Resident Maintenance Engineer for Harford County, the Assistant District Engineer of Maintenance for the Baltimore Metropolitan Area, and has been the Director of the Office of Maintenance for past 15 years. He also served as the chair of the Maintenance Management System Task Force, and vice-chair of the Sub-Committee on Maintenance for the American Association of State Highway & Transportation Officials (AASHTO). Russ is currently the Maryland delegate for the Sub-Committee on Maintenance within AASHTO. Russ helped pioneer Managing for Results for SHA, and has led SHA in performance-measuring for maintenance and system preservation. Russ currently resides in Harford County with his wife and the 3 youngest of his 5 children. Russ recently became a grandfather. He enjoys hunting and fishing in-between his many remodeling projects as part of his extreme make-over of their personal residence.

MARYLAND WATER MONITORING COUNCIL

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POSTER ABSTRACTS

(Listed alphabetically by lead author's last name)

Conditions in the Patapsco River Following Removal of Simkins and Union Dams: Are They Suitable for Reintroduction of Eastern Elliptio?

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Dam removal is increasingly being employed to restore streams by reconnecting habitat, improving water quality, and aquatic communities. This is particularly true where dams block migratory fishes, of which some are hosts for unionid mussels in their reproductive cycle. Still, the effects of dams and their removal on mussels are poorly understood. We examined associations in host-fish (American eel) and physiochemical variables among dam removal sites in the Patapsco River, Maryland and other streams where Elliptio complanata was present and apparently absent. Although improving American eel passage was a main objective of the dam removal, their pre- and post-removal densities were comparable to densities of Piedmont streams with E. complanata. Using principal components analysis, we identified a subset of variables that accounted for 73% of the variation in abiotic conditions across sites with E. complanata. We then used the subset of variables to examine patterns across streams with and without mussels in comparison to pre- and post-removal sites. Habitat metrics best explained the variation (66%) in conditions across streams. Substantial overlap was observed among streams indicating that conditions in streams with E. complanata were not different from pre- and post-dam removal sites. Post-hoc comparisons using standardized PC scores further supported the conclusion that stream classes did not differ. We could not ascertain whether dam removal made Patapsco River conditions suitable for E. complanata because the variables we measured did not differ before and after dam removal (i.e., eels were already present) or when compared to streams with mussels. However, dam removal may allow eel density to increase further upstream where abiotic conditions may currently be suitable for E. complanata to a level necessary for recruitment.

Surface Mining Impacts at the Gene Level

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Surface mining of coal, including mountaintop removal mining (MTM), is an increasingly important form of mining in the Appalachian Basin. MTM results in increased ambient air particulates relative to underground mining, and together with the practice of valley filling, may pose a health threat to surrounding communities via exposure to MTM-impacted waters. Therefore, we investigated the effect of MTM-impacted waters on human kidney cells and found evidence of cellular changes. Samples taken from streams and privately owned wells near active West Virginia MTM sites were filtered by tangential flow ultrafiltration (TFU). Then cells were exposed to TFU water at varying concentrations. RNA was extracted and used for real-time PCR. Microarrays determined the relative abundance of specific RNA molecules within the cells as a measure of gene expression. Cyclin D1 (Ccnd1), a gene activated during cell division and DNA synthesis, was up-regulated at 2 out of 3 sites tested. The gene Ddit3 (DNA-damage inducible transcript 3) was up-regulated at all sites, indicating a response to DNA damage. Eukaryotic transcription factor 1 (E2f1), a transcription factor representing an early response to stimuli such as xenobiotics, showed up-regulation at one site. These are the first results to suggest that exposure to MTM waters may affect human cells at the gene level. The genes expressed indicate probable DNA damage and suggests that in some cases DNA repair or synthesis mechanisms are not functioning (down-regulation). Further investigations are needed to fully understand the potential for adverse human health effects on populations living near MTM.

Rognel Heights Storm Water Outfall Water Year 2011

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The Rognel Heights storm water outfall pipe in Baltimore is a small storm water-shed that has been monitored and sampled by the Baltimore Ecosystem Studies and USGS from 1998 to 2010. In October of 2010, CIES took over the management of the discharge measurements done in this pipe. In the 2011 water-year there were 119 stormflow events and ~50.5 inches of rain. This poster will chart the flow by storm and composite sample collection period, compare values of discharge between stage/velocity measurements and the USGS rating curve, and estimate run-off rates utilizing discharge versus rainfall as measured by the Baltimore Ecosystem Study Raingage Network managed by CUERE.

Updates to the U.S. Geological Survey StreamStats Web Application for Maryland

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StreamStats (http://streamstats.usgs.gov) is a GIS-based Web application that was developed by the U.S. Geological Survey (USGS) to provide information needed by others for water-resource conservation, planning and management activities, as well as for engineering design. StreamStats allows users to select data-collection station locations shown on a map and obtain previously published streamflow statistics, basin characteristics, and descriptive information for the stations. Users also can select any location along a stream to obtain the drainage-basin boundary, basin characteristics, and streamflow statistics for the location, estimated based on regional regression equations or based on the flow per unit area for nearby streamgaging stations. In addition, numerous tools allow searching the stream network upstream and downstream from user-selected points to identify and obtain information on points of interest, such as streamgages, water-quality stations, dams, and point discharges, as well as to trace flow paths and obtain stream channel and land surface elevation profiles. StreamStats was first made available to the public for the Gunpowder and Patapsco River Basins in Maryland in 2007. In 2010, StreamStats availability was expanded to cover about a third of Maryland in an area centered on Baltimore, and to add the ability to provide summaries of water use to users. In October 2012, StreamStats availability was expanded to cover all of Maryland. Estimates of peak-flow statistics can now be obtained for ungaged sites throughout Maryland using the newest available regression equations, whereas estimates of low-flow statistics and summaries of water use are available only in limited areas.

TMDL Compliance Planning at the Maryland Port Administration

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The Maryland Port Administration (MPA) is committed to the stewardship of the Chesapeake Bay. As part of that effort, MPA recently completed a Water Quality Management Plan (WQMP), with the goal of meeting NPDES MS4 permit requirements and pollutant load targets from the Chesapeake Bay TMDL. The plan included an inventory of existing stormwater controls; calculations of impervious area and treated area; calculations of existing nutrient and sediment loads; estimated pollutant reductions from existing controls using methods compatible with the Chesapeake Bay TMDL; feasibility analysis of potential stormwater retrofits and non-structural measures; recommendations for stormwater controls appropriate for MPA facilities; concepts and cost estimates for specific stormwater retrofits; and estimates of pollutant load reductions from recommended treatment measures. Results showed a significant amount of stormwater treatment already in place, sufficient to treat sixteen percent of the impervious area. Conventional retrofits were identified to provide treatment for an additional 28 impervious acres. Area-wide alternatives, such as catch basin filters, underground sand filters, or street sweeping, could meet the TMDL goals on site, but only through widespread implementation of the most costly options. Offsite mitigation was more cost-effective, but less certain from a regulatory standpoint. Moving forward, the MPA's primary challenge in meeting TMDL targets will be dealing with a single pollutant source sector: urban landside stormwater, and working within stringent site constraints to find successful approaches for pollutant reduction.

Analysis of Private Well Water Quality and Well Owner Education Program in Maryland: A Pilot Project

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Around 1 million Maryland residents use private wells for drinking water. However, private wells serving fewer than 25 people are neither regulated nor regularly tested for contaminants. With no required monitoring, little is known about testing performed by private well owners; knowledge regarding well maintenance and testing; and private well water quality. A prior knowledge needs assessment survey was used to capture current knowledge of Cecil County private well owners. Trainings were conducted on collecting well water samples, interpreting water testing results, and addressing high contaminant levels. Twenty-seven well water samples were collected from private homes in April 2012. Samples were analyzed for total and fecal coliform bacteria, E. coli, Enterococcus spp., and Salmonella using membrane filtration. Nitrates, total dissolved solids (TDS), and pH were measured using commercially available kits. Total arsenic was analyzed by the Maryland Department of Health and Mental Hygiene using inductively coupled plasma mass spectrometry. Total and fecal coliforms were identified in 11.1% and 18.5% of all well water samples. No E. coli or enterococci were identified in any samples. Arsenic concentrations for all samples were below 0.002 ppm. The average nitrate concentration in samples was 3.1 mg/L. The majority of private well water samples from Cecil County, MD were below EPA maximum contaminant levels for total and fecal coliforms, E. coli, nitrate, and arsenic. Most of the well water samples were also below secondary contaminant levels for TDS and pH. A key aspect of this project is the collaboration between Extension educators and UMD researchers.

Preventing Point Source Pollution in an Urban MS4: Status of the Cecil County Illicit Discharge Detection and Elimination Program

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Illicit discharges are discharges not composed entirely of stormwater and can consist of sewage, carwash and laundry wastewater, improper disposal of auto and household toxics, and broken pipes. In urban settings illicit discharges often go unnoticed and can be persistent and large contributors of a broad range of pollutants in streams. They lead to increased levels of heavy metals, toxics, solvents, nutrients, and bacteria in watersheds. EA Engineering, Science, and Technology (EA) is conducting an illicit discharge detection and elimination (IDDE) program to decrease point source pollution of contaminants into streams and rivers in Cecil County. EA performs outfall evaluations to determine structural condition and presence/absence of flow. If flow is present, water quality screening, source tracking, and follow up monitoring are performed. Source tracking consists of tracing the upstream flow to identify pathway and origin; water quality testing is performed to confirm type and source of discharge. EA inspected over 100 sites and reported at least 8 instances of confirmed or possible illicit discharges containing chlorine, ammonia, phenols, and/or detergents. Illicit discharges were tracked to sources including a broken water main, sewage pipes, and illicit connections to residential sump pumps. The Cecil County Department of Public Works coordinated with municipalities and individual homeowners to repair a leaking water main and update outdated sewage systems to eliminate the confirmed illicit discharges. Cecil County and EA have participated in eliminating contaminants entering the Chesapeake Bay and its watersheds by detecting and eliminating illicit discharges into streams and rivers.

Chesapeake Bay FieldScope

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Chesapeake Bay FieldScope is an online geographic information system (GIS) used to engage citizen scientists and students in the health of the Bay and its watershed. FieldScope allows users to collect water quality data from the Bay and its tributaries, then display the data and photographs they have collected alongside real-time data from NOAA's Chesapeake Bay Interpretive Buoy System and other continuously-updated water quality monitors. Citizen scientists also can apply their findings to the broader context of the watershed's health by displaying map layers that include both human and physical geography features, such as state boundaries, land cover, and watershed boundaries. Graphing features allow users to visualize data, and compare information from various locations and data sources for analysis. FieldScope aims to connect a community of learners through collaborative data sharing, and to help users understand the interconnected relationship between human societies and the natural world.

Rare, Threatened, and Endangered Odonate Fauna of Two Watersheds in the Lower Potomac River Drainage, Maryland

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Sixty percent of Maryland's odonate species are considered Rare, Threatened, or Endangered (RTE). To prioritize areas for the protection of biodiversity, the Maryland Department of Natural Resources (MD DNR) has identified 10 watersheds with the highest rates of occurrences of imperiled and rare stream species, including odonates. We examined the odonate fauna of two of these conservation priority watersheds to determine the distribution and status of several imperiled odonate species in Maryland. Odonate nymphs collected from 2000-2009 from two Lower Potomac River drainage watersheds, Zekiah Swamp Run and Breton Bay, by volunteers and MD DNR's Maryland Biological Stream Survey were identified to species, when possible. Eight RTE species were collected in the Zekiah Swamp Run watershed and six were collected in the Breton Bay watershed. These data detail the distribution and habitats of rare odonates in two priority watersheds in Maryland and will be critical to the conservation and management of these species and their habitats.

Urban Stressors for Pesticide Endangered Species Assessments: Should Recent Nutrient TMDLs and Laws be Considered?

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During 2000-2002, the US EPA proposed new, stringent nutrient criteria under the Clean Water Act (CWA). Pursuant to §303(d) of the CWA, state agencies have designated more than 41,000 of their surface water bodies as "impaired." Approximately 16,000 waters are impaired by nutrient-related pollution. Consequently, many TMDLs (total maximum daily loads) and state and local laws have recently been promulgated that target nutrients and the related parameters suspended sediments, dissolved oxygen, chlorophyll a, and temperature. Pesticide endangered anadromous fish assessments conducted by NOAA routinely list nutrients and temperature in urban and other environments as stressors that justify conservatism in their assessments. Full implementation of nutrient-based TMDLs would directly reduce the risk of eutrophication, which directly relates to dissolved oxygen concentrations. TMDL implementation can indirectly reduce urban runoff temperature increases as a result of vegetated BMPs. Thus these stressors can be reduced. A confounding factor is increased urbanization. Our initial focus on the Chesapeake Bay watershed and Florida is being expanded.

Forest Harvesting Best Management Practices in Maryland

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Forest harvesting in Maryland is required to use best management practices to avoid water quality impacts. BMPs are widely used in practice, with over 81% implementation rates statewide. When the 20% highest risk harvest sites were assessed in 2004 and 2005, BMPs were 77% effective in avoiding sediment in the waterways. Maryland requires that best management practices (BMPs) be used on forest harvest sites to avoid adding sediment or other pollution to streams and waterways. Common BMPs include streamside management zones, restrictions on roads or skid trails on steep slopes, use of water bars, stabilized harvest entrances, and limits on locating landings and haul roads. The USFS Northeastern Area Forest Harvesting BMP Assessment Protocol was used to gauge the effectiveness of the required BMPs. Over 90% of harvest sites between 2003 and 2005 avoided stream crossings, the most common source of sediment. For sites with stream crossings or streamside management zones, we saw 81% compliance with correct application of BMPs. Those BMPs were 77% effective in avoiding sediment in waterways on these higher risk sites. Of the 48,000 feet of streamside management zones assessed, sediment was observed entering the buffer at 39 locations and reached the stream in 6 of those; buffers effectively filtered 85% of the sediment trails and greatly reduced volumes of the transported sediment.

Patapsco River Dam Removal Study: Assessing Changes in American Eel Distribution and Abundance

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The Maryland Biological Stream Survey (MBSS) in collaboration with American Rivers, NOAA, and the DNR Fisheries Service, is performing biological monitoring in the Lower North Branch Patapsco River as part of the removal of Simkins, Union and Bloede dams. One goal of this project is to determine the potential impacts of dam removal on the distribution and abundance of American eels (Anguilla rostrata). Sampling was conducted at twenty-six sites in spring and summer of 2009-2012 in an attempt to fully assess the changes to the eel population in the river after the dams were removed. Removal of Union Dam was completed in September of 2010 and the removal of Simkins Dam was completed in January 2011. The feasibility of removing Bloede Dam (the downstream most dam) is currently under investigation. American eels were present at all twenty-six sites. Overall, abundance decreased with increasing distance upstream while average eel size increased. In the two years following the removal of Union and Simkins Dams, eel abundance decreased directly below Simkins Dam, and the average size of American eels decreased at sites upstream of the dam. It is not known at this time whether these changes are due to habitat changes related to disturbance from the dam removal project or to changes in eel distribution following the removal a migration barrier. Continued monitoring is needed to determine the full impact of the Union and Simkins Dam removals on American eels in the Patapsco River, as well as impacts that the impending removal of Bloede Dam is sure to have.

Suspended Sediment Export from Parkers Creek Watershed; a Heavily Forested Area with a Tidally Influenced Creek

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Parkers Creek is a small tributary located in Calvert County, Maryland with headwaters beginning south of Prince Frederick and emptying into the western shore of the Chesapeake Bay along the Calvert Cliffs formation in Port Republic. This sub-estuary contains many distinct ecological zones including forests, beach, fresh and saltwater wetlands, and adjoining bayside cliffs. The area is located on preserved land that is also in the fastest growing region of the Washington D.C. metropolitan area. Historically, the watershed experienced post-WW II (1940s) reduction of agriculture and recreational development with subsequent successional reforestation resulting in current forest coverage of 76%- up from a low of 13% recorded in A 1847 maritime chart. There are very few watersheds with this scale of forest cover in Chesapeake Bay. Having monitoring data from control locations along the relatively pristine Parkers Creek provides opportunities for comparisons to more impacted sub-estuaries. Here we present measurements of total suspended sediment loads at various scales in the Parkers Creek watershed for storm and baseflow events since 2011. We propose that such measures in relatively non-impacted watersheds can inform our assessment of the relative impact of climate change on coastal plain estuaries of Chesapeake Bay.

What is in Stormwater Runoff? Results from 500 Storms

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Since 1996, Versar has provided stormwater runoff monitoring support to several Phase I municipalities in Maryland and Virginia. Versar has successfully monitored nearly 500 storm events, yielding an informative long-term database of analytical concentrations for metals, nutrients, and suspended solids with which to characterize water chemistry. For selected jurisdictions, Versar has also monitored water chemistry during baseflow conditions. Monitoring locations include instream and end-of-pipe sampling sites. Additionally, since 2002, Versar has conducted BMP effectiveness monitoring for selected facilities in Montgomery County, MD, and Fairfax County, VA, which serves to illustrate "what may have been in stormwater runoff." Versar will present compiled results in time series, regression, or box plots.

Continuous Conductivity Monitoring in Maryland

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A Maryland Department of Natural Resources study is underway to characterize baseline stream conductivity in western Maryland streams prior to Marcellus Shale natural gas development. Conductivity measures the ability of water to pass an electrical current. An increase in cations and anions (i.e., salts), associated with contamination from Marcellus Shale natural gas activities, will be reflected in higher conductivities in affected streams. Conductivity is a good water quality parameter for detecting a variety of pollutants associated with natural gas extraction. New water quality monitoring technology is available, allowing for remote and continuous collection of conductivity measurements using data loggers. These data loggers can be placed in streams for extended periods of time to record stream conductivity at set intervals. Summaries of this initial baseline stream conductivity monitoring at 12 stations in Garrett County will be presented.

Responses of Stream Fish Assemblages to the Removal of Simkins Dam in the Patapsco River, Maryland

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The removal of a dam changes flow patterns, water temperature, channel geomorphology, riparian vegetation, substrate composition, and other physical and chemical properties of a river. Such changes can have negative and positive effects on fish assemblages, especially those assemblages in areas immediately upstream and downstream of the dam. The Maryland Biological Stream Survey conducted quantitative surveys of fish assemblages at seven sites in the Patapsco River mainstem before and after the removal of Simkins Dam (early 2011). We documented changes in species richness, assemblage composition, fish density and biomass, and game fish abundance and size structure. Erosion of sediment from previously-impounded upstream reaches and aggradation of sediment in areas below the dam caused observable changes to the quality and quantity of fish habitat in these areas. Changes in fish assemblages (e.g., decline in benthic species, reduced fish density) were most evident in downstream reaches where fine sediments reduced habitat heterogeneity. Future monitoring efforts will determine if these adverse impacts attenuate with time as fine sediments are transported out of the study reach and the geomorphology of the river stabilizes.

Zinc in Drinking Water: the Connection to Learned Fear

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Previous work on mice has shown the important function of zinc (Zn) in the amygdala, the area of the brain involved in the perception of fear. We have previously shown that long-term exposure to elevated Zn in drinking water can alter the levels of this metal in rat brain, and that this increase is associated with impaired learning and memory. Here we report a series of behavioral experiments in rats that consistently show that increased Zn in drinking water can cause impaired fear extinction, i.e. the ability to learn that a stimulus no longer predicts fear. Rats were dosed both pre- and post-natally on 10 ppm Zn as ZnCO3 in drinking water for four months. Rats were then exposed to a tone paired with a shock to condition a fear response. One day after training, rats were given a series of tones presented without shock, to extinguish the fear. Those raised on Zn froze significantly more during the tone presentation than rats raised on tap water (controls), indicating an impaired ability to extinguish the conditioned fear. When exposed to the tone in a different environment the rats again froze more, compared to the controls. Rats raised on Zn, but given a longer extinction training, again showed significantly more freezing to the tones than controls. Furthermore, the level of Zn in the blood was related to the ability to extinguish fear, with high levels showing impairment. These results associate elevated Zn with poorer extinction of learned fear and may have implications for understanding conditions such as post-traumatic stress disorder.

Factors Influencing Blooms of *Sphaerotilus natans* in the Lower Jones Falls

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The objective of this study was to determine the factors responsible for an ongoing filamentous bloom of *Sphaerotilus natans* on the Lower Jones Falls. Physical data, nutrient data, benthic invertebrate samples, and bacterial samples collected were taken at regular intervals at sites upstream and downstream of the location during summer 2012. At the site exhibiting S. natans filamentous bloom growth, dissolved oxygen and pH were significantly lower than at upstream and downstream sites. Between sites, no significant differences were found for nutrients or bacterial counts, although there was a strong non- significant trend for Enterococcus counts that were higher at both downstream sites, possible indicating sewage infiltration between the upstream site and the S. natans site. The pH levels were significantly lower at the S. natans site than the other two sites. This is important because the pH levels observed at the site containing the bloom are in the optimal range for S. natans growth. There was a significant temporal difference in the Hilsenhoff Biotic Index for benthic samples, although no significant differences between sites were observed. All scores improved in the later sample, in part due to lower numbers of pollution intolerant invertebrates such as Oligochaetes and Chironomids. Anecdotal observations at other sites during the course of the study found emergent S. natans blooms at heavy infiltration of sewage. This implicates that S. natans is present throughout the Jones Falls and that sewage, pH, and dissolved oxygen are correlated with periodic blooms.

Monitoring Acidification and Carbonate Chemistry Dynamics in Chesapeake Bay and Other Coastal Ecosystems

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Because of their relative shallowness and reduced salinity and alkalinity, coastal marine habitats and estuaries are inherently less buffered to changes in pH than is the open ocean. This makes coastal systems more prone to CO2-induced changes in pH. Coastal systems also have more complex carbon cycles than the open ocean, which maintains an air:sea equilibrium in its surface waters. Ecosystem metabolism (e.g., benthic respiration and photosynthesis) strongly influences day:night cycling and seasonal carbonate chemistry dynamics, while tidal/circulation patterns are important drivers of land:sea interactions that can affect chemistry at local scales. Our group has developed instrumentation that enables real-time measurements and logging of pCO2. Working in the Rhode River (Edgewater, MD), we have documented carbonate chemistry dynamics intensively during the past year and see striking patterns of temporal and spatial variability in pCO2. Despite the natural variability in pH and pCO2, increases in atmospheric CO2 may well generate a shifting ecological baseline, much more complex than is expected in the open ocean. To date, few studies have focused on measuring and understanding the complicated nature of carbonate chemistry dynamics in coastal systems, especially at spatial and temporal scales that are ecologically relevant to the biota that inhabit them. Such investigations will be critical for understanding the process of coastal acidification, but also have the potential to inform natural resource managers regarding habitat and fisheries restoration (e.g., which locations/conditions may be more or less favorable for oyster survivorship and growth).

Using DNA Barcoding to Identify Hydropsyche Species in the Patapsco Lower North Branch Watershed - STUDENT POSTER

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DNA barcoding can be used as a diagnostic technique for species identification using a short, standardized DNA. In this research, we used DNA barcoding to identify caddisfly larvae to species using the mitochondrial cytochrome oxidase gene (mtCOI). The purpose of this research was to (1) examine Hydropsyche species or genotypes present in the Patapsco Lower North Branch Water Watershed and (2) identify the seven Hydropsyche molecular operational taxonomic units (mOTUs) from Pilgrim (2011) to species using Genbank submissions. Twenty-three caddisfly larvae were collected from Herbert Run, Bull Run, and Santee Branch and stored in 95% ethanol. DNA was extracted from 10-20 mg of abdomen tissue, and the COI gene was amplified by polymerase chain reaction with universal primers. Of the 23 specimens processed for DNA analysis, 12 specimens (52%) yielded COI sequences that were approximately 700 base pairs (bp) in length. An initial BLAST search of the full length 700 nucleotide sequence of one of our specimens revealed 72 hits that were all in the genus Hydropsyche confirming that our PCR product was indeed what we expected. Preliminary results from barcode analysis with Hydropsyche species from GenBank revealed the existence of at least two genotypes of Hydropsyche betteni in Herbert Run, Bull Run, and the Santee Branch. In addition, we identified caddisfly larvae belonging to genus Neophylax (Uonidae) in the Santee Branch.

Using Benthic Macroinvertebrates for the Identification and Conservation of Coldwater Lotic Habitats in Maryland

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Water temperature is an important abiotic factor that influences the distribution of aquatic species due to its influence on biological processes. Species can be categorized as cold, cool, or warmwater when temperature requirements for each are defined. The identification of coldwater species can be used by states to develop water quality standards intended to protect and maintain the quality of surface waters. Many states focus exclusively on salmonid fishes to identify coldwater habitats; however, benthic macroinvertebrate communities can accomplish the same goal. There is a paucity of information in the literature regarding temperature preferences and tolerances for benthic macroinvertebrates. The Maryland Department of Natural Resources analyzed benthic macroinvertebrate and stream temperature data at 1140 sites statewide to empirically derive a list of temperature sensitive indicator organisms that can be used to identify coldwater lotic systems. We will present the methods used to identify these coldwater taxa, provide information on the ecology of these organisms, and illustrate how these benthic macroinvertebrates can be used in Maryland to conserve coldwater habitats by affording them the required thermal protection through a regulatory framework.

Quantifying Microplastics in the Chesapeake Bay - STUDENT POSTER

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Coauthors: Elizabeth Friedel and Lance Yonkos

Discovery of plastics during the middle of the last century has led to the manufacture of numerous inexpensive and disposable commodities now in common use. Once believed to degrade into simple compounds and eventually "disappear" in our environment, there is increasing evidence showing otherwise. Plastics entering the environment are reduced physically to an extent that they become imperceptible to the naked eye yet in total mass are not significantly reduced. Thus, more and smaller plastics particles occupy various environmental compartments. These microplastics, defined as measuring between 0.3mm and 5.0mm, are now a contaminant category of concern for aquatic ecosystems. Materials may be toxic themselves or allow adsorption of other toxic substances. There is also the possibility that filter-feeding organisms might ingest these microplastics thus introducing them to the aquatic food web. For the current study waters of the Chesapeake Bay, within Maryland, were sampled with a manta net for appropriately sized microplastics. Triplicate samples were collected on five occasions between July and December 2011 from four estuarine systems (Corsica, Magothy, Patapsco, and Rhode rivers). Samples were "cooked" in hydrogen peroxide and subjected to hyper-saline density separation to isolate plastics particles. Results are reported as mass of microplastics per volume of water sampled (a surrogate for concentration). Of sixty samples collected only one contained no microplastics. Mass, size, and variety of plastic constituents varied substantially between river systems and sample dates, but were generally consistent between replicates. Samples with the highest concentrations were in the low ng/L (PPB) range.

Utilization of New Technology with the Maryland Biological Stream Survey

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Since 1994, the Maryland Biological Stream Survey and Stream Wader Volunteer Monitoring Program have collected biological, chemical, and physical data from over 10,000 sites in non-tidal freshwater streams across the State. Management, quality assurance, and dissemination of this vast amount of data present a considerable challenge. In recent years, MDNR has moved from a paper-based approach (Old Method) to a digital (New Method) data collection and management process. Improvements in technology and mapping allow us to streamline the data path from start to finish. This new approach has improved the exhibition of these data to professionals and the public, while our new StreamHealth website provides an easy method to view the conditions of Maryland streams.

The Maryland Biological Stream Survey

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The Maryland Biological Stream Survey (MBSS) was started by the Maryland Department of Natural Resources in 1993 as a small pilot study in three watersheds. In 1994, the study was expanded as a statewide demonstration project. As of today, there have been three complete statewide surveys, or "rounds" conducted across Maryland. The MBSS was Maryland's first probability-based random design stream sampling program. It provides unbiased estimates of stream conditions within large river basins, medium-sized watersheds, and the entire State. The MBSS was designed to be a cost-effective way to characterize Maryland's 15,000 miles of small freshwater non-tidal streams. The third round of statewide random sampling concluded in the summer of 2009. Since then, MBSS sampled targeted areas around the state, as well as sites related to other research. This includes studying the influx of high flows due to heavy summer rains, assessing stream restorations,and monitoring the status of rare aquatic species. This year, MBSS will conduct special project sampling and produce reports based on the data collected from 2007-2009. The fourth statewide round will start in 2013 or 2014.

Evaluation of Groundwater Nitrate Levels at a Conservation-Managed Coastal Plain Farm in the Choptank River Watershed, Talbot County, MD

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The Environmental Protection Agency (EPA) has listed the Choptank River as impaired for nutrients. The excessive nutrient loading fuels algal blooms that increase turbidity and decrease dissolved oxygen. Nitrogen is the major source of impairment, with approximately 73% of the nitrogen delivered to the Choptank River from non-point source pollution (e.g. agriculture). Groundwater is the primary source of nitrogen to streams and encompasses on average, 52% to 85% of the total volume of water in Eastern Shore Coastal Plain streams. The Choptank River watershed is roughly 1813 km2, 60% of which is in agriculture. A recent United States Geological Survey (USGS) study found increasing nitrate loads to the Choptank River. In order to reduce groundwater nitrate loading, we must first understand how land use changes influence groundwater nitrate loads spatially and temporally. This study looks to evaluate whether conservation practices implemented on land previously used for high intensity row crop agriculture has affected groundwater nitrate, and how those changes occur over time. The results from this study will provide information about the lag time between the implementation of conservation practices and the return of groundwater nitrate to baseline levels. Application of these results will directly impact best management practices.

Seasonal Changes of In-stream Nutrient Removal in St. Mary's Run - STUDENT POSTER

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The world's streams and rivers are increasingly being threatened by nutrient pollution as excess nutrients can alter stream ecosystems and can be transported downstream into larger systems. This project examined seasonal changes in nutrient concentration in St. Mary's Run (SMR) downstream of a wastewater treatment plant (WWTP) discharge. Stream sampling done in June, July, September, and October was conducted at six sites along SMR. Stream water was analyzed for conductivity, dissolved reactive and total P, ammonium, nitrate and sulfate. Nutrient concentrations were used to determine if SMR is acting as a nutrient "source" or "sink". The WWTP dramatically increased DRP, TP, and nitrate immediately downstream of the discharge on all dates but only ammonium on some dates. July had the greatest increase in DRP, TP, and nitrate while September had the greatest increase in ammonium just after the WWTP. Nutrient levels decreased as the distance from the discharge increased demonstrating the stream's capacity to process excess nutrients. Ammonium concentrations returned to upstream levels on some dates; however, nitrate and phosphorus levels did not return to upstream conditions. SMR is still a "sink" for nutrients because the amount exported is less than the amount of input.

A Powerful New Tool for Visualizing Water and Habitat Quality Data

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In the summer of 2012, the Maryland Department of Natural Resources was invited to participate in the Research Experience for Undergraduates (REU) Program hosted by the Department of Mathematics and Statistics at the University of Maryland Baltimore County (UMBC). This interdisciplinary program in high performance computing aims to provide students with the opportunity to apply high performance computing and statistical methods to real-world problems. As part of this collaboration, a Graphical User Interface (GUI) was developed using the R statistical programming language. This interactive software, which can be used to graphically view water quality data in a number of different ways and to calculate formal statistical results for status and trends analyses, provides scientific researchers and the general public with a powerful new tool to aid in the understanding of water and habitat quality data.

An Overview of Ecological Monitoring Associated With Patapsco Dam Removal

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Although Bloede dam (located downstream from Simkins and Union dams) is still a barrier to migratory fish movement, the removal of Union and Simkins dams is expected to provide benefits to the Patapsco River ecosystem by improving the connectivity of the river for the unimpeded movement of resident fishes. However, because these dams were removed without first removing the sand, gravel, and sediment from behind them, physical habitat substantially changed in the river as this material moved downstream. The Department of Natural Resources Monitoring and Non-Tidal Assessment Division conducted monitoring to assess the ecological impacts of restored connectivity and of habitat changes to the ecology of the Patapsco. Ecological monitoring was conducted before and after dam removal. There are six aspects of the Patapsco River's ecosystem that were examined. These include migratory fish, American eels, resident fish, benthic macroinvertebrates, freshwater mussels, and water quality. Resident fish, eel, freshwater mussel, and benthic macroinvertebrate data were collected at 21 non-tidal sites using standard Maryland Biological Stream Survey protocols. Five other sites, primarily located in the tidal portion of the river, were sampled once per week during the spring anadromous fish spawning migration (March -- May) to determine the extent of spring migratory fish runs. Water quality data that were collected monthly from January 2000 -- December 2011 by Maryland DNR's Core Trend Program were examined to look for patterns coincident with dam removals. We hope the conclusions and recommendations from monitoring associated with the removal of Union and Simkins Dams will be useful in guiding continued Patapsco River restoration efforts and for other attempts to restore river connectivity in Maryland and elsewhere.

Regenerative Stream Conveyance (RSC) as an Approach to Restoration of Ecosystem Services

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Many zero, 1st and 2nd order channels have been degraded by urban runoff. In addition to the sediment and nutrient loading, their degradation has resulted in the reduction of important habitat as well as ecosystem services. The use of stream and wetland restoration techniques, applied with a focus towards enhancing/restoring ecosystem function, suggests we can make significant positive contributions to the quality and quantity of our coastal resources and improve the quality of life in our local coastal communities. In ephemeral or intermittent drainage channels, this approach includes the use of a carbon-rich granular substrate (e.g., sand to gravel with 20% V:V shredded wood) to fill the eroded channel, a series of constructed pools and riffle weirs to provide non-erosive conveyance, and on-grade seepage wetlands to capture and treat the pulsed storm water runoff. In perennial streams, the incised stream channel is raised (where feasible), to reconnect peaky urban discharges to the adjacent riparian/floodplain corridor through the placement of boulder and riffle grade controls. In addition, riparian/floodplain storage is increased through the construction of on-grade seepage wetlands. To date, monitoring and research have documented the positive effects on urban hydrology (i.e., reduced peak discharge, increased flow concentration time), water quality (i.e., sediment and nutrient discharge load reductions), habitat (e.g., species diversity and density), quality of life (e.g., increased usage), as well as other metrics of ecosystem services (e.g., groundwater supply). Generally, this ecological engineering approach costs a fraction of the standard engineering approach (i.e., drop structures, pipe, concrete outfalls).

Fish Passage Program & Patapsco River Restoration

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This poster will give the viewer an overview of the Fish Passage Project including its mission, goals, recent accomplishments and future priorities. The poster will highlight recent work done on the Patapsco which compliments work being done by other programs.

Technologies Used to Conduct a Spatially Intensive Survey of Stream Temperature

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Water temperature can be highly variable over the length of a stream. Both point and non-point source discharges can affect stream temperature and various other water quality parameters. Locating groundwater discharge areas spatially along a body of water can help focus resources for either remediation or preservation. However, non-point source discharge zones, such as groundwater seeps, can be difficult to locate in surface water over broad spatial scales. Therefore, this presentation will highlight technologies that can be applied to identify areas of non-point source discharge of groundwater into streams, using temperature contrasts. Measuring water temperature over a variety of spatial scales can be achieved with hand-held and boat- and airplane-mounted devices. Hand-held Forward Looking Infrared (FLIR) cameras provide detailed water-temperature information for smaller areas, such as stream banks. For broader areas, the U.S. Geological Survey (USGS) has developed a radio controlled boat that is capable of taking a variety of water-quality parameters, including temperature. In addition, the USGS has acquired a fleet of Unmanned Aerial Vehicles (UAV) equipped with both visual and infrared camera capabilities. The UAV Raven* is a fixed wing aircraft, with a 4 foot wingspan, that can record infrared video over a large area. The UAV T-Hawk* is a hovering aircraft that can remain in one area and take more detailed infrared images, but on a smaller areal extent than the Raven. Collectively, the capability exists to efficiently survey stream temperature over a broad spatial scale.
*The use of product names in this abstract is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Nanticoke River 2011 Report Card: Community Outreach

Beth Wasden
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In 2012, the Nanticoke Watershed Alliance created its third Nanticoke River Report Card. Using data collected by volunteer Nanticoke Creekwatchers, the report card follows EcoCheck's standard report card format and provides easy-to-understand grades and explanations about the health of the river and its tributaries. Learn about the health of the Nanticoke and its creeks during the 2011 calendar year.

Maryland Stream Waders: Get Out, Get Wet, Get Involved!

Sara Weglein
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Beginning in 2000, the Stream Waders Program is a way for volunteers to help Department of Natural Resources (DNR) biologists assess the health of Maryland streams by increasing the density of sampling sites throughout the state. In order to participate, volunteers agree to attend one day of training and then spend about 2 days in the March-April sampling season collecting macroinvertebrate samples from streams in their area. Join the Maryland Stream Waders Program if you would like to take local action, help DNR biologists, meet other people interested in stream health, or learn more about life in Maryland Streams.

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MARYLAND WATER MONITORING COUNCIL

18th Annual Conference

December 6, 2012

ANNUAL AND STANDING COMMITTEE REPORTS

Maryland Water Monitoring Council
2011 Annual Report

2011 was another good year for the Council. The Board of Directors continued to guide the Council toward its goals and new members provided fresh ideas that helped move the Council forward. The Annual Conference set an attendance record of 370 and the MWMC website is snazzier than ever. Committee work continued in earnest, including outreach to local government planners; a plan to develop a new, online "data finder"; and new efforts to reach out to watershed associations. The Council enters 2012 with a renewed commitment to pursue the three Cs – Communication, Coordination and Cooperation - among water monitoring agencies and organizations throughout the State.

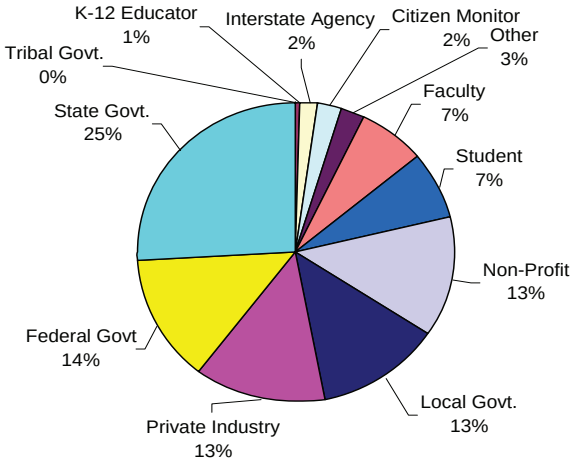
Board of Directors

Long-time MWMC Board member Keith Van Ness (Montgomery County) stepped down from his role as Board Chair and the Council welcomed its new Chair, Mark Southerland (Versar, Inc.). Megan Ward (Nanticoke Watershed Alliance) was unanimously approved as Vice-Chair. Sally Hornor (Anne Arundel Comm. College), Sue Veith (St. Mary's County), Charlie Poukish (MDE) all renewed for another three-year term. Sonja Schmitz (Comm. College of Balto. County) and Sandy Hertz (SHA) joined the Board in January. The Board acknowledged the efforts of outgoing members Bob Paul (St. Mary's College), and Dave Bolton (Maryland Geological Survey).

Outgoing Board member Bob Paul receives a Certificate of Appreciation from Chairman Mark Southerland.

2011 Annual Conference

The Annual Conference was once again held at the Maritime Institute in Linthicum and the 17th MWMC Annual Conference was bigger and better than ever. The event's theme was "Think Baywide, Act Streamside" emphasizing the Chesapeake Bay TMDL and the need to "work upstream" to help address the Bay's issues. Plenary speakers were Jeff Corbin (Chesapeake Bay Program) and Carl Hershner (Virginia Institute of Marine Science). Bill Stack received the 5th Annual Carl Weber Award. About 370 attendees attended sessions on such diverse topics as the intersection of NPDES and TMDLs, urban fishes, environmental justice, and the Federal Urban Waters Initiative. Fifty-two talks, 23 posters, ten vendors and 12 "special interest" exhibits all contributed to a diverse and well-rounded agenda.



MWMC 2011 Annual Conference attendee affiliations

MWMC on the Web

MWMC Webmasters Katherine Hanna and Luke Roberson continue to improve our web presence. They diligently update job announcements, conference and workshop events, Board and committee activities and links to agency and organizations monitoring water in Maryland and regionally. Additions to the website included 13 job postings, five conferences, and four miscellaneous announcements. The Annual Conference is well-covered on the site with the Conference Program, links to Power Point

presentations, and photos from the events. Users can find a talk of interest, click on the talk title in the Program, and download a complete pdf version of the presentation. Talks given at Board meetings, Board meeting agendas, and minutes are also available on the MWMC website. Find everything you wanted to know about the MWMC at www.marylandwatermonitoring.org.

Workshops

MWMC sponsored the Fourth Maryland Stream Monitoring Roundtable at the USGS Water Science Center in Catonsville. The goals of the February 25th event were to 1) discuss who is doing what, where, when and how; 2) avoid potential duplication of effort by sampling at the same stream site; and 3) facilitate data sharing. The Roundtable drew 19 participants from state, federal, and local agencies, watershed associations, and consulting firms. Prior to the gathering, presenters provided georeferenced site information to DNR to produce a statewide map of sampling sites in 2011. This map was displayed during the event so participants could examine site overlap, gaps, and sampling protocols to be used during 2011. For more information about the Roundtable, contact Dan Boward at dboward@dnr.state.md.us.

Committees

The Community Outreach and Citizen Science Committee was co-chaired by Michelle Dobson (Harford County), Sonja Schmitz (Comm. College of Balto. County), and Cathy Wiss (Audubon Naturalists Society). The Committee worked to improve the MWMC website during 2011. One goal for 2012 is to focus on certain target audiences: citizens, students, and colleagues, not only from Maryland but also from surrounding states, in an effort to learn from each other! The committee will also develop and post on the website feature articles from MWMC board members and post news and video clips from speakers from the annual conference, focusing on success stories. Learn more about the Committee by contacting Michele Dobson at mgdobson@harfordcountymd.gov.

Wayne Davis (US EPA) and Ed Doheny (USGS) co-chaired the new Information Management and Communication Committee. Committee members developed long-term goals for the new committee, including 1) exploring existing data management procedures employed in Maryland and developing recommendations for data management and quality assurance; 2) creating and maintaining an interactive Google Earth map of current and past monitoring activities that would replace the previously developed MWMC Clickable Map; 3) organizing and subsequently maintaining an inventory of data and metadata, on the web with appropriate contact information for all data sets and years of applicability; 4) developing and maintaining a database of reports and papers in PDF format on the web; and 5) and encouraging people in the local water resources community to make data and reports available online so they can be linked and maintained in the MWMC inventory. For more information, contact Dan Boward at dboward@dnr.state.md.us.

The Monitoring and Assessment Committee was co-chaired by Ron Klauda (DNR) and Jim Cummins (ICPRB). The Committee developed a questionnaire to the Directors of County Planning and Zoning Departments. The purpose of the questionnaire was to determine how water monitoring information is/is not linked with land use planning at the local level. The questionnaire was mailed to all County Planning and Zoning Department Directors and MD State Highway Administration staff in July. Five responses were received by the end of the year. Additional efforts to engage and get feedback from county and SHA staff will be made in 2012. For more information, contact Ron Klauda at rklauda@dnr.state.md.us.

Maryland Water Monitoring Council
Monitoring and Assessment Committee
2012 Annual Report

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Andy Becker	MD DNR
Jim Cummins	ICPRB
Sherm Garrison	MD DNR
Clark Howells	Baltimore City RNRS
Paul Kazyak	MD DNR
Ron Klauda	MD DNR
Cherie Miller	USGS
Rob Mooney	Sutron Corporation
Marian Norris	National Park Service
Doug Redmond	M-NCPPC
Mark Southerland	Versar, Inc.

2012 Accomplishments

A. Since the 2011 MWMC Annual Conference, the M&A Committee met on March 1, April 9, and June 4, 2012, to discuss committee plans for 2012.

B. Several members of the Committee attended the MWMC-sponsored Stream Roundtable held at the USGS office adjacent to the UMBC campus on February 9. The Roundtable was organized and moderated by Committee member, Andy Becker.

C. To follow-up the questionnaire that the Committee prepared and distributed to directors of County planning and zoning departments in 2011 and 2012, the Committee organized a session at the summer

MACo meeting held in Ocean City on August 15. Mark Southerland talked about the MWMC and also Montgomery County's Special Protection Area zoning efforts. Dave Brownlee talked about Calvert County's use of water monitoring data to guide their land use decisions. The lunchtime session was attended by about 45 people. Committee Co-Chair, Ron Klauda, and Committee members, Cherie Miller and Rob Mooney, also attended this MWMC-sponsored session at MACo.

D. With help from Committee members Andy Becker, Paul Kazyak, Rob Mooney, and Mark Southerland, Anna Baker and Ron Klauda co-chaired a workshop focused on "Water Resources Monitoring and Marcellus Shale Gas Development in Maryland: What Do We Need and What Do We Have?". Sponsored by the MWMC and held at Garrett College in McHenry MD, the workshop drew over 100 attendees. The Steering Committee is working to post speakers' power points and other information related to the workshop on the MWMC website.

E. Committee member, Doug Redmond, organized and will moderate a technical session "Don't Cut Off the Headwaters to Spite the Watershed" at the 2012 MWMC Annual Conference on December 6. He and Committee member, Mark Southerland, will present talks in this session.

F. Committee Co-Chair, Ron Klauda, and Committee member, Paul Kazyak, organized and will co-moderate a technical session "Marcellus Shale, Natural Gas, Water Quality, and People" at the 2012 MWMC Annual Conference.

G. Committee Co-Chair, Ron Klauda, and Committee member, Clark Howells, served on the 2012 MWMC Annual Conference Planning Committee.

2013 Goals

A. In late 2012 or early 2013, the M&A Committee will meet again to plan our activities for 2013. One topic to be discussed with be a possible workshop to be organized by the Committee on climate change.

B. At our next Committee meeting we will also talk about how best to follow-up with county planning and zoning staff to offer help from the MWMC to make better use of water monitoring data in their land use decisions.

Submitted by Ron Klauda, October 31, 2012

Maryland Water Monitoring Council
Information Management and Communication Committee
2012 Annual Report

Chair

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Tom Parham	Maryland DNR
Matt Rowe	Maryland Dept. of the Environment
Keith Van Ness	Montgomery County DEP
Bill Richardson	U.S. EPA
Wayne Davis	U.S. EPA

Committee Goals

The goals of the committee include (1) exploring existing data management procedures employed in Maryland and developing recommendations for data management and quality assurance; (2) creating and maintaining an interactive map of current and past monitoring activities, with appropriate contact information for all data sets and activities, that will replace the previously developed MWMC Clickable Map; (3) developing an inventory of web links where Maryland-related water-monitoring data, reports, and maps can be easily located online; and (4) encouraging people in the local water resources community to make data and reports available online so they can be easily accessed by the Maryland water-resources community.

2012 Accomplishments

1. Maryland DNR has begun work on an online mapping tool that that will be used to track current and past water monitoring activities in Maryland. The tool was demonstrated for the first time at the most recent MWMC Board of Directors meeting in October 2012 and after some revisions and testing, will be made available on the MWMC web site.

2. Ed Doheny and other IMC Committee members attended the Maryland Water Monitoring Council Stream Monitoring Roundtable held at the USGS Water Science Center Office in Baltimore in February 2012.

3. Wayne Davis (USEPA, and former member of the MWMC Board of Directors), Bill Richardson (USEPA), and Mark Southerland (MWMC Board of Directors Chairman) continued to explore potential resources and sources of funding for initiating a data finder pilot project for Maryland.

4. Wayne Davis gave a lunch time demonstrating of USEPA's existing online data finders at the April 2012 MWMC Board of Directors meeting.

5. The IMC Committee began investigating and compiling web links for online data resources, such as online water monitoring data, publications, and maps, from different government agencies with a goal of sharing the information on the MWMC web site.

6. Wayne Davis will be moderating a session at the MWMC Annual Conference on Environmental Information. Topics to be covered include an update from USEPA on "What's New in Water Tools" and "Better Public Access to Point Source Wastewater Pollutant Discharge Information".

2013 Goals

1. The IMC Committee would like to expand membership, particularly in the skill areas of Geographical Information Systems and web design.

2. The IMC Committee will work in collaboration with MD DNR to fully implement the new online mapping tool for use on the MWMC web site.

3. The IMC Committee, with help from the MWMC Board of Directors, will continue to seek resources and funding opportunities for a data finder project that would be piloted for Maryland and hosted on the MWMC website.

4. The IMC Committee will continue to compile online data resources and will begin posting an organized list of key web links on the MWMC web site.

Submitted by E.J. Doheny, October 26, 2012

Maryland Water Monitoring Council
Indicators Committee
2012 Annual Report

Organizer

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2012 Accomplishments

Environmental indicators are fundamental to the interpretation of water quality and our efforts to maintain or improve conditions. During 2012 we explored a limited number of water quality indicators to investigate the feasibility and utility of eventually organizing as many as possible into a central depository. This effort began by developing a categorical prototype of MDE water quality standards.

2012 Goals

The workgroup plans to meet on Thursday December 13th to further develop practical applications for the indicators spreadsheet. We are currently considering placing the list on a web server (or similar format) for the monitoring community. Other potential ideas include possibly embedding the list with specific water quality monitoring and regulatory projects- including the 303d List.

The general idea is to make established environmental indicators easily accessible, for practical use by all. The MWMC is actively seeking new members to become actively involved with this workgroup.

Submitted by Charles Poukish, October 31, 2012

Maryland Water Monitoring Council
Communication and Outreach Committee
2012 Annual Report

Co-Chairs

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Accomplishments

- Completed draft an on-line survey through survey monkey to reach out to Maryland watershed organizations so that the MWMC can better serve the citizen scientists.

Goals

- Distribute on-line survey to as many watershed organizations as possible.
- Post survey on MWMC website, make available at MWMC annual conference.
- Synthesize survey data and assess to meet needs of watershed organizations.
- Continue to build on and improve communication through the website
- Focus in on target audience – citizens, students, colleagues not only from MD but also from surrounding states – what can we learn from each other!
- Develop / include feature articles from MWMC board members and post news / video clips from speakers from the annual conference / success stories
- Include updated volunteer watershed organizations / what is available to citizens

Maryland Water Monitoring Council
2012 Board of Directors

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