MWMC

21st Annual Conference

Protecting the Source

Sustaining Maryland's Waters

November 13, 2015 • The Maritime Institute • Linthicum, Maryland

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The 21st Annual Conference of the Maryland Water Monitoring Council

Protecting the Source - Sustaining Maryland's Waters

The 2015 MWMC Annual Conference Planning Committee and I would like to welcome you once again to the 21st Annual Conference of the Maryland Water Monitoring Council. We are excited to have put together another great day of terrific speakers and breakout sessions providing insight into the ways in which the monitoring community has helped to protect and sustain Maryland's Waters. This year's conference theme "Protecting the Source- Sustaining Maryland's Waters" was selected to help make a connection between the efforts of the monitoring community to preserve and protect water quality and the benefits those efforts have made in sustaining our source water resources.

Often in the monitoring community it is all about fish, bugs and analyzing trends in water quality. We should also recognize how preservation efforts and monitoring benefit people, influence policy decisions and provide for the drinking water resources that support the citizens of Maryland. As they say, our next wars may be fought over water instead of oil. It is important for us to remember that high quality source waters not only benefits the fish and bugs but also our society, the economy and public health. Without our abundant source water resources, Maryland would not be the strong and vibrant state that we have all come to enjoy.

We are honored to have with us for the morning plenary session two fantastic speakers Rudolf S. Chow, P.E., Director of Public Works for the City of Baltimore and Peter Grevatt, Director, EPA Office of Ground Water and Drinking Water who will provide insight about the importance of our source water resources, provide some history of the Safe Drinking Water Act and EPA's perspective on protecting and sustaining source waters.

Also 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.

The MWMC and the Board of Directors would like to thank the monitoring community for their efforts and look forward to working with all of you to continue to find new ways to facilitate collaboration and cooperation between all of the individuals and organizations that work every day to maintain our valuable state water resources. As with any organization the MWMC is only as strong as the members and 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. 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. We would like to thank the Maritime Institute who has partnered with us to provide on-site recycling, motion-activated lighting in the hallways, and washable/compostable tableware for our breaks. Please enjoy the facility and today's conference program.

Let's make this a great conference!

Clark Howells
Chair, Maryland Water Monitoring Council

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

2014 – Jim Long

2013 - Paul Kazyak

2012 - Charlie Conklin

2011 - Bill Stack

2010 - Sally G. Horner

2009 - Peter Bergstrom

2008 - Ron Klauda

2007 - Susan "Abby" Markowitz and Dr. Paul Massicot

2015 Annual Conference Planning Committee

Andy Becker	KCI Technologies, Inc.
Dan Boward (Chair)	Maryland Department of Natural Resources
Kevin Brittingham	Baltimore County Department of Environmental Protection and Sustainability
Clark Howells	Baltimore City Department of Public Works
Tom Parham	Maryland Department of Natural Resources
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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)
Joanne Alewine	Maryland Department of Natural Resources (Conference preparation and registration table)

MARYLAND WATER MONITORING COUNCIL

21st Annual Conference Agenda

Friday, November 13, 2015

PROTECTING THE SOURCE – SUSTAINING MARYLAND'S WATERS

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

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

8:30 ***MWMC Board Chair's Call to Order*** **– Clark Howells – Baltimore City Department of Public Works; Chairman, MWMC Board of Directors**

8:45 ***A Vision for Sustainable, High-Quality Water*** **– Rudy Chow – Director, Baltimore City Department of Public Works**

9:15 ***Source Water Protection Priorities for Drinking Water*** **– Peter Grevatt – Director, EPA Office of Ground Water and Drinking Water**

9:45 ***Carl S. Weber Award*** **– Sandy Hertz, MD State Highway Administration, and Cathy Weber**

10:00 Break/Poster Session – ***Authors Present***

10:30 – 12:00	Auditorium	Room A-300	Classroom 3	Room A-111/113	Classroom 1	Classroom 2
	Stream Restoration Monitoring Results I**- Moderator, Scott Stranko (MDNR)** **Pooled Monitoring: Concentration of Monitoring Resources to Answer Key Questions – Jana Davis and Sadie Drescher (CBT) and Scott Stranko (MDNR)** **Stream Function Pyramid and Restoration – Mark Secrist (USFWS)** **Stream Restoration and the TMDL Process: Challenges Posed by Climate Change – Mike Williams (SERC) and Guido Yactayo (UMCES), Gopal Bhatt (Penn State), and Solange Filoso (UMCES)** **Integrating Biological Habitat into Stream Restoration Design: An Emphasis on Ecological Factors Influencing Design Strategy and Structures – Jai Cole (M-NCPPC, Montgomery County Parks) and Scott Lowe (McCormick Taylor, Inc.)**	***Water Water Everywhere – But is it Enough?*** **– Moderator, Clark Howells (Balto. City)** **Groundwater Sustainability in Maryland's Coastal Plain Province - Andrew Staley (Maryland Geological Survey)** **2015 Washington Metropolitan Area Water Supply Study – Cherie Schultz, Sarah Ahmed, and Karin Bencala (ICPRB)** **Developing a Drought Planning Tool for the Susquehanna River Basin - Josh Weiss and Justin Irving (Hazen and Sawyer), Richard Palmer and Kathryn Booras (University of Massachusetts Amherst),** **John Balay and Ben Pratt (Susquehanna River Basin Commission), and Clark Howells (City of Baltimore DPW)**	***Emerging Stressors I – Moderator*** **– Moderator, Charlie Poukish (MDE)** **Harmful Algae Blooms in Maryland: Increased Scientific Understanding Affects Response, Coordination, and Management – Chris Luckett (MDE)** **Monitoring for Chloride in Maryland Freshwater Streams – Allison O'Hanlon (MDE)** **Chemicals of Emerging Concern and Fish Health: An Update - Vicki Blazer (USGS)**	***Status and Trends in the Chesapeake Bay*** **– Moderator, Tom Parham (MDNR)** **Comparison of Relationships Between Nutrient Inputs, Land Use Changes, and Implementation of Best Management Practices Across Basins of the Chesapeake Bay Watershed – Andrew Sekellick, Jeni Keisman, Lillian Gorman-Sanisaca, Joel Blomquist, (USGS), Olivia Devereux (Devereux Envir. Consulting, Inc.), Matt Johnston (Univ. of MD), Andrew LaMotte (USGS), and Jeff Sweeney (US EPA)** **Trends in the South River: An Historical Perspective to Guide the Future - Kate Fritz (South River Federation)** **Declining Nitrate-N Yields in the Upper Potomac River Basin: What is Really Driving Progress Under the Chesapeake Bay Restoration? – Keith Eshleman and Robert Sabo (UMCES)**	***Water Quality and Sustainability: Where do we Go from Here?*** **– Moderator, Sandy Hertz (SHA)** **Managing Forests for Source Water Protection – Anne Hairston-Strang (MDNR)** **Accounting for Maryland's Ecosystem Services – Elliott Campbell (MDNR)** **The Greater Baltimore Wilderness Coalition: Planning for Resilience – Gary Allen (Center for Chesapeake Communities)**	***Citizen Science*** **– Moderator, Caroline Donovan (UMCES)** **Cooperation and Coordination Between MDNR Streamwaders and the Howard County Watershed Stewards Academy Home Owner Association Partnership Program – Al Pflugrad (Howard County Watershed Steward Academy)** **Citizen Science on the Chester River - Tim Trumbauer (Chester River Association)** **Harnessing the Power of Citizen Science for Communication and to Test Stream Assessment Hypotheses with Microbial Communities - Bob Hilderbrand, Sara Laperriere, Regina Trott, and Jason Cessna (UMCES), and Stephen Keller (University of Vermont)**

12:00 – 12:30 Break/Poster Session – ***Authors Present***

12:30 – 1:30 Lunch

1:30 – 3:00	Auditorium	Room A-300	Classroom 3	Room A-111/113	Classroom 1	Classroom 2
	***Stream Restoration Monitoring ResultsII* - Moderator, Scott Stranko (MDNR)** **Maryland DNR's Stream Restoration Policy and Guiding Principles - Greg Golden and Susan Makhlouf (MDNR)** **Watershed Rehabilitation and the Beaver Creek Trout Hatchery – John Mullican, Mark Toms, and Josh Henesy (MDNR)** **Developing a Pooled Monitoring Program: Montgomery County's Effort to More Efficiently and Holistically Study Development Impacts within Special Protection Areas – Jenny St. John (Mont. Co. DEP)** **Comparison of Biological Responses to Stream Restoration Across Maryland - Nancy Roth, Elizabeth Franks, Theresa Hage, Brenda Morgan, and Ryan Corbin (Versar, Inc.)**	***Where the Rubber Meets the Road: A Primer on Regulating Stormwater and Wetlands* – Moderator, Matt Stover (MDE)** **NPDES Industrial Stormwater Primer– Paul Hlavinka (MDE)** **NPDES: Industrial Stormwater Discharges: the Other Side of the Fence – Jeff Reagan (MD Environmental Service)** **Monitoring and Assessment in Maryland's Wetlands and Waterways Program – Denise Clearwater (MDE)**	***Emerging Stressors I – Moderator* – Moderator, Charlie Poukish (MDE)** **Microplastics in the Chesapeake Bay – Lance Yonkos (University of MD)** **Re-Emerging Contaminants: Examining Toxicity in Bear Creek Sediment– Sharon Hartzell and Lance Yonkos (University of MD), Michael Unger (VIMS), Beth McGee (CBF), and Andrew Heyes (UMCES)** **Microbial Diversity as an Index of Biological Water Quality in Maryland Headwater Streams - Alyson Santoro, Sarah Laperriere, Stephen Keller, Regina Trott, Jason Cessna, and Robert Hilderbrand (UMCES)**	***Monitoring Around the Inter-County Connector Highway Project: What's Being Learned?* – Moderators, Ron Klauda (MDNR retired) and Doug Redmond (M-NCPPC retired)** **Stormwater Monitoring Commitments for the ICC– Rob Shreeve (SHA)** **Biological Monitoring for the Inter-County Connector Project: A Summary of Results to Date – Sean Sipple (Coastal Resources, Inc.)** **A Wild Trout Population in the Path of the ICC – Mark Staley (MDNR) and Charlie GougeonMDNR retired)** **Monitoring the Selection, Design, Construction, and Success of ICC Mitigation Projects: A Landowner's Perspective - Matthew Harper, Erin McArdle, and Jai Cole (M-NCPPC, Montgomery County Parks)**	***Aquatic Invasive Species I* – Moderator, Jay Kilian (MDNR)** **Aquatic Invasive Species in Maryland: Sources, Impacts, and the Challenges we Face in Dealing with Them - Jay Kilian (MDNR)** **Continued Dispersal of Zebra Mussel in the Upper Chesapeake Bay and its Estuaries – Matt Ashton (MDNR) and Ron Klauda (MDNR retired)** **Why We Should Care About Snakeheads: Myth vs. Reality – Joe Love (MDNR) and Joshua J. Newhard (USFWS)**	***Beyond the Pipe: Stormwater, Sewage and Illicit Discharges* – Moderator, Clark Howells (Balto. City)** **Illicit Discharge Detection and Elimination (IDDE) - A Cost-effective BMP – Lori Lilly (Lori A. Lilly Environmental Solutions)** **Exposed Sewer Asset Assessment, Prioritization, and Protection: Rock Creek Park, Washington, DC - Justin Hayes (Straughan Environmental, Inc.)** **Real-Time Performance Monitoring of Stormwater Infrastructure Provides Critical Evaluation of Nonpoint Source Pollution Reduction - Jamie Lefkowitz and Marcus Quigley (OptiRTC, Inc.)**

3:00 – 3:30 Break/Poster Session – *Authors Present* – Announcement of Student Poster Award Winners (registration/food area)

3:30 – 4:30	Auditorium	Room A-300	Classroom 3	Room A-111/113	Classroom 1	Classroom 2
	***Stream Restoration Monitoring Results III* – Moderator, Mark Southerland (AKRF, Inc.)** **Connecting True Functionality to a "Function-Based Framework" for Stream (and Wetland) Assessment and Restoration – Erik Michelsen (Anne Arundel Co.)** **Tackling Urban Stream Restoration in Philadelphia's Parks: Lessons Learned from the Field and Office - Shandor Szalay and Art Wawiemia (AKRF, Inc.) and Lance Butler and Rick Howley (Philadelphia Water)** **Evaluating Stream Restoration Success Through Priority Pollutant Load Reductions -Colin Hill and Michael Pieper (KCI Technologies, Inc.)**	***Water Quality Data and Regulations* – Moderator, Richard Mitchell (US EPA)** **Maryland's Clean Water Act Section 303(d) Program: Plans for 2016-2022 – Tim Rule (MDE)** **Guide to Federal Water Data: Case Study for the Patapsco and Gunpowder River Watersheds – Gary Fisher (USGS)** **Navigating a Phase II Permit: Montgomery Parks Perspective – Amanda Matheny and Jai Cole (M-NCPPC, Montgomery County Parks)**	***Emerging Stressors III – Moderator* – Moderator, Charlie Poukish (MDE)** **Molecular Microbial Source Tracking as a Tool to Assess the Presence of Human and Pet Waste in the Baltimore Harbor Watershed - Wolf T. Pecher (University of Baltimore), David Flores and Alice Volpitta (Blue Water Baltimore)** **Occurrence of Elevated Radioactivity in the Upper and Lower Patapsco Aquifers in Charles Co., MD - David. C. Andreasen and David W. Bolton (Maryland Geological Survey)** **The Potential for Groundwater Contamination from Dredged Material at the Masonville Vessel Berth (Baltimore, MD) and the Cox Creek Dredged Material Containment Facility (Anne Arundel Co., MD) - Johanna M. Gemperline and David C. Andreason (Maryland Geological Survey)**	***There's Something Fishy Here* – Moderator, Joel Moore (Towson University)** **Non-Lethal Detection of Intersex (Testicular Oocytes) in Black Basses (Micropterus spp.) Using Laparoscopy - Alexander MacLeod and Lance Yonkos (University of MD)** **Predicting the Frequency of Disruptive Flow Events for Lithophilic Spawning Fish Using Monitoring Data: Implications for Protection and Restoration – Stan Kemp (University of Baltimore)** **Assessing River Herring Spawning Runs in Tributaries of Chesapeake Bay - Matthew B. Ogburn, Michael Hannam, Don Weller, and Anson H. Hines (Smithsonian Environmental Research Center)**	***Aquatic Invasive Species II* – Moderator, Jay Kilian (MDNR)** **Protecting Maryland Marshes Through Nutria Eradication - Bill Wilmoth (USDA)** **Preventing Introduction of Aquatic Invasive Species – Barbara Beelar (Friends of Deep Creek Lake) and Dana Stein (MD House of Delegates)**	***Creek Freaks, Sculpins, and Therapy for the Severn* – Moderator, Sandy Hertz (SHA)** **Creek Freaks Meets Trout in the Classroom – Leah Miller (IWLA) and Sarah Mitchell (Ches. Conservation Corps)** **A Novel Parasite of Sculpin: Possible Effects on Populations - Cynthia Adams, Vicki Blazer, Nathaniel Hitt, and Erin Snook (USGS)** **A Proposal to Restore the Upper Headwaters of Severn Run – A Use IV Tributary to the Severn River – Using the Technique of Self Organization and Channel Evolution - Mitch Keiler (Fort Meade - Directorate of Public Works)**

4:30 Adjourn - SOCIAL AT HEAVY SEAS BREWERY STARTING AT 5:00

Poster Presentations (In Order of Primary Author's Last Name)

PRELIMINARY FINDINGS FROM THE FIRST YEAR OF MONITORING MARYLAND'S FIRST LARGE SCALE MUSSEL RELOCATION - Matt Ashton, Kyle Sullivan, Jim McCann, and Dave Brinker (MDNR)

THE NINTH ANNUAL MARYLAND STREAMS ROUNDTABLE - Andy Becker (KCI Technologies, Inc.) and Dan Boward (MDNR)

INVESTIGATING REACTION PATHWAYS OF PHARMACEUTICAL COMPOUNDS DURING WASTEWATER TREATMENT - Mary Bedner and William MacCrehan (National Institute of Standards and Technology)

MICROBIAL COMMUNITY RESPONSE TO USED MOTOR OIL, A COMPONENT OF RUNOFF - STUDENT POSTER - Alexis Bosiacki, Sergut Admasu, Katherine M. Krasnodemski, Emily Hicks, and Kimberly Pause Tucker (Stevenson University)

STUDY ON SOCIO-ENVIRONMENTAL FACTORS AFFECTING WATER QUALITY IN THE BALTIMORE CITY WATER SUPPLY SYSTEM - STUDENT POSTER - Nikia Brown, Miracle Oloro, Janette North, and Mintesinot Jiru (Coppin State University)

MONITORING, MODELING AND RESEARCH AS PART OF THE BALTIMORE URBAN WATERS FEDERAL PARTNERSHIP - Edward Doheny (USGS), Emily H. Majcher (CNTS), Morgan J. Grove (USDA Forest Service) Michael Galvin (SavATree), Peter Groffman (Cary Institute of Ecosystem Studies), David Flores (Blue Water Baltimore), Laura Connelly (Parks and People Foundation), Kimberly Grove (City of Baltimore), James Caldwell and Lindsay DeMarzo (Howard County), Kevin Brittingham and Steven Stewart (Baltimore County)

INTEGRATING CITIZEN AND NON-TRADITIONAL MONITORING DATA INTO THE CHESAPEAKE BAY PROGRAM NETWORK - Caroline Donovan (UMCES), Anna Mathis (Alliance for the Chesapeake Bay), Leah Miller (Izaak Walton League), Julie Vastine, (ALLARM), and Peter Tango (USGS)

INDICATORS OF FECAL CONTAMINANTS IN PUBLICALLY ACCESSIBLE FREDERICK COUNTY STREAMS - STUDENT POSTER - Sara Eckard, Andrea Kozlosky, Drew Ferrier, and Claire Hudson (Hood College Center for Coastal and Watershed Studies)

MEASURING THE EFFECTS OF URBANIZATION ON STREAM WATER CHEMISTRY IN BALTIMORE COUNTY, MD - STUDENT POSTER - Rian Fleming, Corey Mueller, and Joel Moore (Towson University)

SEDIMENT FINGERPRINTING MODEL FOR ESTIMATING SOURCE CONTRIBUTIONS TO SUSPENDED SEDIMENT FLUX - Lillian Gorman Sanisaca, Allen C. Gellis, and David L. Lorenz (United States Geological Survey)

POLYAROMATIC HYDROCARBONS IN STREAM WATER OF WESTERN MARYLAND: A BASELINE ASSESSMENT BEFORE POSSIBLE HYDRAULIC FRACTURING - Andrew Heyes, Cheryl Clark, Rachel Clark (University of Maryland Center for Environmental Science)

EVOLUTIONARY CHANGES INDUCED BY EXPOSURE TO USED MOTOR OIL IN CHESAPEAKE BAY WATERSHED BACTERIAL ISOLATES - STUDENT POSTER - Emily Hicks, Katherine M. Krasnodemski (Stevenson University), and Ava Nicole Schein and Kimberly Pause Tucker (Stevenson University; NOAA/JHT, Inc.)

VERNAL POOL STUDY, CORCORAN WOODS, SANDY POINT STATE PARK: ANATOMY OF A LONG-TERM, STUDENT-LED RESEARCH PROJECT - Susan Lamont (Anne Arundel Community College)

LANDS GREEN WATERS CLEAN - Leah Miller (Isaac Walton League of America)

NO CHILD LEFT DRY - Leah Miller (Isaac Walton League of America) and Sarah Mitchell (Chesapeake Conservation Corps Volunteer; Isaac Walton League of America)

ELECTRICAL CONDUCTIVITY: AN INDICATOR OF URBANIZATION IN MATTAWOMAN CREEK AND ITS TRIBUTARIES - Jim Long and Ken Hastings (Mattawoman Watershed Society) and Carrier Hoover, Margaret McGinty, Alexis Park and Jim Uphoff (MDNR)

SEASONAL VARIATION IN SURFACE-GROUNDWATER EXCHANGES IN AN URBAN FLOODPLAIN WITH ACTIVE GRAVEL-BAR FORMATION - D. L. Lundberg and K. L. Prestegaard (University of Maryland)

A TRICKLE THROUGH TIME: AN ANALYSIS OF STREAM INTEGRITY IN AN URBANIZING ENVIRONMENT - - STUDENT POSTER - Kelly Nellenbach, Eric Mazur, and Susan Gresens (Towson University)

POLLUTANT REMOVAL EFFICIENCIES OF SELF-CONVERTED DRY DETENTION PONDS IN BALTIMORE COUNTY, MD - Rob Owen (KCI Technologies, Inc.), Nicole Hartig (Towson University), Colin Hill and Mike Pieper (KCI Technologies Inc.), Ryan Casey (Towson University), Kevin Brittingham and Steve Stewart (Baltimore County DPES), and David Ownby (Towson University)

EFFECTS OF COMMON ANTHROPOGENIC POLLUTANTS ON FRESHWATER SYSTEMS: INSIGHTS FROM THE SURROGATE ZOOPLANKTON, DAPHNIA MAGNA - - STUDENT POSTER - Veronica Pereira, Timothy Woo, Andrew East, Laina Lockett, and Christopher J. Salice (Towson University)

DC FISH TOXICS AND MARYLAND WATER SOURCES: AN INTERJURISDICTIONAL PROBLEM - Harriette Phelps and Sonia Rose (University of the District of Columbia)

EVALUATING REGENERATIVE STORMWATER CONVEYANCE FOR STREAM RESTORATION - Max Ruehrmund (Smithsonian Environmental Research Center)

BEAR CREEK SEDIMENT TOXICITY: A TIME-COURSE STUDY - STUDENT POSTER - Allison Satterfield, Sharon Hartzell, and Lance Yonkos (University of Maryland)

USE OF BARIUM/STRONTIUM RATIOS AS A POTENTIAL INDICATOR OF SURFACE WATER CONTAMINATION FROM FRACKING FLUID SPILLS Johan Schijf and Caroline G. Coulter (UMCES)

THE ROLE OF ICPRB IN THE DEVELOPMENT OF ALGAE MONITORING METHODOLOGIES WITHIN THE POTOMAC RIVER BASIN: PAST, PRESENT, AND FUTURE - Gordon Selckmann (Interstate Commission on the Potomac River Basin)

GREEN STORMWATER INFRASTRUCTURE (GSI) MAINTENANCE COSTS VARY 3-FOLD BY SCALE, TYPE, AND OTHER FACTORS - Mark Southerland and Kevin Flynn (AKRF, Inc.)

RIPARIAN BUFFERS AND THEIR IMPACT ON AQUATIC ORGANISMS - Angela Trenkle (Maryland DNR Forest Service; Chesapeake Conservation Corps)

WHO ENGAGES IN ENVIRONMENTAL STEWARDSHIP? PARTICIPATION IN THE MARYLAND WATERSHED STEWARDS ACADEMIES - William A. Yagatich (University of Maryland, College Park)

POTENTIAL CLIMATE CHANGE IMPACTS ON THE SPRING PHYTOPLANKTON BLOOM IN CHESAPEAKE BAY - Meng Xia and Long Jiang (University of Maryland Eastern Shore)

CONCENTRATION-DISCHARGE RELATIONSHIPS FOR NUTRIENTS AND SEDIMENT IN MAJOR TRIBUTARIES TO CHESAPEAKE BAY: TYPICAL PATTERNS AND NON-STATIONARITY - Qian Zhang and William P. Ball (Johns Hopkins University)

A NOVEL PARASITE OF SCULPIN: POSSIBLE EFFECTS ON POPULATIONS

Cynthia Adams; cradams@usgs.gov; U.S. Geological Survey

Co-authors: Vicki Blazer, USGS; Nathaniel Hitt, USGS; Craig Snyder, USGS; Erin Snook, USGS

During stream fish community surveys within Catoctin Mountain Park, raised pale cysts were observed on Blue Ridge Sculpin Cottus caeruleomentum. The portion of the watershed in which affected sculpin were observed contained lower than expected numbers of sculpin and a nearby stream in the study watershed lacked sculpin, raising concerns about population effects of this infection. A number of affected sculpin were preserved in buffered formalin and when examined histologically multiple cysts containing spherical endospores with a refractile central body, characteristic of Dermocystidium species were observed. The genus Dermocystidium belongs to the Mesomycetozoea, a phylum of protists placed phylogenetically near the point of animal-fungal divergence. This is the first report of Dermocystidium in a fish species in the eastern United States and in a species other than salmonids in the US. The findings illustrate the need to better understand emerging parasites/pathogens on ecosystem health.

Cynthia Adams is a Pathways student with the US Geological Survey's National Fish Health Research Laboratory in Kearneysville, WV. She recently started a Master's degree program at George Mason University. An aspect of her research will focus on developing molecular techniques to identify and study fish pathogens.

THE GREATER BALTIMORE WILDERNESS COALITION: PLANNING FOR RESILIENCE

Gary Allen; gallenbay@gmail.com; Center for Chesapeake Communities

The Greater Baltimore Wilderness Coalition (GBWC) is a voluntary alliance of local, regional and state organizations seeking to establish a regional green infrastructure network in central Maryland. In 2014, the GBWC received a Hurricane Sandy Coastal Resiliency Grant to plan for increasing resilience to sea level rise and increased storm events anticipated to coincide with changes in our climate. The project is identifying and mapping green infrastructure opportunities to increase landscape resilience and showcases the importance of landscape (hub and corridor) as well as site level (low impact development) uses of the green infrastructure concept. Policy and planning tools for implementation have been reviewed and recommendations are being developed for how to incorporate green infrastructure into local environmental land use planning and hazard mitigation. The team will explore how increasing green infrastructure protection, restoration and maintenance for a future climate can reinforce investments that are being made to handle current stormwater and water quality impacts. An overview of the GBWC work, the resilience grant project and the need for a regional approach to building sustainable landscapes will be provided.

Gary is the Executive Director of the Center for Chesapeake Communities, a nonprofit organization founded in 1997, to assist local governments with tools, techniques and financial assistance to protect their own natural resources and the Chesapeake Bay. In prior roles, Gary served as the former mayor of Bowie, MD and the former chair of the Bay Program's Local Government Advisory Committee. Gary currently serves as Chair Emeritus of the Governor's Sustainable Forestry Council.

OCCURRENCE OF ELEVATED RADIOACTIVITY IN THE UPPER AND LOWER PATAPSCO AQUIFERS IN CHARLES COUNTY, MARYLAND

David Andreasen; david.andreasen@maryland.gov; Maryland Geological Survey

Co-author: David Bolton, Maryland Geological Survey

Five public-water supply systems in Charles County that obtain water from the Upper and Lower Patapsco aquifers exceeded the USEPA's Maximum Contaminant Level (MCL) of 15 picocuries per liter (pCi/L) for gross-alpha particle activity (GAPA). Polonium-210 was detected in two of these water systems. Radium-226 plus radium-228 concentrations were all below the MCL of 5 pCi/L. GAPA levels in eleven other Charles County water systems in these aquifers were between 10 and 15 pCi/L. To determine whether the radioactivity is localized in specific zones within these aquifers, Maryland Geological Survey personnel compiled existing water-quality and well-construction data from the affected water-supply systems. The presence of multiple screened intervals in the wells, as well as inconsistencies and variability in data reporting, hampered determination of vertical distribution of radioactivity within the aquifers. Additional sampling is recommended for private water-supply wells near the affected public water systems. These wells typically have screened-interval lengths of ten feet or less, which will make them useful in locating source of radioactivity within the stratigraphic section.

David Andreasen is a hydrogeologist with the Maryland Geological Survey (Hydrogeology and Hydrology Program). The focus of his work has related primarily to water-supply issues, groundwater-flow modeling, and aquifer property and framework characterization. Recently he's been involved in the development of a GIS-based aquifer information system for the Coastal Plain of Maryland, and creation of a network of survey stations to monitor land subsidence related to groundwater extraction.

CONTINUED DISPERSAL OF ZEBRA MUSSEL IN THE UPPER CHESAPEAKE BY AND ITS ESTUARIES

Matthew Ashton; matthew.ashton@maryland.gov; Maryland Department of Natural Resources

Co-author: Ronald Klauda; Maryland Department of Natural Resources (retired)

The invasion of North American by zebra mussels and its subsequent ecological impacts has been well documented. Their spread continues despite a wealth of research and outreach campaigns, albeit at a slowed pace. We describe the spread and proliferation of zebra mussel into one of the more recently invaded states, Maryland. Veliger counts and fixed hard surface monitoring suggest that a population is established within the lower Susquehanna River to the head of the Chesapeake Bay. A relatively narrow tidal-freshwater habitat envelope with suitable salinity may restrict zebra mussels from establishing reproducing populations further downstream. However, in years when salinity is low, they could spread in the estuary. This pattern was observed in 2015. Zebra mussels were reported from the Bush, Gundpowder, and Middle River sub-estuaries following a period of near to below average salinity. Dispersal to other freshwater habitats in Maryland seems likely as the current area of infestation is highly used by commercial and recreational boaters, although regulations are in place that could help slow or prevent spread. Successful invasion will likely also be a function of water chemistry, which may be limiting in parts of the state.

Matt Ashton has been a Natural Resource Biologist with DNR's Monitoring and Non-Tidal Assessment Division for eight years and serves as the freshwater mussel expert and crew leader for the Maryland Biological Stream Survey. He has handled monitoring and reporting on zebra mussels for the Department since 2012. Prior to joining DNR, Matt earned his M.Sc. from Tennessee Technological University where he researched the ecology of rare fish and mussel communities in regulated rivers.

PREVENTING INTRODUCTION OF AQUATIC INVASIVE SPECIES

Barbara Beelar; barbara@friendsofdcl.org; Friend of Deep Creek Lake

We face the growing spread of aquatic invasive species in the Maryland waterways. Delegate Dana Stein introduced a bill in the last General Assembly to prevention further introduction of these species in Maryland owned and managed lakes. The bill was passed and now a Working Group is developing a report on recommendations and funding to be submitted to the General Assembly by the end of this year. This presentation will cover the rationale for introduction of the bill and the excellent Findings by the Attorney General's office. Opposition to the bill and its implementation will be covered along with the challenges the Working Group has faced developing the report. This effort in Maryland is part of a larger effort to slow spread of invasive species which impair our waterways. We will be very interested in reports from the audience on their observations of AIS and prevention and control measures being undertaken.

Barbara Beelar is been Director of the Friends of Deep Creek Lake. Having grown up at the lake, she returned to find the lake facing challenges including spread of aquatic invasive species. FoDCL initiated the introduction of the AIS bill to stop further AIS spread. Academically Barbara has Masters in City Planning and Latin American Studies-- none of which prepared her for the extremely complex challenge of protection and restoration of DCL.

CHEMICALS OF EMERGING CONCERN AND FISH HEALTH; AN UPDATE

Vicki S. Blazer; vblazer@usgs.gov; U.S. Geological Survey

Co-authors: Luke Iwanowicz and Patrick Phillips, U.S. Geological Survey

Observations of skin lesions and mortality, as well as less obvious adverse effects such as high internal parasite loads and intersex (testicular oocytes) and vitellogenin in male fishes have raised concerns about endocrine disruptors and other "chemicals of emerging concern". Estrogenic compounds, including hormones and anthropogenic chemicals, have been associated with reproductive endocrine disruption as well as immunomodulation. However, within the Potomac drainage, including sites in Maryland, intersex in smallmouth bass is correlated with agricultural landuse and specifically with herbicides such as atrazine. Atrazine has also been shown to influence the immune system and disease resistance of fish. Fish are exposed to complex chemical mixtures as well as other environmental stressors throughout their life. Identification of the most important factors, as well as of key exposure periods (eggs/fry; adults during recrudescence) for long term effects may be very important in terms of management for healthier fish populations. An update of ongoing monitoring and assessment of biological effects and chemical concentrations in sediment, water and fish tissue will be presented.

Vicki Blazer is a fish health researcher with the USGS's National Fish Health Research Laboratory in Kearneysville, WV. Vicki received her PhD from the University of Rhode Island, completed a postdoctoral position at the University of Georgia Veterinary College and was on the faculty and the assistant unit leader of the Cooperative Fish and Wildlife Unit in the School of Forest Resources, University of Georgia prior to coming to WV in 1992.

ACCOUNTING FOR MARYLAND'S ECOSYSTEM SERVICES

Elliott Campbell; elliott.campbell@maryland.gov; Maryland Department of Natural Resources

The ecosystems contained within the borders of the State of Maryland provide a myriad of benefits to the people that reside there. Forests clean the air, wetlands clean the water and the Bay provides fish and crabs. For some of these benefits a market exists to set a dollar value, but that is not the case for many of the benefits. When ecosystem services are not considered in decision making, the door is left open for decisions to be made that decrease the long term sustainability of the state, ultimately resulting in society having to either invest in additional built infrastructure or restoration of natural lands to replace lost services. This work quantifies and value ecosystem services (ES) from the natural lands of Maryland; quantifying each ecosystem service in terms of its biophysical energy flow and relating the flow of energy to money by observing instances where people have exhibited monetary preference for the work of the environment. Results are presented for ecosystem benefits from Maryland's forests, wetlands, and the Chesapeake Bay; totaling $5.65 billion per year.

Elliott has been working in the field of quantifying and valuing the benefits that people receive from the work of the environment for more than 10 years. He now works for Maryland's Department of Natural Resources, where he maintains Maryland's Genuine Progress Indicator, an alternative measure of well-being, and advises on economic policy.

MONITORING AND ASSESSMENT IN MARYLAND'S WETLANDS AND WATERWAYS PROGRAM

Denise Clearwater; denise.clearwater@maryland.gov; Maryland Department of the Environment

The Maryland Department of the Environment Wetlands and Waterways Program (Program) implements regulatory programs in tidal and nontidal wetlands, and waterways and their 100-year floodplains. Monitoring and assessment plays a role in review of proposed activities; success of mitigation projects; pooled monitoring efforts; and as part of national aquatic resource surveys. Recently MDE has identified needs to improve assessment of sites proposed for restoration. This presentation describes current and planned efforts to improve monitoring and assessment methods and incorporate information from other work into improved management of wetland and water resources.

Denise Clearwater is the Special Projects Coordinator in the Maryland Department of the Environment Wetlands and Waterways Program. She has experience in implementation and policy/guidance development for regulatory review; nontidal wetland mitigation; wetland monitoring and assessment; and various other projects for improving the Program's management of wetland and waterway resources.

INTEGRATING BIOLOGICAL HABITAT INTO STREAM RESTORATION DESIGN: AN EMPHASIS ON ECOLOGICAL FACTORS INFLUENCING DESIGN STRATEGY AND STRUCTURES

Jai Cole; Jai.Cole@Montgomeryparks.org; M-NCPPC, Montgomery County Parks

Co-author: Scott Lowe; McCormick Taylor, Inc.

Renewed focus on goals and outcomes of stream restoration projects has been created though recent hierarchy of stream function strategies (Harman et al 2012). While these functional assessments encourage practitioners to focus on achievable and measurable goals for restoration projects, one trending inclination is to understate goals, particularly pertaining to ecological uplift, to ensure projects are considered successful. Because documenting an increase in IBI scores as a result of stream restoration is historically difficult, it is often the metric dropped from design goals. The authors suggest that through an understanding of faunal habitat considerations, and utilizing Rapid Habitat Assessment tools (Barbour and Stribling 1991), a biological framework can be utilized for evaluating design strategies which may result in additional, more achievable opportunities for biological uplift to occur which would incentivize designs that account for these factors. A thorough understanding and evaluation of ecological principles in addition to geomorphology will be discussed that can aid stream restoration professionals to identify stressors and create design strategies that have the highest probability of achieving ecological uplift.

Mrs. Cole is the Natural Resources Manager for M-NCPPC, Montgomery County Department of Parks. Cole has 15 years of experience and specializes in biological monitoring, stream restoration, stormwater management. Mr. Lowe is a Senior Environmental Scientist and Team Leader for McCormick Taylor's Ecological Restoration Design Group. He has over 19 years of experience performing all aspects of environmental design and permitting services.

POOLED MONITORING: CONCENTRATION OF MONITORING RESOURCES TO ANSWER KEY QUESTIONS

Jana Davis; jdavis@cbtrust.org; Chesapeake Bay Trust

Co-authors: Sadie Drescher; Chesapeake Bay Trust and Scott Stranko,;Maryland Department of Natural Resources

Questions remain about impact of watershed restoration practices, and individual projects are often monitored as part of the restoration effort or to meet regulatory requirements. However, measurements taken at individual projects, one at a time, limits interpretation of results beyond the individual project. The ability to use data from multiple projects to answer broader questions can be hampered by differences in data collection methods or timing. Instead, we propose a structure in which efforts are concentrated to answer specific questions in a statistically robust way using an experimental design (replication and control sites to capture spatial and temporal variability) that enables extrapolation of results. Monitoring is expensive: The pooled monitoring approach is a reorganization of monitoring resources to answer specific questions, such as how restoration practices perform under certain conditions. We start with what we want to know, then ensure that the monitoring program is appropriate to rigorously answer those questions. Collection of data that do not directly help answer key questions identified a priori is not encouraged. The answers are then directed back into the regulatory and management communities.

Dr. Jana Davis is the Executive Director of the Chesapeake Bay Trust, a non-profit grant-making organization. The Trust is supported by the Treasure the Chesapeake license plate program and numerous partnerships. A marine ecologist by training, Jana is learning the world of stream restoration science and is applying her interest in experimental design and statistics to monitoring questions. Jana has degrees from Yale University and the Scripps Institution of Oceanography.

DECLINING NITRATE-N YIELDS IN THE UPPER POTOMAC RIVER BASIN: WHAT IS REALLY DRIVING PROGRESS UNDER THE CHESAPEAKE BAY RESTORATION?

Keith N. Eshleman; eshleman@al.umces.edu; University of Maryland Center for Environmental Science

Co-author: Robert D. Sabo (UMCES, Appalachian Laboratory)

Reducing nutrient pollution of surface and coastal waters remains a major environmental challenge for the 21st century. In the case of the Chesapeake Bay, we still lack proof that watershed-based management has been effective at reducing nonpoint-source nutrient loads in accordance with restoration goals. While the conventional wisdom is that implementation of best management practices has turned the tide against nutrient pollution, we examined long-term nitrate-N trends in streams and tributaries of the Upper Potomac River Basin and found that: 1) dramatic reductions in annual discharge-weighted concentrations and yields can be almost universally attributed to reductions in atmospheric N deposition as opposed to on-the-ground management actions; 2) observed water quality changes comport with a modified kinetic N saturation model; 3) the model can separate the nitrate-N yield that is responsive to N deposition from a legacy yield; and 4) N saturation from N deposition appears to be a reversible process. These unanticipated region-wide water quality benefits can be attributed to NOx emission controls brought about by the 1990 Clean Air Act Amendments and reflect one of a very few success stories in the Chesapeake Bay restoration.

Dr. Keith N. Eshleman is Professor at the University of Maryland Center for Environmental Science based at Appalachian Laboratory in Frostburg, Maryland. Dr. Eshleman's professional expertise is in the field of watershed hydrology. Recent research projects have focused on the hydrological impacts of acid deposition, forest disturbances, surface mining, and shale gas development activities in the Appalachian Mountain region.

GUIDE TO FEDERAL WATER DATA: CASE STUDY FOR THE PATAPSCO AND GUNPOWDER RIVER WATERSHEDS

Gary. T. Fisher; hydrologyguy@gmail.com; WaterData.US

Reliable current and historical water data are essential for effective water-resource engineering, research, planning, and management. Current data enable operations and warnings. Historical data provide statistical parameters for design and risk assessments, identification of trends, and assessment of impacts such as those from landuse or climate change. In general, more data improves the reliability of decisions and designs. For regional evaluations or for large areas such as the Chesapeake Bay watershed, the most important databases are those maintained by Federal agencies. These include data collected directly by the agencies as well as data contributed to the database by others. The most notable databases are USGS and EPA, but important data are also available from the Corps of Engineers, NOAA, NSF, and others. The Patapsco and Gunpowder River watersheds provide an example of water data available from Federal databases. The watersheds are relatively rich in availability of water data from Federal sources. For example, the USGS NWIS database alone includes 62 active streamgages and 39 active wells. It also includes historical data for 162 inactive streamgages and 873 inactive wells with more than one measurement.

Gary Fisher retired from the U.S. Geological Survey in 2013 with 34 years of Federal service and 40 years of professional experience. He is a national expert in water web applications and database services. As a Scientist Emeritus with USGS, he continues some national activities and long-term collaboration with the Baltimore Ecosystem Study and the USGS Maryland Water Science Center. Gary attended Virginia Tech and the University of Maryland and is a Registered Professional Engineer.

TRENDS IN THE SOUTH RIVER: A HISTORICAL PERSPECTIVE TO GUIDE THE FUTURE

Kate Fritz; kate@southriverfederation.net; South River Federation

Since its incorporation in 1999, the South River Federation has been a scientific authority whose mission is to protect, preserve, restore, and celebrate the South River (located near Annapolis). In that time, the Federation has built a robust water quality-monitoring program that takes a watershed-wide approach, and evaluates 21 tidal and 22 non-tidal monitoring stations. This monitoring includes control, pre-restoration, and post-restoration sites to characterize existing water quality conditions, examine nutrient and sediment reduction, and assess changes in trends in response to habitat enhancement. This presentation will touch on the physical, biological, and chemical trends of the South River over the last decade.

Kate Fritz is the Executive Director of the South River Federation, and has over ten years of experience in water resource management, specifically in land use and sustainability planning. Kate's love of the Chesapeake Bay started with the time she spent as a summer field technician while attending St. Mary's College of Maryland.

THE POTENTIAL FOR GROUNDWATER CONTAMINATION FROM DREDGED MATERIAL AT THE MASONVILLE VESSEL BERTH (BALTIMORE, MARYLAND) AND THE COX CREEK DREDGED MATERIAL CONTAINMENT FACILITY (ANNE ARUNDEL COUNTY, MARYLAND)

Johanna M. Gemperline; johanna.gemperline@maryland.gov; Maryland Geological Survey

Co-author: David C. Andreasen; Maryland Geological Survey

Periodic maintenance dredging is required to maintain adequate depths in the Port of Baltimore shipping channels. The Maryland Port Administration, seeking to increase future storage capacity for dredged material, has recently proposed the addition or expansion of facilities at the Masonville vessel birth and the Cox Creek Dredged Material Containment Facility. The placement of dredged material at both sites has the potential to affect the Lower Patapsco and Patuxent aquifer systems, which are major sources of drinking water for Anne Arundel County. The Maryland Geological Survey conducted studies in 2014 and 2015 to determine the likelihood of groundwater contamination or flow change at these sites. Using lithologic logs, geophysical logs, and groundwater levels, the studies concluded that the direction of groundwater flow and effectiveness of confining units prevent contamination of the aquifer systems.

Johanna Gemperline is a hydrogeologist at the Maryland Geological Survey. She received her Bachelor's in Civil Engineering and Master's in Geology from the University of Illinois at Urbana-Champaign.

MD DNR'S STREAM RESTORATION POLICY AND GUIDING PRINCIPLES

Greg Golden; greg.golden@maryland.gov; Maryland Department of Natural Resources, Integrated Policy and Review Unit

Co-author: Susan Makhlouf; MD DNR

The Maryland Department of Natural Resources (DNR) finalized its first stream restoration policy earlier this year (2015). The policy and supporting documents were developed by an interdisciplinary team within DNR, and will guide the Department's own review, support, funding, and/or construction of stream restoration (and related) projects in Maryland. Major goals of this policy initiative include documentation of the Department's vision; Guiding Principles; and common terms, definitions, and concepts associated with the field of stream restoration. In addition to providing a framework and underlying core principles for DNR staff to use in their technical work, the materials will support staff in communicating with DNR's partners and stakeholders on the Department's position on restoration topics. True to the nature of stream restoration practice itself, the supporting materials for the DNR policy are expected to be living documents over time and will be updated as the science of restoration advances. In this presentation, the major themes of the DNR protocols and criteria for stream restoration project review will be discussed, along with the associated Guiding Principles document and our draft review checklist.

Greg Golden received a Bachelor's Degree at the Univ. of MD in Natural Resource Conservation in 1983. His early field work included surveying, and invasive plant management. Greg joined MD DNR in 1985, working 6 years in coldwater fisheries. After a short stint in nontidal wetlands permitting, he served for 20 years in DNR's Environmental Review Unit, working on project reviews, programmatic comments, and policy. Greg now serves as a senior reviewer in DNR's Integrated Policy & Review Unit.

MANAGING FORESTS FOR SOURCE WATER PROTECTION

Anne Hairston-Strang; Anne.Hairston-Strang@maryland.gov; Maryland Department of Natural Resources, Forest Service

Forests are the most protective land use for water quality, and commonly used around reservoirs and in source water headwaters. Principles of forest management focus on forest resilience through forest diversity, multiple layers, and regeneration. Approaches that can help sustain healthy forests for water quality include self-supporting forest management, forest buffer conservation in watersheds, targeting restoration of buffers and wetlands, and sustainable forest certification. Experiences from Frederick City Watershed, Cumberland, and Baltimore will illustrate benefits and challenges.

Anne Hairston-Strang has been the Forest Hydrologist with Maryland DNR Forest Service since 1997. She has a Ph.D. in forest hydrology from Oregon State University, M.S. in forest soils from University of Minnesota, and a B.S. in forest resource management from Virginia Tech.

MONITORING THE SELECTION, DESIGN, CONSTRUCTION, AND SUCCESS OF ICC MITIGATION PROJECTS: A LANDOWNER'S PERSPECTIVE

Matthew Harper; matthew.harper@montgomeryparks.org; M-NCPPC, Montgomery County Parks

Co-authors: Erin McArdle and Jai Cole; M-NCPPC, Montgomery County Parks

The construction of 18.8 miles of the east-west Intercounty Connector Highway by SHA crossed a number of public and private lands, but none as vast or more ecologically sensitive than the M-NCPPC stream valley parks within Montgomery County. Of the extensive package of environmental stewardship, compensatory mitigation and community stewardship projects generated to offset the construction of this roadway, more than half were completed on Montgomery County parkland. This included 323 acres of reforestation, 10.5 miles of stream restoration, 56 acres of wetland creation, and 38 stormwater management projects. Staff will present examples and discuss the landowner's role in working with SHA, the design teams and the contractors to ensure that; a) projects on parkland minimized natural resource impacts while meeting project goals and remaining both practical and sustainable; b) the design goals and intent were consistently communicated from the planning stages, through construction and beyond; and c) projects were being monitored both formally and informally post construction to help guide future land management decision making.

Matt, an Aquatic Ecologist, and Erin, an Environmental Engineer with Montgomery Parks both have over 10 years of experience in the field. Matt runs the parks' biological monitoring program and specializes in environmental review of projects on parkland. Erin is a member of Montgomery Parks Phase II NPDES MS4 project team, helping to implement stormwater retrofits, stream restoration projects, and other sustainable practices on Parkland.

RE-EMERGING CONTAMINANTS: EXAMINING TOXICITY IN BEAR CREEK SEDIMENT

Sharon Hartzell; sehartzell@email.wm.edu; University of Maryland, College Park

Co-authors: Lance Yonkos; Department of Environmental Science and Technology, College of Agriculture and Natural Resources, University of Maryland, College Park, Michael Unger; Virginia Institute of Marine Science, College of William & Mary, Beth McGee; Chesapeake Bay Foundation, and Andrew Heyes, The University of Maryland, Center for Environmental and Estuarine Studies, Chesapeake Biological Laboratory

Sediments of Bear Creek near Baltimore, MD serve as a reservoir for industrial contaminants, particularly heavy metals and PAHs. Toxicity tests were conducted on surface sediments and sediment cores at discrete depths to 80 cm, to develop a spatial array and depth profile of toxicity within the study area. Results demonstrate (1) toxicity of surface sediments increases with proximity to sources of current/recent deposition; and (2) greater toxicity is present at depth in sediment cores. Results from core tests demonstrate complete lethality of sediments at depth in two study locations that were only moderately toxic at the surface. The study also investigated two field-portable analytical techniques to measure PAHs and heavy metals in sediments. Results from an antibody-based PAH biosensor indicate sub-surface sediments are up to twenty-seven times more contaminated with PAHs than are surface sediments. This study demonstrates that surface toxicity and contaminant concentrations in Bear Creek sediments are not indicative of toxicity or contamination at depth. Results advance our understanding of the spatial extent of toxicity in Bear Creek, and provide relevant information for future pollution management decisions in the area.

Sharon Hartzell is a second-year master's candidate at the University of Maryland, College Park, in the Department of Environmental Science & Technology. She holds bachelor's degrees in chemistry and environmental science & policy from the College of William & Mary. She has spent the past year researching sediment contamination in the vicinity of Baltimore Harbor, and looks forward to continuing her work in Bear Creek and other pollutant-impacted ecosystems in the future.

EXPOSED SEWER ASSET ASSESSMENT, PRIORITIZATION AND PROTECTION: ROCK CREEK PARK, WASHINGTON, DC

Justin Haynes ; DEVELOPMENT@STRAUGHANENVIRONMENTAL.COM; Straughan Environmental, Inc.

The stability of sewer assets located in stream valleys in urban areas are often severely affected by uncontrolled urban stormwater runoff that causes progressive and accelerated stream bed and bank erosion leading to asset exposure. This presentation will step attendees through a photographic record collected in the region which provides examples of the problem and provides a link to the most recent nationwide water quality assessment that provides compelling evidence that this is likely a nationwide water quality driver in rivers, streams and wetlands. Further, the presentation will illustrate a geomorphically based approach to assessing stability of five sewer assets in the Soapstone Creek stream valley of Rock Creek in the District of Columbia and the prioritization of projects to provide long-term protection through an adaptive natural channel design approach. The methodology and design of a stream restoration to provide long term asset protection will also be presented. The method includes three major elements: inventory and condition assessment of assets, stream geomorphic assessment and development of a watershed model, and stream restoration design.

Justin Haynes is the Vice President for State and Local Programs at Straughan Environmental, Inc. Justin's experience focuses on environmental compliance and permitting issues, ecological restoration for streams and wetlands, and environmental program management for large capital improvement projects. Justin holds an MS in Environmental Engineering and Science from Johns Hopkins University and a BS in Applied Sciences from James Madison University.

HARNESSING THE POWER OF CITIZEN SCIENCE FOR COMMUNICATION AND TO TEST STREAM ASSESSMENT HYPOTHESES WITH MICROBIAL COMMUNITIES

Robert Hilderbrand; hilderbrand@al.umces.edu; UMCES Appalachian Lab

Co-authors: Sarah Laperriere, UMCES Horn Point Lab ; Regina Trott and Jason Cessna; UMCES Appalachian Lab; and Stephen Keller, University of Vermont

As part of our headwater stream microbiome research using 'next generation' DNA sequencing of the 16S ribosomal RNA gene, we partnered with several watershed groups to leverage our research beyond academia. We worked with them to identify questions of interest to them for assessing their watersheds. While we provided scientific guidance, we gave them nearly complete freedom to decide upon what, when, and how to sample. Based on our preliminary research findings that microbial communities in water samples seem to better reflect catchment-level attributes than samples from stream sediments, two groups chose to conduct pre- and post-rain event sampling to examine microbial communities across a discharge gradient. A third group collected samples above and below a suspected point source in a way that also allows assessment of variation over short spatial scales. Because our knowledge of headwater stream microbiomes is still in its infancy, any findings will substantially add to our understanding. The questions posed also added new dimensions for our research. Sequencing results will be presented and provide useful insights into monitoring and assessment with microbes.

Bob Hilderbrand is an associate professor at the UMCES Appalachian Lab in Frostburg. His main research interests revolve around the ecology and conservation of headwater streams.

EVALUATING STREAM RESTORATION SUCCESS THROUGH PRIORITY POLLUTANT LOAD REDUCTIONS

Colin Hill; colin.hill@kci.com; KCI Technologies, Inc.

Co-author: Michael Pieper, KCI Technologies

Pre- and post-restoration monitoring was performed at the Brampton Hills stream restoration project site located in Ellicott City, Maryland. The restoration included bed and bank stabilization efforts for approximately 3,100 linear feet of stream channel in addition to outfall stabilization. Water quality sampling was performed for 2 years prior to restoration and for 3 years post-restoration. Annual loads were estimated using the Flow-weighted Concentration (Ratio Estimate) method within the USACE FLUX32 Load Estimation program for each sampling parameter, and compared between pre- and post-restoration loading rates to obtain estimates of load reductions. Estimated reduction rates per linear foot are higher at Brampton Hills compared to current interim removal rates approved by Maryland Department of the Environment. Results indicate a sediment (TSS) removal rate of 54.2 lbs/ft restored compared to 44.9 lbs/ft, and nutrient removal rates of 0.14 lbs/ft for Total Nitrogen (TN) and 0.15 lbs/ft for Total Phosphorus (TP) compared to 0.075 lbs/ft TN and 0.068 lbs/ft TP.

Colin Hill is a Senior Environmental Scientist in the Natural Resources Group at KCI Technologies, Inc. Over the past 15 years, he has been performing stream and watershed assessments and studies throughout Maryland and in numerous states across the country. Colin holds a Master of Science degree in environmental sciences from Towson University and a Bachelor of Science degree in Biology from Loch Haven University.

NPDES INDUSTRIAL STORMWATER PRIMER

Paul Hlavinka; paul.hlavinka@maryland.gov; Maryland Department of the Environment

Certain industrial activities are required to have stormwater permit, which impose specific controls and actions to protect Waters of the US. This presentation will provide a background on which operators in Maryland are required to have permits and what is required of them, including what types of monitoring. The presentation will also provide information on how to identify sites that have permits and how to find information on their permit coverage.

Hlavinka received his B.S. from NDSU, MBA from St.Thomas, Masters in Environmental Engineering from UMD–College Park. Through his working career in industry, he has experience as a design engineer and a project manager. He currently works at Maryland Department of the Environment in the Water Management Administration in the Industrial and General Permits Division as the technical lead, and works primarily with individual permits and Industrial Stormwater permitting.

A PROPOSAL TO RESTORE THE UPPER HEADWATERS OF SEVERN RUN – A USE IV TRIBUTARY TO THE SEVERN RIVER – USING THE TECHNIQUE OF SELF ORGANIZATION AND CHANNEL EVOLUTION

Mitch Keiler; mitchell.a.keiler2.civ@mail.mil; Fort Meade - Directorate of Public Works

An approach is proposed to restore the upper headwaters of Severn Run – a Use IV Tributary to the Severn River – using the technique of Self Organization and Channel Evolution. Stream restoration has become an accepted approach to rehabilitating degraded streams in Maryland. The cost associated with various restoration practices has continued to increase, putting into question cost-effectiveness. Monitoring of stream restoration has not provided conclusive data that biology is responsive to treatments under a variety of watershed characteristics, while evidence indicates designs continue to harden streams and reduce plan form variability. The evolution of stream restoration practices and ecological thought mandates that we continue to evaluate alternative, cost-effective approaches. Stream channels naturally exhibit self-organizing behavior to various degrees based on channel gradient, sediment size, presence of large woody debris, and other physical factors. The proposed self-organization approach to restoring ecological function to the upper headwaters of Severn Run is based on literature review specific to natural processes, such as those observed in regional streams during recent tropical storm events.

Mitch Keiler currently serves as the Water Resources Program Manager for Fort Meade and as a stream restoration subject matter expert for Department of Army. His responsibilities include administration of the MS4 Program and restoration of aquatic resources at Fort Meade. When he's not in the stream you can find him backpacking a mountain trail, casting a fly or running 100 miles somewhere.

PREDICTING THE FREQUENCY OF DISRUPTIVE FLOW EVENTS FOR LITHOPHILIC SPAWNING FISH USING MONITORING DATA: IMPLICATIONS FOR PROTECTION AND RESTORATION

Stanley J. Kemp; skemp@ubalt.edu; University of Baltimore

River chub (Nocomis micropogon) is an urbanization sensitive species which constructs nesting habitat for other lithophilic spawners in Maryland, and is therefore a keystone species in local fish communities. Despite its importance, little is known regarding the relationship between its populations and environmental degradation. The application of robust frameworks to achieve functional lift through restoration is impeded by this lack of information. In order to improve understanding, field studies at Maryland river chub sites in the vicinity of USGS flow gauges were conducted during 2013- 2014. Monitoring of marked nest survivorship established a consistent relationship between flow and destruction or damage of river chub nests. Using these thresholds, flow monitoring data from streams with and without river chub were used to predict frequency of potentially disruptive events. The frequency of these events is significantly greater in urbanized streams lacking river chub. Improved mechanistic understanding of relationships between stream processes and biotic responses is essential for better incorporation of biota into protection and restoration design.

Stan Kemp has been an assistant professor at University of Baltimore since 2008, where he teaches environmental science and sustainability courses. His research interests are focused on the impacts of urbanization on fish communities, and how characterizing these impacts can lead to better strategies for stream protection and restoration.

AQUATIC INVASIVE SPECIES IN MARYLAND: THEIR SOURCES, THEIR IMPACTS, AND THE CHALLENGES WE FACE IN DEALING WITH THEM

Jay Kilian; jay.kilian@maryland.gov; Maryland Department of Natural Resources, Resource Assessment Service

Introductions of invasive species in the U.S. cost billions of dollars annually in damages to industry, fisheries, tourism, property values, and ecosystems. In Maryland, aquatic invasive species (AIS) are a major concern. Despite increased public awareness of the issue, AIS introductions continue and the list of invasive species threatening Maryland waters is growing. This presentation will review the major sources (vectors) responsible for introductions and spread of AIS in the state and will describe the species of greatest concern and their impacts. This presentation will also describe recent efforts to prevent further AIS introductions, the next steps needed, and challenges we face in combating this growing problem. The intent of this presentation is to provide a general overview of AIS in Maryland as a backdrop for the species case-study presentations that will follow in this session.

Jay Kilian is a biologist with the Maryland Department of Natural Resources, Resource Assessment Service. He is a member of the MDNR Invasive Species Matrix Team, the Maryland Invasive Species Council, and the Mid-Atlantic Panel on Aquatic Invasive Species.

REAL-TIME PERFORMANCE MONITORING OF STORMWATER INFRASTRUCTURE PROVIDES CRITICAL EVALUATION OF NONPOINT SOURCE POLLUTION REDUCTION

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Co-author : Marcus Quigley ; OptiRTC, Inc.

The U.S. Environmental Protection Agency first began permitting non-point stormwater discharges 25 years ago, with the goal of extending regulatory protection of our nation's surface water resources beyond point source pollution. Today, stormwater continues to be a significant contributor to surface water pollution and there is little transparency into the effectiveness of the investments made to protect our most valuable resource. With recent advances in technology, namely the ability to connect sensors in the field to the internet, cloud-based infrastructure monitoring has become financially feasible at a highly distributed level. Real-time environmental performance monitoring is a necessary link to directly quantify the benefits of integrated watershed planning efforts. This presentation will provide an overview of the current state of the practice for data-driven stormwater management made possible by cloud-based monitoring technology.

Jamie Lefkowitz is a registered professional water resources engineer with experience in stormwater management, integrated watershed planning, surface water quality, and hydrologic modeling. She has nine years of industry experience and currently works for Opti, a new company based out of Boston that is advancing the technology of stormwater infrastructure monitoring, performance reporting, and active control using cloud-based software technology.

IDDE - A COST EFFECTIVE BMP

Lori A. Lilly; lorililly@gmail.com; Lori A. Lilly Environmental Solutions

Illicit Discharge Detection and Elimination (IDDE) is one of the six minimum control measures of Municipal Separate Storm Sewer (MS4) permits. IDDE is often viewed as the "forgotten step-child" of stormwater management programs – the elements of an effective program are not well understood, resources and guidance are limited, and yet control of illicit discharges is one of the most cost effective management strategies for achieving clean water goals and regulatory mandates that a local government can implement. Illicit discharges can be significant contributors of pollution and their elimination can help make considerable strides toward Total Maximum Daily Load (TMDL) nutrient and bacteria reduction targets. This presentation will provide a brief overview of IDDE programs, review several illicit discharge detection and tracking case studies, and discuss the relevance in relation to the recently approved Chesapeake Bay program crediting recommendations. Ongoing behavior change research related to sanitary sewer overflows caused by the improper disposal of materials in sanitary systems will be discussed.

Lori A. Lilly is an independent environmental consultant and a part-time Watershed Restoration Specialist for the Alliance for the Chesapeake Bay's READY program. Lori directed a non-profit implemented watershed restoration projects in Oregon and worked for the Center for Watershed Protection as a Watershed Ecologist / Planner. Lori is currently leading multiple illicit discharge and restoration projects in the Chesapeake Bay and grassroots watershed efforts in Howard County.

WHY WE SHOULD CARE ABOUT SNAKEHEADS: MYTH VS REALITY

Joseph Love; joseph.love@maryland.gov; Maryland Department of Natural Resources, Inland Fisheries

Co-author: Joshua J. Newhard; U.S. Fish and Wildlife Service and Mary Groves; Maryland Department of Natural Resources, Inland Fisheries

Northern snakehead (Channa argus) is invasive in Maryland, where it was discovered in the tidal Potomac River in 2004. Since then, it spread quickly in Potomac River and Chesapeake Bay watershed. Estimated population size in Potomac River is 21,279 subadults and adults. Since encouraging harvest, commercial and recreational harvest has increased significantly. Between 2011 and 2012, there was a near doubling of colonized drainages in the watershed, possibly because of increased flows during tropical storms. Studies indicate that northern snakeheads do not show strong prey preference for sunfish, topminnows, and perch-like fishes. Conspicuous prey items such as goldfish were slightly preferred. Adults (1.7-2.2 kg) consumed approximately 7 fish per 2 weeks during summer (water temperatures: 22-27°C), resulting in an estimated average consumed biomass of 1.7 kg/yr for a 2 kg northern snakehead in a captive environment and assuming constant consumption rate. This was not greater than that reported for adults of other top predators including largemouth bass. Ecological impacts will be similar to those from other introduced predators, limiting resources in some areas, and affecting copious and conspicuous prey.

Joseph Love works for Maryland Department of Natural Resources as tidal bass program manager and is a Fisheries Service representative for their Invasive Species Matrix Team. He earned his Ph.D. working with stream fishes and invertebrates in Arkansas and then moved to Maryland for his post-doc to work with coastal and estuarine fishes. He began working with snakeheads out of concern from bass anglers on the impact to their fishery.

HARMFUL ALGAE BLOOMS IN MARYLAND: INCREASED SCIENTIFIC UNDERSTANDING AFFECTS RESPONSE, COORDINATION, AND MANAGEMENT

Chris Luckett; chris.luckett@maryland.gov; Maryland Department of the Environment

This talk will focus on what we have learned about harmful algae in the last decade and how the State of Maryland learns about and reacts to harmful or potentially harmful algae blooms when they occur. Harmful algae blooms threaten aquatic resources, animal, and human health through a variety of means, including oxygen deprivation and toxin exposure. Toxins can affect fish, or humans through direct contact, contact with or ingestion of water, or through bio-accumulation of toxins by shellfish we consume. Using past recent scenarios, we will discuss how HAB events are addressed. Each scenario requires a different response and multiagency coordination to be addressed to inform and protect the public. The efforts and roles of agencies involved in HAB management have evolved over time. They will need to continue to evolve in a world where climate change is expected or if aquatic systems shift toward a more eutrophic state.

Chris received his BS in Marine Biology in 1985. For 15 years, he was an ecologist at the Smithsonian Institution, making living models of various coastal ecosystems and researching controlled algae culture to remove nutrients and other pollutants from water. In 2000 he came to MDE. Chris investigates fish kills and algae blooms, conducts fish and benthic community assessments in fresh and estuarine water, and is involved in various projects involving aquatic biology, and pollution control.

NON-LETHAL DETECTION OF INTERSEX (TESTICULAR OOCYTES) IN BLACK BASSES (MICROPTERUS SPP.) USING LAPAROSCOPY

Alexander MacLeod ; alexx.macleo@gmail.com; University of Maryland, Department of Environmental Science and Technology

Co-author: Lance Yonkos (Mentor); University of Maryland, Department of Environmental Science and Technology, College Park

Intersex in wild fish populations has received considerable attention in the scientific literature and public media. Characterizing the health status of a fish population often requires tissue collection for histopathology and/or contaminant analysis. To date, the tools available for such collection either require sacrificing the fish for tissue collection or complex and invasive surgery with long post-operative holding times and a high likelihood of infection and subsequent mortality. We examined the efficacy of endoscopy via the genital pore (laparoscopy) as a non-lethal sampling technique for collection of largemouth bass (LMB) testis to detect testicular oocytes (TO). Our research expands on previous efforts by collecting multiple testis biopsies (n=5) to quantify TO prevalence and severity. Male LMB (n=20) post-operative recovery was high (90%) for survival and healing (≥28 days). Smallmouth bass (SMB) testis was collected by biopsy post-fixation for comparison. Detection in transverse sections and biopsies for SMB was 70% and 62%, respectively and 76% total. Detection in transverse sections and biopsies for LMB was 24% and 11%, respectively and 46% total. Average severity was higher in SMB than LMB using transverse sections.

Alex is currently finishing his Masters of Science at the University of Maryland in the department of Environmental Science and Technology under the guidance and expertise of Dr. Lance Yonkos. He completed his Bachelors of Science at Western Washington University. His current research interests include developing non-lethal methods for monitoring endocrine disruption in aquatic organisms.

NAVIGATING A PHASE II PERMIT: MONTGOMERY PARKS PERSPECTIVE

Amanda Matheny; amanda.matheny@montgomeryparks.org; M-NCPPC, Montgomery County Parks

Co-author: Jai Cole; M-NCPPC, Montgomery Parks

The Maryland-National Capital Park and Planning Commission (M-NCPPC) is a bi-county state-chartered entity. The M-NCPPC Department of Parks (Montgomery Parks) has implemented a MS4 Phase II NPDES permit program since 2009 as well as 12 NPDES industrial permits since the mid – 1990's. Montgomery Parks is unique amongst NPDES Phase II permit holders in that we are a large landowner, managing approximately 11% of the land in the County, but we also work closely with Montgomery County, a NPDES Phase I permit holder, on a number of initiatives. We own and maintain approximately 485 stormwater management facilities, and are primarily a stream valley park system (approx. 457 miles of stream flow through parkland) – two resources Montgomery County utilizes in reaching compliance with their permit. This presentation will highlight lessons learned from working toward permit compliance, highlighting how to successfully engage staff across the organization, how to build internal support to ensure permit requirements remain a priority Department-wide, how to work effectively with other agencies to meet requirements and more efficiently serve the local community, as well as strategies for engaging stakeholders and volunteers.

Amanda Matheny has over 6 years of experience in the stormwater field and is currently a Senior Natural Resources Specialist with M-NCPPC, Montgomery County Department of Parks where she works on a variety of NPDES-related initiatives, develops educational content for staff, conducts environmental review of projects, and participates heavily in Montgomery Parks' biological monitoring program.

CONNECTING TRUE FUNCTIONALITY TO A "FUNCTION-BASED FRAMEWORK" FOR STREAM (AND WETLAND) ASSESSMENT AND RESTORATION

Erik Michelsen; pwmich20@aacounty.org; Anne Arundel County Watershed Protection and Restoration Program

Recently, in response to the fact that many of the conventional success metrics for stream restoration had been form-based and insufficiently tied to the ecosystem response of restored sites, the US EPA, in conjunction with the US Fish and Wildlife Service and other partners, rolled out "A Function-Based Framework for Stream Assessment & Restoration Projects." The Function-Based Framework is tied closely to a conceptual model, a Stream Function Pyramid, where various stream functions are stacked, and contingent upon one another (i.e., hydrology, hydraulics, geomorphology, physicochemical, and biology). While the framework represents progress from the status quo, its heavy grounding in the paradigm of Natural Channel Design largely assumes that the "lowest" opportunity on the pyramid to engage these systems is "geomorphology," or channel form. This presentation will explore the limitations of such an approach to stream and wetland restoration and synthesize contemporary research on the topic, building the case for a more fundamental intervention in these systems.

Erik Michelsen is currently the Administrator of Anne Arundel County's Watershed Protection and Restoration Program and is charged with managing a billion dollar restoration program to clean up the County's waterways and satisfy its Municipal Separate Storm Sewer System (MS4) and Chesapeake Bay TMDL requirements. He previously served as Executive Director of the South River Federation.

CREEK FREAKS MEETS TROUT IN THE CLASSROOM

Leah Miller; leah@iwla.org Izaak Walton League of America

Co-author: Sarah Mitchell; Chesapeake Conservation Corps and Izaak Walton League of America

Creek Freaks is a program started by the Izaak Walton League in 2010. It was created to teach 4th-8th grade students about their local watershed and the factors impacting its cleanliness. In addition to training school teachers about the biological, chemical, and physical factors involved in water quality, this year the League will be teaming with Trout Unlimited to merge Creek Freaks curriculum with the Trout in the Classroom raise and release program. While mastering the art of raising juvenile trout in clean fish tanks, middle school students will learn how a stream is connected to a larger watershed. In addition, students will conduct biological and chemical water quality tests, and implement stewardship projects to enhance the health of a particular stream in their area. This presentation will include demonstrations of hands-on environmental education activities from Creek Freaks and Trout in the Classroom that relate to water quality monitoring and expanding student understanding of the context of monitoring data. We also will discuss how conference participants can get further training and resources to implement Creek Freaks and Trout in the Classroom in their communities.

Leah has a degree in political science and organismal biology from Yale University. Leah has 17 years of experience coordinating volunteer monitoring efforts and is currently the Director of Clean Water Programs at the Izaak Walton League of America. Leah also oversees Creek Freaks, an environmental education program that engages children in grades 4-8 in stream monitoring and related science learning.

WATERSHED REHABILITATION AND THE BEAVER CREEK TROUT FISHERY

John Mullican; john.mullican@maryland.gov; Maryland Department of Natural Resources, Inland Fisheries

Co-author: Mark Toms and Josh Henesy; MD DNR Inland Fisheries

During the last decade, many stream restoration projects and agricultural best management practices have been completed within the Beaver Creek watershed in Washington County, Maryland. The Beaver Creek Watershed Association, the Washington County Soil Conservation District, federal and state agencies, conservation and angling organizations, local communities, and landowners have worked cooperatively to establish riparian vegetation and improve in-stream habitat. Among the goals of these projects is to enhance existing naturalized brown trout (Salmo trutta) populations and improve recreational fishing opportunities. Using population estimates and measures of biomass and density derived from electrofishing depletion surveys, the Maryland Department of Natural Resources, Inland Fisheries Division documented the response of the trout fishery in the watershed at multiple sites. Adult brown trout biomass has increased 19% to 37% annually. The improved trout resources have become a destination fishery generating several local businesses catering to anglers.

John Mullican is the Western Region, District II Manager responsible for managing and enhancing the sport fisheries in Washington and Frederick Counties. He has been with the Inland Fisheries Division for 28 years.

ASSESSING RIVER HERRING SPAWNING RUNS IN TRIBUTARIES OF CHESAPEAKE BAY

Matthew B. Ogburn; ogburnm@si.edu ; Smithsonian Environmental Research Center

Co-authors: Michael Hannam, Don Weller and Anson H. Hines; Smithsonian Environmental Research Center and Don Weller

River Herring populations in Chesapeake Bay have declined substantially since the mid-1900's. The 2013 Stock Assessment indicated that data available for Chesapeake Bay were insufficient to determine stock status. The purposes of this project were to begin to establish baseline abundance, demography and distribution data for River Herring in the Chesapeake watershed and develop predictive habitat models to guide conservation and restoration efforts. Abundance and demography data have been collected for the Choptank River, Marshyhope Creek and Deer Creek. Abundance was determined by conducting fish counts using Dual-Frequency Identification Sonar (DIDSON) and size, age, sex and spawning history were assessed for biological samples collected by electrofishing and net sampling. Distribution data have been collected for the Choptank River, Deer Creek and the Patapsco River using visual, cast-net and ichthyoplankton surveys. A preliminary habitat use model has been developed for the Choptank River watershed based on historical and modern presence/absence data of adult fish in spawning streams and land cover. The results of this work will be discussed in relation to conservation and restoration efforts in Chesapeake Bay.

Dr. Matt Ogburn is an Ecologist at the Smithsonian Environmental Research Center studying fish and invertebrate communities and the fisheries they support. His primary expertise is in blue crab ecology and fisheries and his other research topics include river herring conservation, coastal migrations, oyster restoration and shallow-water ecosystems. Since 2013, he has been leading a SERC research team studying river herring in the Chesapeake Bay watershed.

MONITORING FOR CHLORIDE IN MARYLAND FRESHWATER STREAMS

Allison O'Hanlon; allison.ohanlon@maryland.gov; Maryland Department of the Environment

In 2010, the Maryland Department of the Environment (MDE) began listing chloride as an impairing pollutant on the Maryland Integrated Report. MDE has identified elevated concentrations of chloride (Cl-) as a potential cause 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- 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 monitoring design was developed to aid MDE in determining the spatial and temporal extent of chloride loadings to non-tidal surface waters in Maryland.

Allison O'Hanlon has worked as a natural resource biologist and planner for the Maryland Department of the Environment since 1989. She has supervised the Biological Stressor Identification Section and currently supervises the TMDL Monitoring Section.

MOLECULAR MICROBIAL SOURCE TRACKING AS A TOOL TO ASSESS THE PRESENCE OF HUMAN AND PET WASTE IN THE BALTIMORE HARBOR WATERSHED

Wolf T. Pecher; wpecher@ubalt.edu; University of Baltimore, College of Arts and Sciences

Co-author: David Flores and Alice Volpitta; Blue Water Baltimore

Baltimore Harbor and its main tributaries (the non-tidal Patapsco River, Gwynns Falls, and Jones Falls) are heavily impaired by nutrients and fecal bacteria. Sources of fecal contamination include runoff from impervious surfaces, leaking sanitary sewers, and storm drains that discharge fecal bacteria, often from humans and possibly pets. Traditionally, fecal contamination is assessed through the enumeration of fecal indicator bacteria. However, these methods do not discriminate between fecal sources (e.g., human vs. dog waste). Methods to identify the source of fecal contamination have been developed, and are commonly referred to as "microbial source tracking" (MST) methods. Since 2013 we have been assessing the presence of human and dog waste at selected sites in the Baltimore Harbor Watershed using present/absent molecular-based MST assays. Our data so far suggest that in addition to human waste, dog waste is a prominent source of fecal contamination. Furthermore, we identified a site in the Jones Falls where other unknown animal sources are major contributors to fecal contamination. These results show the potential of molecular based MST tools to assist in the development and evaluation of targeted remediation strategies.

Wolf T. Pecher is an Assistant Professor at the University of Baltimore (UB). He received his PhD from the University of College Park in Marine Estuarine Environmental Sciences. Prior to his position at the University of Baltimore he worked at the Center of Marine Biotechnology (now IMET) at the University of Maryland Biotechnology Institute. His research focuses on the use of microbes to track pollution using microbiology and molecular biology based approaches.

COOPERATION AND COORDINATION BETWEEN MD DNR STREAMWADERS AND THE HOWARD COUNTY WATERSHED STEWARDS ACADEMY (WSA) HOME OWNER ASSOCIATION (HOA) PARTNERSHIP PROGRAM

Alan Pflugrad; pflugal@gmail.com; Howard County Watershed Steward Academy

Co-author: Lori Lilly; Watershed Consultant and Howard County Restoring the Environment and Developing Youth (READY) Program

This presentation summarizes progress-to-date of a Howard County WSA team that is providing HOAs with resources to remedy their stormwater challenges. DNR allowed this WSA team to sample stream sites near targeted HOAs. As the WSA team surveyed each stream, they simultaneously captured stream habitat information, occasionally captured chemical data and always picked up trash. DNR greatly expedited their analysis of the collected sample so that the results (IBI scores) can be used to engage the communities. The outreach to date has included surveys and workshop for residents sometimes as part of regular and/or special HOA meetings or events. In certain cases, best practices have already been identified and implemented. Nine HOA's are participating. The IBI scores at all sites were poor or very poor. The HOAs vary greatly in size and type ranging from small town home complexes to large estate communities. Summaries of neighborhood characteristics, land use characteristics and drainage areas will be discussed.

Alan Pflugrad is a Howard County Master Watershed Steward (since 2013). He has participated in the Maryland DNR Streamwaders program approximately six times. He volunteers with the MD DNR Teaching Environmental Awareness in Maryland (TEAM) program and several other county environmental groups as well.

NPDES: INDUSTRIAL STORMWATER DISCHARGERS- THE OTHER SIDE OF THE FENCE

Jeffrey C Reagan; jreag00@gmail.com ; Maryland Environmental Service

Have you ever wondered about the impacts to water quality from the stormwater runoff of industrial sites? Are you curious about what's on the other side of that fence? Are industrial stormwater permits a burdensome regulation that diminish corporate profitability and efficiency without providing any beneficial impact to water quality or are they a much needed mechanism for pollution prevention? Here's a behind the scenes look at real-world industrial stormwater discharge facilities and the challenges they face to meet NPDES permit requirements. This presentation will provide photo-documentation and monitoring results of actual 12SW and 10MM facilities with a focus on meeting benchmark monitoring and numeric effluent limitations, and the corrective actions taken by permit holders to comply.

Jeff Reagan is living his dream as an Environmental Specialist with the Technical & Environmental Services Group of the Maryland Environmental Service, and serves on the Board of Directors for the Maryland Water Monitoring Council and as a Board Member to the State Water Quality Advisory Committee. Jeff enjoys sharing his passion for environmental stewardship as an Anne Arundel County Master Watershed Steward and Maryland Master Naturalist.

COPARISON OF BIOLOGICAL RESPONSES TO STREAM RESTORATION ACROSS MARYLAND

Nancy Roth; nroth@versar.com; Versar, Inc.

Co-authors: Elizabeth Franks, Theresa Hage, Brenda Morgan, and Ryan Corbin; Versar, Inc.

Continued uncertainty exists among the stream restoration community as to how effective stream restoration is in improving biotic communities in restored reaches. We frequently hear this phrased as "If we build it, will they come?" Along with degraded habitat, biota are affected by water quality, upstream activities, and watershed land cover, and are limited by connectivity to downstream habitats and available species pools. Versar, in partnership with local jurisdictions and DNR, is conducting long-term biological monitoring at stream restoration sites throughout central Maryland. We highlight examples of restoration monitoring of biota and associated habitat in three watersheds. Pre- and post-restoration monitoring of fish and macroinvertebrates has been conducted at the Pinecliff tributary to Frederick County's Monocacy River since 2008. Biological monitoring at Red Hill Branch, Howard County, tracks trends in condition before and after Trust Fund restoration. Monitoring at Cabin Branch in Patapsco basin, Anne Arundel County, incorporates new tools for assessing ecological function. Methods and results integrated across multiple projects can improve understanding of restoration effectiveness in different geographic settings.

Nancy Roth, Senior Scientist and Program Manager at Versar, has more than 20 years of experience in stream ecology, biological assessment, and watershed restoration planning. She has provided consultant support to the Maryland Biological Stream Survey and a number of local MS4 programs in Maryland and Virginia. When time permits, she is out paddling the waters of the Chesapeake Bay and exploring its treasures.

MARYLAND'S CWA SECTION 303(d) PROGRAM: PLANS FOR 2016-2022

Timothy C. Rule; tim.rule@maryland.gov; Maryland Department of the Environment

Maryland's TMDL Technical Development Program is in the process of aligning with the U.S. EPA's "New Vision" for Section 303(d) of the federal Clean Water Act. The New Vision is intended to facilitate quantifiable improvement in water quality via the development of TMDLs or suitable alternatives to address impaired waters. Maryland has developed an approach to prioritize its development of TMDLs (or suitable alternatives) over the next few years, in keeping both with the New Vision and with MDE's mission of protecting and restoring water quality and protecting public health. This presentation will describe Maryland's approach and outline the waters identified for prioritization from 2016-2022.

Tim Rule heads up the TMDL Technical Coordination and Biological Stressor Identification Division within the TMDL Technical Development Program at the Maryland Department of the Environment (MDE). He has been with MDE for nineteen years.

DEVELOPING A POOLED MONITORING PROGRAM: MONTGOMERY COUNTY'S EFFORT TO MORE EFFICIENTLY AND HOLISTICALLY STUDY DEVELOPMENT IMPACTS WITHIN SPECIAL PROTECTION AREAS

Jenny St. John; Jennifer.St.John@montgomerycountymd.gov Montgomvery Co. DEP

Montgomery County's Department of Environmental Protection (DEP) monitors restoration projects to evaluate specific project goals and to fulfill permit and/or grant requirements. DEP also has a similar targeted monitoring program to monitor development impacts within Special Protection Areas (SPAs) that have unusually high quality and/or sensitive aquatic resources. The restoration and SPA monitoring programs mirror each other in terms of how projects are individually permitted, implemented, and monitored. DEP has recognized many similar challenges with data comparability, study designs, efficiencies, monitoring timeframes, and interpretation of results.

No Bio Submitted

MICROBIAL DIVERSITY AS AN INDEX OF BIOLOGICAL WATER QUALITY IN MARYLAND HEADWATER STREAMS

Alyson Santoro; asantoro@umces.edu; UMCES

Co-authors: Sarah Laperriere, Stephen Keller, Regina Trott, Jason Cessna, and Robert Hilderbrand; University of Maryland Center for Environmental Science

Microbes play an important role in maintaining healthy aquatic ecosystems, including removing nitrogen, processing carbon, or indicating elevated stressors such as chloride. A molecular approach using 'next generation' DNA sequencing of the 16S ribosomal RNA gene allows cost-effective measurement of stream microbial composition from a small sample of water or sediment, allowing comparison with more traditional invertebrate indicators of stream water quality. We used this approach to sample microbial diversity in water and sediments in 96 streams across the state in spring and summer in conjunction with the Maryland Biological Stream Survey program. We found significant differences in the microbial community composition between sediment and water samples; sediment samples from different streams were more similar than water and sediment samples from the same stream. We observed differences in microbial species richness between regions, with the highest diversity present in Highland and Piedmont streams, and the lowest diversity in Eastern Shore streams. Analysis of land use within each watershed indicated lower microbial species richness in streams with a higher percentage of agricultural and urban land use.

Alyson Santoro is an Assistant Professor at the Horn Point Laboratory, part of the University of Maryland Center for Environmental Science in Cambridge, Maryland.

2015 WASHINGTON METROPOLITAN AREA WATER SUPPLY STUDY

Cherie Schultz; cschultz@icprb.org; Interstate Commission on the Potomac River Basin

Co-authors: Sarah Ahmed and Karin Bencala; ICPRB

The most recent Washington, DC, metropolitan area (WMA) water supply study, released this year, finds that the area's current system may be strained by the year 2040. Population served by the major WMA suppliers is projected to increase from 4.6 to 5.7 million between 2015 and 2040, and over this same period, WMA water demand is forecast to rise from its current level of approximately 486 million gallons per day (MGD) to 545 MGD. Study results indicate that by 2040, under a repeat of conditions similar to a severe historic drought, mandatory water use restrictions will be likely, a key system reservoir, Little Seneca, may be emptied, and there is a small chance that flow in the Potomac River will drop slightly below the minimum environmental flow level of 100 MGD at Little Falls dam near Washington, DC. Factoring in the potential effects of climate change adds considerable uncertainty to study results. Under some climate change scenarios, serious water supply shortages are projected to occur during a severe drought.

Cherie L. Schultz, Ph.D., is Director of Operations for the Section for Cooperative Water Supply Operations on the Potomac (CO-OP) at the Interstate Commission on the Potomac River Basin (ICPRB). Dr. Schultz holds a M.S. degree in Civil Engineering from the University of Maryland, a Ph.D. in Physics from the State University of New York at Stony Brook, and a B.S. in Physics from Stanford University.

COMPARISON OF RELATIONSHIPS BETWEEN NUTRIENT INPUTS, LAND USE CHANGES, AND IMPLEMENTATION OF BEST MANAGEMENT PRACTICES ACROSS BASINS OF THE CHESAPEAKE BAY WATERSHED

Andrew Sekellick; ajsekell@usgs.gov; Chesapeake Bay Program

Various management strategies (best management practices or BMPs) have been implemented in the Chesapeake Bay watershed in an effort to reduce nitrogen (N) and phosphorus (P) loads to the estuary. A better understanding of the effectiveness of these management strategies at mitigating or reducing N and P loads is needed to support restoration efforts. A comparison of long-term trends in anthropogenic sources of N and P as well as BMP implementation and land use change across the Chesapeake Bay watershed and its sub-basins was performed. Long-term changes in agricultural practices (i.e. livestock populations, crop acres, and manure and fertilizer application) and other land use changes helped describe changes observed in nutrient inputs. Insights from these comparisons also were used to develop hypotheses regarding potential drivers of changes in stream water quality. Comparing changes in sources, land use, and BMP implementation across different sub-basins improved the ability to identify watersheds with the greatest potential to inform management strategies designed for nutrient reduction.

Andrew Sekellick works for the MD-DE-DC Water Resources Division of the U.S. Geological Survey in Baltimore, MD. He holds a B.S. in Geography and Environmental Systems and a Masters in GIS from the University of Maryland, Baltimore County. He currently works as part of the Chesapeake Bay Explaining Trends team within the USGS and focuses on describing changes in sources and management practices within the watershed using monitored and modeled data.

STORMMWATER MONITORING COMMITMENTS FOR THE ICC

Rob Shreeve; RShreeve@sha.state.md.us; Maryland SHA

The Intercounty Connector (ICC) Project, a 6 lane 18 mile long highway built across environmentally-sensitive watersheds, committed to performing real-time water quality monitoring during construction. Maryland State Highway Administration (SHA) built the storm-related monitoring effort into the requirements of the contractors to ensure that highway construction could be controlled in a manner that would minimize environmental impacts. SHA implemented stormwater management and Environmental Site Design (ESD) best management practices in the Paint Branch watershed during highway construction. This presentation will discuss the erosion and sediment controls, monitoring methods implemented, and the results of storm-related monitoring.

No Bio Submitted

BIOLOGICAL MONITORING FOR THE INTER-COUNTY CONNECTOR PROJECT: A SUMMARY OF RESULTS TO DATE

Sean Sipple; seans@coastal-resources.net; Coastal Resources, Inc.

The Maryland State Highway Administration (SHA) took considerable effort to avoid/minimize impacts to aquatic resources during construction of the Intercounty Connector (ICC). Biological/geomorphic data were collected within the project area upstream and downstream of all major (and some smaller) stream crossings. Assessments included surveys of aquatic habitat, benthic macroinvertebrates, fish, temperature, in situ water chemistry, longitudinal profile, cross sectional area, stream bed material, and instream features. In addition, SHA constructed 21 stream restoration sites, 5 wetland restoration sites, 25 best management practice (BMP) sites, 19 storm water management retrofits/water quality sites, 17 reforestation sites, and 8 community stewardship sites. This presentation discusses the BMPs, stewardship, and mitigation used to minimize impacts from construction of the ICC. It also discusses the results of biological/geomorphic monitoring and the preliminary biological monitoring findings for several stream restoration projects to date. Based on this wide range of data collected over the monitoring period (2003-2013), the potential for large-scale effects from construction of the ICC appear to have been minimized.

Sean Sipple is a Senior Environmental Scientist with Coastal Resources, Inc. He has over 13 years of experience working in natural resources, in the research, government, and private sectors. Sean conducts, reviews, and assembles natural resource studies related to residential, commercial, transportation, and utility projects, focusing on water quality and wetland assessments.

GROUNDWATER SUSTAINABILITY IN MARYLAND'S COASTAL PLAIN PROVINCE

Andrew Staley; andrew.staley@maryland.gov; Maryland Geological Survey

Groundwater is nearly the sole source of fresh drinking water for approximately 1.4 million people living in Maryland's Coastal Plain. A sustainable supply of clean drinking water is crucial to the health and well-being of the citizens of Maryland, in addition to a strong economic future for the State. Aside from being the dominant drinking water source, groundwater is also important for irrigation, commercial and industrial uses, and power plants. And because groundwater interacts with streams and wetlands, it also plays a vitally important role in sustaining healthy populations of fish and other aquatic organisms. Groundwater in the Coastal Plain of Maryland occurs in at least 15 regional aquifer systems, each possessing a unique hydrogeology with a variety of challenges to sustainable use. In certain areas of the Coastal Plain groundwater supply may be severely constrained in the future as a result of overuse of the aquifers and poor water quality, while in other areas groundwater supply is robust and sustainable. In this talk, concepts of groundwater sustainability will be discussed and case studies illustrating both sustainable and non-sustainable groundwater supplies will be presented.

Andrew Staley is a hydrogeologist with the Maryland Geological Survey. He has conducted field investigations of aquifer systems in the Maryland Coastal Plain, and has worked extensively to develop regional GIS coverages of the aquifers and confining units of the Coastal Plain. He received his BA in Geology and Environmental Studies from Macalester College, and his MS in Geology from the University of Wisconsin-Madison.

A WILD TROUT POPULATION IN THE PATH OF THE ICC

Mark Staley; mark.staley@maryland.gov; Maryland Department of Natural Resources,

Co-author: Charlie Gougeon; Maryland Department of Natural Resources (formerly of MD DNR Fisheries Service)

The Paint Branch watershed of the Anacostia River basin contains a wild brown trout population in an urbanizing landscape. MD DNR Fisheries Service has monitored the population and conducted annual population estimates in Paint Branch since 1979. Trout numbers, age structure and changes in distribution will be discussed. The impacts of the ICC (construction and restoration) on trout and trout habitat will be examined. Brown trout population indices in the Good Hope tributary declined to historic lows before ICC construction in the watershed began in 2009 and ended in 2013. Brown trout reproduction and recruitment failed or was absent during the years 2011 through 2014 in the Good Hope tributary reference station. Sampling in 2015 found young of year brown trout again inhabiting the Good Hope tributary reference station in low densities. The construction of the ICC in the Good Hope watershed resulted in very few incidents of sediment or uncontrolled stormwater runoff impacting the stream. The low densities of brown trout in the Good Hope watershed during the construction of the ICC and in the post-construction years may be the result urbanization impacts to the watershed that preceded the construction of the ICC.

Mark has worked as a fisheries biologist for MD DNR since 1988 in Central MD. His responsibilities include the management of warmwater species in reservoirs, tidal bass, and wild and stocked trout fisheries. Charlie Gougeon worked for MD DNR Fisheries from 1980-2015. Charlie has been a tireless advocate for protecting the brown trout population in Paint Branch and has an encyclopedic knowledge of it's history.

TACKLING URBAN STREAM RESTORATION IN PHILADELPHIA'S PARKS: LESSONS LEARNED FROM THE FIELD AND OFFICE

Shandor Szalay; sszalay@akrf.com; AKRF, Inc.

Many of Philadelphia's remaining streams flow through urban parks. While these parks provide some insulation from the surrounding urban land use, most of Philadelphia's streams are degraded by stormwater and combined sewer overflows. We review varying approaches to restoring Philadelphia's urban streams, focusing on three recent projects: Wises Mill Run, Gorgas Run, and Tacony Creek. The talk highlights both (1) unique challenges associated with implementing stream restoration in urban parks and (2) strategies for implementing projects that lead to strong ecological outcomes, while protecting cultural/historical resources and incorporating other park amenities into project designs. We define design principles for urban stream restoration in parks that focus on limiting natural area disturbance via two related strategies: (1) rebuilding ecologically-appropriate baseflow channel systems within overwidened and incised stream channels (rather than manipulating bankfull) and (2) using upstream hydrologic regime modification to improve baseflow, reduce erosion rates, and improve water quality. Lastly, we discuss how stream, park, and drainage area characteristics can systematically drive the choice of restoration approaches.

Shandor Szalay is a Senior Vice President at AKRF with extensive experience related to sustainable water resources and infrastructure management, including green stormwater infrastructure design, natural channel and bioengineering stream restoration, natural landscape restoration, and watershed management and planning. Shandor has a masters from the University of Minnesota and is an adjunct professor at Villanova University.

CITIZEN SCIENCE ON THE CHESTER RIVER

Tim Trumbauer; ttrumbauer@chesterriverassociation.org; Chester River Association

Tim Trumbauer will discuss the work of 60+ citizen scientists that volunteer for the Chester River Association's Chester Tester Program. The discussion will include a brief overview of the Chester River Association, the Chester Tester Volunteer Program, challenges, successes, and the future of monitoring on the Chester River.

Tim Trumbauer is the Chester River Association's Watershed Manager. He runs the water quality monitoring program on the Chester River, which includes 49 tidal and non-tidal monitoring stations. Prior to joining CRA, Tim spent 12+ years in the environmental consulting industry in roles including environmental science, marketing, and management. When he is not crusading for a healthy Chester River, Tim, a native of Chestertown, enjoys fishing, sailing, croquet, and spending time with his family.

DEVELOPING A DROUGHT PLANNING TOOL FOR THE SUSQUEHANNA RIVER BASIN

W. Josh Weiss; jweiss@hazenandsawyer.com; Hazen and Sawyer

Co-authors: Justin Irving; Hazen and Sawyer, Richard Palmer and Kathryn Booras; University of Massachusetts Amherst,John Balay and Ben Pratt; Susquehanna River Basin Commission, Clark Howells, Department of Public Works, City of Baltimore, MD

It is exceedingly difficult to foresee the onset of a drought, and once in place, difficult to identify the end of a drought with enough lead time for effective management decisions. Further, management responses can be difficult and costly to implement, and often are not taken quickly for fear of initiating actions that will prove both costly and unnecessary. Advanced warning of impending drought conditions enables a variety of proactive responses to help resource managers more effectively limit impacts to system residents and stakeholders. Our team is currently working on a NOAA-funded effort to develop a Drought Planning Tool (DPT) for the Susquehanna River Basin that processes common hydrologic and climatological indicators for input to a water supply system simulation model. The DPT will serve as a framework for developing and applying quantitative drought predictions for regional-scale drought planning, focused on early warning triggers for proactive drought impact mitigation measures. This presentation will provide an overview of the DPT project and describe applicability of the tools and methods across the wider Chesapeake Bay region.

Dr. Josh Weiss is an Associate in the Baltimore office of Hazen and Sawyer. He holds a BS in Civil Engineering from Georgia Tech and an MS and PhD in Environmental Engineering from Johns Hopkins University. Dr. Weiss specializes in water resources management, systems modeling, source water quality, and water treatment processes. He has extensive expertise in water supply planning and real-time management of reservoir systems to meet multiple objectives.

STREAM RESTORATION AND THE TMDL PROCESS: CHALLENGES POSED BY CLIMATE CHANGE

Michael Williams; mwilliams@umces.edu; UMCES

Co-authors: Guido Yactayo; UMCES/CBPO, Gopal Bhatt; Penn State, and Solange Filoso; UMCES/CBL

Traditional approaches used to decrease pollutant export from developed watersheds commonly include the modification of hydraulic conditions and stabilization of stream channels. However, improving water quality has proven especially difficult using these approaches. The stream restoration community in the Chesapeake Bay region has responded by implementing novel stream restoration designs, including the conversion of degraded channels to stream-wetland complexes. We compare pre- and post-construction loads (TN, TP and TSS) from upland best management practices (BMPs) and a stream-wetland complex constructed at the outflow of a highly developed watershed in the Coastal Plain physiographic province of Maryland. The relative effectiveness of regenerative stormwater conveyance (RSC) BMPs is compared to that of the stream-wetland complex and reductions are compared to those needed to meet TMDL goals. Potential challenges to achieving TMDL goals from a wetter climate expected to occur this century are discussed in light of recent modeling scenarios generated using the Chesapeake Bay Program's watershed model (HSPF) that generally predict an increase in the frequency of larger storm sizes and stream runoff in Maryland.

Michael Williams is an environmental consultant and until July 2015 was a Research Assistant Professor at CBL. His expertise is primarily in the fields of ecohydrology and estuarine ecology. Michael's current research focuses on the impacts of human activities on water resources, and effectiveness of stream restoration and best management practices (BMPs).

PROTECTING MARYLAND MARSHES THROUGH NUTRIA ERADICATION

Bill Wilmoth; bwilmoth@aphis.usda.gov; USDA-APHIS-Wildlife Services (Chesapeake Bay Nutria Eradication Project)

Maryland's marshes are a vital component of the Chesapeake Bay's water filtration system. Nutria, an invasive South American semi-aquatic rodent, have a destructive appetite for these wetlands, thereby having a direct impact on water quality. They have contributed to the loss of thousands of acres of brackish-water wetlands in Dorchester County, and spreading populations in four additional MD counties have threatened the loss of additional acres. USDA's Wildlife Services program (Chesapeake Bay Nutria Eradication Project, CBNEP) has been tasked with eradicating all breeding populations of nutria from the Delmarva Peninsula. The CBNEP has successfully employed a system of traditional harvest methods and innovative monitoring tools to protect wetlands. Since 2002, the CBNEP has been successful in eliminating all known breeding populations of nutria from approximately ¼ million acres of wetlands. The project will spend the remaining years conducting intensive monitoring surveys to detect & remove any remaining animals from previously cleared watersheds.

Bill Wilmoth is a Wildlife Biologist and the Acting Project Leader on the Chesapeake Bay Nutria Eradication Project for USDA-APHIS-Wildlife Services (WS). He received his B.S. in Wildlife Management with a minor in Biology from Virginia Tech in 1992. Bill's current areas of interest include the use of GIS and mobile GPS/field computers in invasive species management. He grew up in Newport News, VA where fishing and crabbing on the Bay heavily influenced his love for water and wildlife.

MICROPLASTICS IN THE CHESAPEAKE BAY

Lance Yonkos; lyonkos@umd.edu; University of Maryland

Increasing evidence suggests plastics entering the environment are mechanically, photochemically, and/or biologically degraded to the extent that they become imperceptible to the naked eye yet are not significantly reduced in total mass. Thus, more and smaller plastics particles, termed microplastics, reside in the environment and are now a contaminant category of concern. The current study tested the hypotheses that microplastics would be more abundant in proximity to urban sources, and vary temporally in response to weather phenomena such as storm events. Surface water samples were collected approximately monthly between July and Dec. 2011 from four Chesapeake Bay tributaries using a manta net to capture appropriately sized microplastics (0.3-5.0 mm). Selected sites have watersheds with broadly divergent land use characteristics (e.g., urban/suburban, agricultural and/or forested) and wide ranging population densities. Microplastics were found in all but one of 60 samples, with concentrations correlating positively with population density, imperviousness and proportion of urban/suburban development within watersheds. The greatest microplastics concentrations also occurred at 3 of 4 sites shortly after major rain events.

Lance Yonkos is an Assistant Professor at the University of Maryland teaching and performing aquatic toxicological research within the Department of Environmental Science and Technology. Active areas of investigation include: microplastics in the Chesapeake Bay; risks of legacy contaminants from industrial activities (e.g., Bear Creek, Baltimore Harbor; Anacostia River, DC); and development of non-lethal methods of detecting contaminant effects in aquatic biota

PRELIMINARY FINDINGS FROM THE FIRST YEAR OF MONITORING MARYLAND'S FIRST LARGE SCALE MUSSEL RELOCATION

Matt Ashton; matthew.ashton@maryland.gov; Maryland Department of Natural Resources

Co-authors: Kyle Sullivan, Jim McCann, and Dave Brinker; Maryland Department of Natural Resources

Freshwater mussels are the most imperiled aquatic fauna in North America. Relocation is widely used as a conservation action to avoid direct and indirect impacts to mussels and their habitat. The efficacy of mussel relocation is not well known because the ecology of most species is poorly understood, only a few relocations have been monitored, and recapture rate has been low. Implementing best practices and new survey techniques in relocations has seemingly improved mussel survival and recapture. Results from the first large scale mussel relocation in Maryland and preliminary findings from the first year of monitoring are presented. The main objective was to reduce risk to mussels by removing as many as practical. The relocation entails a rigorous monitoring plan to evaluate its efficacy by 1) surveying sites stocked with mussels and sites stocked with no mussels with the same methods before removing and relocating mussels from the impact site and 2) uniquely marking individual mussels to track their condition over time. Ultimately, we will compare mussel condition at relocation sites over time to that observed at control sites to assess the efforts success and inform standards for future relocations in Maryland.

THE NINTH ANNUAL MARYLAND STREAMS ROUNDTABLE

Andy Becker; andy.becker@kci.com; KCI Technologies, Inc.

Co-author: Dan Boward, Maryland DNR

The MWMC organizes the Maryland Streams Roundtable to foster collaboration and cooperation among the many and varied groups sampling streams throughout Maryland. This gathering provides an excellent opportunity to learn where monitoring is being done and what's being sampled. The Roundtable is intended for professionals, non-profit organizations, and academic institutions monitoring streams. It serves as an opportunity for agencies, academic institutions, and groups to share what and where sampling will be done every year. Forty-one people attended the 8th Annual Maryland Streams Roundtable that was held at the USGS Water Science Center on February 19, 2015. Twenty-one people gave 10-minute presentations on their sampling programs. Included were Federal agencies (2), state agencies (2), local/regional agencies (6), consultants (2), and NGOs (5). Sixteen groups submitted 2015 sampling site point data for display on a web-enabled map. This map was used to locate areas of overlap and identify potential opportunities for collaboration.

INVESTIGATING REACTION PATHWAYS OF PHARMACEUTICAL COMPOUNDS DURING WASTEWATER TREATMENT

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Co-author: William A. MacCrehan, National Institute of Standards and Technology

Many pharmaceutical compounds are released into the environment through wastewater and have been recognized as potential environmental and human health threats due to their inherent bioactivity. To understand the reactivity of pharmaceuticals during wastewater processing, the chlorination and dechlorination behaviors of five commonly-detected compounds were studied in water using simulated conditions. Reversed-phase liquid chromatography was used to separate the parent pharmaceutical compounds and the reaction products, and multiple detection modes were used to aid in product identification. All tested compounds underwent facile reaction with chlorine, in most cases forming multiple products that were more hydrophobic than the parent pharmaceutical. Most notably, acetaminophen reacted with chlorine to form at least seven products, two of which were identified as toxic compounds. For all pharmaceutical compounds studied, many of the reaction products were further transformed by dechlorination with sulfite. More research is needed to assess if the parent compounds or their transformation products have a potential impact on the environment and health.

MICROBIAL COMMUNITY RESPONSE TO USED MOTOR OIL, A COMPONENT OF RUNOFF

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Co-authors: Sergut Admasu1, Katherine M. Krasnodemski, Emily Hicks, Kimberly Pause Tucker; Stevenson Univerisity

Microbial communities play important roles in the ecosystem, including acting as primary producers and breaking down organic matter. In aquatic ecosystems, many types of organisms, including microbes, can be affected by stormwater runoff. Stormwater runoff contains a cocktail of toxins, ranging from excess bacteria and nutrients, to PAHs, PCBs, and heavy metals. To examine the effects of used motor oil, a component of runoff, on the microbial community, sediment samples were collected from the Jones Falls watershed at Meadowood Regional Park (Deep Run). The wet sediment was incubated overnight with different concentrations of used motor oil and then plated to determine colony forming unit (CFU) counts. Also, BIOLOG plates were used to analyze metabolic activities of the treated and untreated microcosms. 16S rDNA PCRs were completed on colonies of bacteria to identify the bacterial species which grew on the oil plates as compared to the control plates. Statistically significant community growth (CFUs) and increased metabolic activity (BIOLOG) were observed when oil was added. The information obtained from this research can be used to gain a better understanding of runoff pollution and the impact on the environment.

STUDY ON SOCIO-ENVIRONMENTAL FACTORS AFFECTING WATER QUALITY IN THE BALTIMORE CITY WATER SUPPLY SYSTEM

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Co-authors: Miracle Okoro, Janette North, and Dr. Mintesinot Jiru: Coppin State University

The EPA states that water quality standards are important because “standards help to identify water quality problems” which are caused by various factors. The focus of this research lies on the socio-environmental factors contributing to the degradation of the Baltimore City water supply system and possible solutions to the problem. This study spans across three watersheds (Loch Raven, Liberty, and Prettyboy), their respective reservoirs and two treatment plants that make up the drinking water supply for Baltimore City. The socio-environmental synthesis approach was used to investigate bio-physical socio-economic issues of water quality deterioration. SES uses repurposed data and shared computational tools to bring together social and environmental perspectives and information on these issues. This poster presents the ongoing comprehensive watershed study which aims at building benchmark characteristics on soil and water quality by comparing spatial data collected during winter and summer of 2015.

MONITORING, MODELING AND RESEARCH AS PART OF THE BALTIMORE URBAN WATERS FEDERAL PARTNERSHIP

Edward Doheny; ejdoheny@usgs.gov; United States Geological Survey

Co-authors: Emily H. Majcher; CNTS, Morgan J. Grove; USDA Forest Service; Michael Galvin, SavATree; Peter Groffman; Cary Institute of Ecosystem Studies, David Flores; Blue Water Baltimore, Laura Connelly; Parks and People Foundation; Kimberly Grove; City of Baltimore, James Caldwell and Lindsay DeMarzo; Howard County, and Kevin Brittingham and Steven Stewart; Baltimore County

The National Urban Waters Federal Partnership is comprised of 13 Federal Departments, including the U.S. Environmental Protection Agency, U.S. Department of Agriculture (USDA), and U.S. Department of the Interior. The Urban Waters Federal Partnership, formally launched in Baltimore in 2011, was developed to reconnect economically underserved urban communities with their waterways by improving coordination among federal agencies and organizations at all levels of government. The USDA Forest Service is the lead agency on the Baltimore Urban Waters Federal Partnership (BUWP). The BUWP has organized with many local agencies and organizations to develop plans and strategic actions in four topical areas with subcommittees for each: (1) Local restoration and best management projects, (2) Spatial mapping information and tools, (3) The Green Pattern Book, and (4) Monitoring, modeling, and research. The goals of the Monitoring, Modeling, and Research topic subcommittee are to enhance communication between partners on monitoring needs, and provide technical leadership on water-related issues such as improved water quality, in urban areas, flood hazards, and water supply in urban areas.

INTEGRATING CITIZEN AND NON-TRADITIONAL MONITORING DATA INTO THE CHESAPEAKE BAY PROGRAM NETWORK

Caroline Donovan; cdonovan@umces.edu; University of Maryland Center for Enviornmental Science

Co-authors: Anna Mathis; Alliance for the Chesapeake Bay, Leah Miller; Izaak Walton League, Julie Vastine; ALLARM, and Peter Tango; USGS

In May 2015, an exciting initiative and partnership was funded by the Environmental Protection Agency – Chesapeake Bay Program to integrate citizen and non-traditional data into the Bay Program network. The project partners work with a diverse team at the Chesapeake Bay Program to: establish a quality assurance project plan for data integration into the Bay program; create multi-tier monitoring program for new data collection; develop a comprehensive inventory of the entities collecting data in the Bay watershed; and construct a data portal for data to be entered into the Bay Program's database by participating partners. This poster will present information about the goals and objectives of this project and provide an overview of the next steps in this multi-year project. Conference attendees are also asked to participate! We are in need of your data for this project. We'd love to hear from you about your monitoring program.

INDICATORS OF FECAL CONTAMINANTS IN PUBLICALLY ACCESSIBLE FREDERICK COUNTY STREAMS

Sara Eckard; see9@hood.edu; Hood College Center for Coastal and Watershed Studies

Co-authors: Andrea Kozlosky and Drew Ferrier: Hood College Center for Coastal and Watershed Studies

Claire Hudson, Hood College Center for Coastal and Watershed Studies" While public swimming beaches are regularly monitored by local governments, many publically accessible waters such as creeks that are still frequently used for recreational activities, receive little or no attention. In partnership with the Chesapeake Bay Foundation, sampling was conducted in six Frederick County waterways from June to August 2015 to monitor levels of Enterococcus bacteria. These bacteria are used by agencies such as the EPA as indicators of fecal contamination. All six sites in Frederick reported levels of Enterococcus well above the EPA safety standard of 33 cfu/mL for a 30 day mean during both dry periods and periods of significant rainfall. An increase in bacteria levels was reported within 24 hours after significant rain events in five out of six sites. The remaining site reported the highest Enterococcus levels during dry periods, rather than following rain events, possibly indicating sources of fecal contamination not related to runoff.

MEASURING THE EFFECTS OF URBANIZATION ON STREAM WATER CHEMISTRY IN BALTIMORE COUNTY, MD

Rian Fleming; rflemi3@students.towson.edu; Towson University, Environmental Science & Studies Program

Co-authors: Corey Mueller and Joel Moore; Dept. of Physics, Astronomy, and Geosciences, Towson University and Urban Environmental Biogeochemistry Laboratory, Towson University

Understanding the effects of urbanization on stream chemistry in Baltimore County, Maryland has implications for local stream ecosystems and for inputs to the Chesapeake Bay. We sampled from May 2014 to June 2015 to compare stream chemistry between forested, surburban, and urban streams with similar bedrock . The pH, temperature, and conductivity were measured in the field and water samples were field-filtered. Samples were analyzed for major ions: Ca, Mg, Na, Cl, SO4, NO3, K, and alkalinity. Despite the similar bedrock chemistry, which should result in similar stream chemistry, stream chemistry showed large differences between the forested, suburban, and urban watersheds. The average electrical conductivities for the forested, suburban, and urban streams measured 26, 188, and 1137 μS/cm, respectively. Average Cl concentrations increased from 2 to 400 ppm from the forested to urban streams, which can be explained by road salt inputs. Average concentrations of Ca increased from 0.8 ppm to 61 ppm and average alkalinities increased from 140 to 1450 μeq/L HCO3 in the forested to urban streams, which is less expected and is likely to be the result of concrete and building stone weathering.

SEDIMENT FINGERPRINTING MODEL FOR ESTIMATING SOURCE CONTRIBUTIONS TO SUSPENDED SEDIMENT FLUX

Lillian Gorman Sanisaca; lgormansanisaca@usgs.gov; United States Geological Survey

Co-authors: Allen C. Gellis and David L. Lorenz; United States Geological Survey

A sound understanding of sources contributing to sediment flux in a watershed is important when developing total maximum daily load (TMDL) management strategies designed to reduce suspended sediment in streams. The sediment fingerprinting approach can qualify and quantify the major sources of sediment in a watershed. Sediment fingerprinting uses trace element concentrations in samples from known potential source areas to determine a signature or "fingerprint" for each potential source, answering the important question of whether the suspended sediment is derived from upland areas or the channel. A mixing model is used to determine the relative source contribution to target samples. The computational steps required to apportion sediment for each target sample are quite time intensive, a problem the Sediment Fingerprinting Model (SFM) addresses. The SFM is a user-friendly model that guides the user through the sediment fingerprinting process. The model is written using the statistical software R and utilizes Microsoft Access as an interface but requires no prior programing knowledge. The SFM model is designed to assist local, state, and federal land management agencies in applying the sediment fingerprinting approach.

POLYAROMATIC HYDROCARBONS IN STREAM WATER OF WESTERN MARYLAND: A BASELINE ASSESSMENT BEFORE POSSIBLE HYDRAULIC FRACTURING

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Co-authors: Cheryl Clark and Rachel Clark; University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory

In 2013 a multiagency effort to collect detailed water chemistry in streams located in western Maryland watersheds where hydraulic fracturing might occur in future was begun. There are concerns over the release of chemicals used in the fracturing process as well as those naturally occurring in shale-groundwater to streams and drinking water aquifers. In order to detect any changes in stream water quality during any period of fracturing and gas withdrawal, pre development chemistry of the area streams was required. Among these parameters we measured Polyaromatic Hydrocarbons (PAHs) in stream waters. PAHs can originate from a number of processes associated with fracking but also have multiple natural and anthropogenic sources making it important to establish both background concentrations. Here we present results from the first two years of the study. The concentrations of PAHs in the stream water are low, in the 10's of ng/L, which is not surprising as many of the streams are considered to be pristine. Many individual compounds are below the level of detection (sub ng/L). The site signatures created by the assemblage of PAHs present appear to repeat over time and will hopefully provide a means to assess any future change.

EVOLUTIONARY CHANGES INDUCED BY EXPOSURE TO USED MOTOR OIL IN CHESAPEAKE BAY WATERSHED BACTERIAL ISOLATES

Emily Hicks; ehicks@stevenson.edu; Stevenson University

Co-authors: Katherine M. Krasnodemski1, Ava Nicole Schein, and Kimberly Pause Tucker; Stevenson University

Human health is threatened by different types of pollution, including the pollution of aquatic environments. Toxic compounds can enter the food web due to stormwater runoff. Studying runoff's effect on microbial populations can provide insight into consequences throughout the food web. Bacterial isolates from the Jones Falls and the Baltimore Inner Harbor are being analyzed to determine any evolutionary changes that occur in response to repeated exposure to used motor oil. The bacterial isolates were identified by genetic sequencing, grown on TSA with 10 ppt used motor oil, and passaged for multiple generations on the oil TSA. Every 10 generations, growth was measured and the metabolic fingerprint was analyzed. By the completion of the experiment, growth rates and the metabolic profiles of the isolates after 50 generations of repeated exposure to used motor oil will be examined to identify differences. DNA fingerprints will also be examined to determine if the used motor oil had mutagenic effects. Studying the impacts of used motor oil on microbes provides a better understanding of the potential of these microorganisms for bioremediation and how environmental bacteria can be used in environmental cleanup.

VERNAL POOL STUDY, CORCORAN WOODS, SANDY POINT STATE PARK: ANATOMY OF A LONG-TERM, STUDENT- LED RESEARCH PROJECT

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Co-author: Chris Gordon; Anne Arundel Community College

Corcoran Woods, located in Sandy Point State Park, is a forested tract, approximately 230 acres in size that is interspersed with vernal pools of various sizes. It is open to the public and contains hiking trails that follow its perimeter and bisect it. The Maryland Department of Natural Resources (DNR) wants to increase public access to and awareness of Corcoran Woods while preserving the unique habitats contained within it. In Spring, 2014, students from Anne Arundel Community College, under direction of faculty from the Biology Department and in collaboration with DNR, initiated a long-term monitoring study of the vernal pool habitat in Corcoran Woods. During Fall semester, vegetative data are collected in and around the vernal pool area when pools are dry. In Spring semester, physical, chemical and biological data are collected within the pools. Students from several different courses within the Biology Department participate as part of Service-Learning. This study shows how research can be designed to provide valuable data while also fitting into the framework of an academic schedule and the constraints of student-led research.

LANDS GREEN WATERS CLEAN

Leah Miller; leah@iwla.org; Izaak Walton League of America

Through Lands Green, Waters Clean, the Izaak Walton League of America is combining social marketing research and on-the-ground BMP implementation to reduce stormwater pollution in Montgomery County, Maryland. The goal is to increase the number of homeowners installing rain gardens, rain barrels, conservation landscaping, and canopy trees on their properties. The League conducted focus groups and A-B testing to determine the most effective target audience, messages, and message delivery to result in homeowner action. The League also investigated barriers preventing homeowners from participating in these activities. As a result, the League developed a comprehensive website at www.landsgreenwatersclean.org and is currently working with 12 homeowners in 4 neighborhoods to design and install demonstration projects and promote the project to the community on a neighborhood by neighborhood basis.

NO CHILD LEFT DRY

Leah Miller; leah@iwla.org; Izaak Walton League of America

Co-author: Sarah Mitchell; Chesapeake Conservation Corps Volunteer, Izaak Walton League of America

Creek Freaks is a program started by the Izaak Walton League in 2010. It was created to teach 4th-8th grade students about their local watershed and the factors impacting its cleanliness. In addition to training school teachers about the biological, chemical, and physical factors involved in water quality, this year the League will be teaming with Trout Unlimited to merge Creek Freaks curriculum with the Trout in the Classroom raise and release program in Montgomery and Frederick Counties. While mastering the art of raising juvenile trout in clean fish tanks, middle school students will learn how a stream is connected to a larger watershed. In addition, students will conduct biological and chemical water quality tests, and implement stewardship projects to enhance the health of a particular stream in their area. Upon completing the school year, students will understand how watershed pollution and riparian zone health can impact trout. Confidence in understanding trout habitats should give participants ideas to improve these aquatic ecosystems.

ELECTRICAL CONDUCTIVITY: AN INDICATOR OF URBANIZATION IN MATTAWOMAN CREEK AND ITS TRIBUTARIES

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Co-authors: Ken Hastings; Mattawoman Watershed Society; Carrier Hoover, Margaret McGinty, Alexis Park, and Jim Uphoff, Maryland DNR Fisheries Habitat and Ecosystem Program, Maryland Fisheries Service

Mattawoman Creek is a fluvial river and tidal-freshwater tributary entering the Potomac River at Indian Head, MD. Its watershed is experiencing rapid development that correlates with declines in estuarine-fish diversity and in riverine spawning of river herring. In the fluvial river, electrical specific conductance is consistently above historical levels and shows a reversed gradient that now increases with distance above head-of-tide. To assess the influence of catchment condition, we are performing periodic measurements at 13 sites over the watershed to complement continuous monitoring of the main-stem and four streams with variable levels of development. The periodic measurements show conductivity increases and remains elevated in urban Waldorf before decreasing toward head-of-tide. Precursory examination of continuous monitoring data suggests that urbanized streams exhibit elevated conductivity compared to streams in more naturalized landscapes. We plan to add chemical sampling to identify which ions contribute to conductivity. This additional information will help identify sources contributing to elevated conductivity that can facilitate development of sound management approaches.

SEASONAL VARIATION IN SURFACE-GROUNDWATER EXCHANGES IN AN URBAN FLOODPLAIN WITH ACTIVE GRAVEL-BAR FORMATION

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Co-author: K.L. Prestegaard

Stream flow exchange with subsurface water in gravel bars and floodplains can vary significantly with variations in streamflow and groundwater heads. In the U.S. mid-Atlantic region, discharge exhibits seasonal cycles driven by seasonal variations in evapotranspiration. We examined the effects of this seasonal cycle on groundwater and surfacewater interactions in a tributary of the Anacostia Watershed. The site is a floodplain fragment in the NE Branch of the Anacostia River with actively accreting gravels bars, chute channels, and a higher level fine-grained floodplain. We measured topography, grain size, hydraulic conductivity, groundwater head, and documented seasonal variations in groundwater flow directions between the channel and the floodplain. Groundwater flowed from topographically higher, fine-grained floodplains during cool seasons, but evapotranspiration and tropical storms generated seasonal reversals in flow between the stream, gravel bar, and the adjacent floodplain. Water flowed from the stream into and through the adjacent gravel bars during storm events for most of the year. Chute channels were activated during high flows and conveyed water onto the floodplains.

A TRICKLE THROUGH TIME: AN ANALYSIS OF STREAM INTEGRITY IN AN URBANIZING ENVIRONMENT

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Co-authors: Eric Mazur and Susan Gresens: Towson University

Five streams were surveyed to detect environmental changes caused by urbanization, and to analyze the effectiveness of best management practices, such as, riparian stream buffers. Chimney Branch and Locust Branch were selected as reference sites for streams with good quality as they have minimal upstream development and land is used primarily for forest and low-density residencies. Western Run and Red Run at the metro station were chosen as impacted reference streams since their catchments became urbanized long ago. The focal stream, Red Run at Pleasant Hill Rd, has been subject to recent upstream urban and suburban development. Nutrients, periphyton abundance, sediment size structure, and conductivity were measured in conjunction with land use data to analyze the integrity of the five streams. Chironomid pupal exuviae were collected and used as biological indicators of response to urbanization. These measurements were then compared with comparable data from the five sites collected in 2002 prior to continued development in the upper watershed, in an effort to distinguish possible effects of urban development from those of weather conditions.

POLLUTANT REMOVAL EFFICIENCIES OF SELF-CONVERTED DRY DETENTION PONDS IN BALTIMORE COUNTY, MD

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Co-authors : Nicole Hartig; Towson University, Colin Hill , Mike Pieper; KCI Technologies Inc., Dr. Ryan Casey; Towson University, Kevin Brittingham and Steve Stewart; Baltimore County DPES, and Dr. David Ownby; Towson University

Stormwater ponds have become a common best management practice for the management of runoff from impervious surfaces in suburban and urban landscapes. In this study, ponds designed to have short hydro-periods were evaluated for their pollutant removal efficiencies. Over time, these ponds can convert from "dry" ponds to ponds that have wetland characteristics (soils, plants) and may also hold water for longer periods of time. This ongoing study has collected data from six ponds (three control and three self-converted), since August 2014. Inlet and outlets have continuous water level sensors installed for continuous flow record and during selected rainfall events, grab samples were collected at inlet(s) and outfalls during the rise, at the peak, and during the falling limb of the hydrograph. Grab samples are analyzed for TSS, Total N, nitrogen species, Total and Ortho-P, and major ions (Na, Cl). Pollutant loading and removal efficiencies are based on flow-weighted event mean concentrations. Endpoints of this study will include data to potentially revise TMDL credit assumptions and assist Baltimore County in determining whether restoration activities are necessary for self-converted ponds to maintain pollutant load reductions.

EFFECTS OF COMMON ANTHROPOGENIC POLLUTANTS ON FRESHWATER SYSTEMS: INSIGHTS FROM THE SURROGATE ZOOPLANKTON, DAPHNIA MAGNA

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Co-authors: Timothy Woo, Andrew East, Laina Lockett, andChristopher J. Salice; Towson University

Towson University, Environmental Science and Studies Program" Ions from road salts and nutrients from agricultural runoff can have significant impacts on stream and Chesapeake bay health. We analyzed existing stream data from the Baltimore Ecosystems Study to characterize the frequency and magnitude of chloride and phosphate environmental concentrations. Chloride concentration was normally under 100 mg/l, but commonly exceeded 4000 mg/l and peaked at 11,600 mg/l. Phosphate concentrations were typically under 100 mg/l but commonly exceeded 1000 mg/l and peaked at 5084 mg/l. We conducted laboratory toxicity studies using Daphnia magna exposed to environmentally relevant concentrations of either NaCl or phosphate. Preliminary results suggest that phosphate has direct and indirect effects to D. magna. In a chronic exposure study, phosphate significantly increased D. magna brood size. In contrast, NaCl was lethal at high-end concentrations with a steep dose-response curve suggesting and abrupt concentration threshold. A 21-day study indicated that NaCl at decreased D. magna growth. This research suggests that both road salts and agricultural runoff at environmentally relevant concentrations can have significant deleterious effects on aquatic organisms.

DC FISH TOXICS AND MARYLAND WATER SOURCES: AN INTERJURISDICTIONAL PROBLEM

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Co-author: Sonia Rose ; University of DC

DC Anacostia food fish have dangerous concentrations of PBT (Persistant Bioaccumulative and Toxic) EPA Priority Pollutants Chlordane and PCBs. 80% of Anacostia watershed is in MD. A river-wide active biomonitoring study with translocated clams identified four legacy chlordane dumpsites upstream in MD subtributaries (none in DC) and chlordane contaminated minnows. Following a sediment trap pond chlordane contamination was not detected indicating suspended sediment transport. MD tributary chlordane-contaminated minnows led to highly chlordane-contaminated tidal food fish (perch) indicating bioaccumulation. DC sediment dredging is planned. A less expensive and successful approach might be coordinated inter jurisdictional approach halting downstream transport of contaminated suspended sediments from known MD sources by construction of appropriate sediment trap ponds (with in-situ contaminant fixation). allowing natural uncontaminated sediment capping of DC's contaminated sediments. Hudson and James Rivers PCB and pesticide fish contamination greatly reduced after controlling upstream sources, without requiring dredging.

EVALUATING REGENERATIVE STORMWATER CONVEYANCE FOR STREAM RESTORATION.

Max Ruehrmund; RuehrmundM@si.edu; Smithsonian Environmental Research Center

Co-authors: Julianne Rolf, Dr. Tom Jordan, Dr. Josh Thompson, Jan Kreibich, and Dr. Will Brogan; SERC

Total Maximum Daily Load levels set for the Chesapeake Bay have created a sense of urgency to mitigate nutrient input into the Bay. Due to stormwater, streams can become eroded to the point where the channel is disconnected from its floodplain inhibiting critical biochemical functions such as denitrification which requires saturated, anaerobic soils. Within Maryland a restoration approach known as Regenerative Stormwater Conveyance (RSC) has gained much popularity. Traditional restorations stabilize stream banks, RSC systems on the other hand seek to increase channel residence time and encourage floodplain connections during higher flows. Similar to other restoration measures, assessing the efficacy of existing RSC systems is difficult. To afford a robust assessment of the effectiveness of a soon to be installed RSC, we are utilizing 40 years of baseline water quality data within two small watersheds, together with recent MBSS monitoring, installation of riparian and channel wells, piezometers, vegetation plots, and intensive in stream chemical water quality monitoring with autonomous sampling at both ends of the reach.

BEAR CREEK SEDIMENT TOXICITY: A TIME-COURSE STUDY

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Co-authors: Sharon Hartzell and Lance Yonkos; University of Maryland

Bear Creek is a historically polluted area in Baltimore, MD. Due to its proximity to the former Bethlehem Steel Company in Sparrows Point, Bear Creek sediments are intensely polluted with industrial contaminants (e.g., heavy metals; PAHs). Previous studies have proven that this site is toxic, but the extent of that toxicity remains unknown. This study expands on an on-going effort to further categorize particularly toxic areas by re-collecting and testing surface sediments from 3 such areas using a standard 10-d sediment toxicity assay. For each site, subsets of 5 replicates were examined for lethality after 3, 6 and 10 d exposures. Results indicate minimal lethality at 3 d, moderate lethality at 6 d, and substantial lethality at 10 d. Results were similar to previous 10-d toxicity tests for 2 of the sites. The third had 48% survival compared to 2% during the previous test. Initial and subsequent collections at site 3 were <10 m apart, illustrating how spatially variable sediment contaminants can be in Bear Creek. This suggests accurate characterization of the extent of toxic contamination might require multiple or repetitive collection of sediments in close proximity to more narrowly define the scale of spatially variability.

USE OF BA/SR RATIOS AS A POTENTIAL INDICATOR OF SURFACE WATER CONTAMINATION FROM FRACKING FLUID SPILLS

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Co-author: Caroline G. Coulter; UMCES/Chesapeake Biological Laboratory

Strontium (Sr) and barium (Ba) are ubiquitous in surface freshwaters at high-nM to low-mM concentrations but enriched in fracking fluids by 4 orders of magnitude. Monitoring Sr and Ba levels has thus been proposed as a way to detect spills. Our survey of western MD streams for 2 years indicates that background Sr and Ba levels are highly variable in space and time, complicating the detection of spills depending on location and season. However, Ba/Sr ratios appear to be constant in individual streams and Ba is often near saturation with respect to barite, whereas Sr is greatly undersaturated with respect to celestite. Chemical modeling of typical stream waters suggests that a fracking fluid spill would raise Sr concentrations yet that Ba would be constrained by precipitation. Hence, even minor spills might trigger a distinctive decrease of the Ba/Sr ratio. Other common ions, while equally variable, are not as enriched in fracking fluids nor subject to solubility limits. For example, Na and Cl levels are less sensitive to spills and could not distinguish them from road salt effluent based on the Na/Cl ratio. One exception may be Br, which is virtually absent from surface freshwaters and could signal a spill by its mere presence.

THE ROLE OF ICPRB IN THE DEVELOPMENT OF ALGAE MONITORING METHODOLOGIES WITHIN THE POTOMAC RIVER BASIN: PAST, PRESENT, AND FUTURE

Gordon Selckmann; GMSelckmann@icprb.org; Interstate Commission on the Potomac River Basin

West Virginia Department of Environmental Protection (WVDEP) has observed and evaluated the breadth and causes of filamentous green algae blooms in rivers across West Virginia since 2007. Beginning in 2012, the Interstate Commission on the Potomac River Basin (ICPRB) has assisted the WVDEP in documenting algae blooms in the South Branch Potomac, Cacapon, and Shenandoah rivers, all located in the Potomac River basin. In response to an EPA Region 3 request, ICPRB developed additional methodologies to assess algal abundance in large river settings. ICPRB has begun to expand its West Virginia filamentous algae monitoring project to investigate ecosystem level effects during bloom events. This project will use new technology such as app-based volunteer reporting in concert with geo-spatial analysis of the Potomac drainage water quality data to help identify high-risk filamentous green algae bloom regions.

GREEN STORMWATER INFRASTRUCTURE (GSI) MAINTENANCE COSTS VARY 3-FOLD BY SCALE, TYPE, AND OTHER FACTORS

Mark Southerland; msoutherland@akrf.com; AKRF, Inc.

Co-author: Kevin Flynn, AKRF, Inc.

Effective and efficient maintenance is critical to the long-term success of Philadelphia Water's and other large (and rapidly expanding) GSI portfolios. A recent nationwide survey of both traditional and GSI Stormwater Management Practices (SMPs) by EWRI of ASCE identified performance issues and maintenance costs that varied 10-fold. Focusing on GSI, AKRF conducted a study of the condition of Philadelphia Water's GSI that identified design lessons and produced a cost model to inform the Philadelphia Water GSI Maintenance Manual. The EWRI nationwide SMP survey concluded that annual maintenance costs were greatest for traditional wet ponds, detention basins, and sand filters (ranging from $1,000-3,000) over bioretention and infiltration trenches/basins ($250-1,000). The AKRF GSI study average maintenance costs by GSI type varied 3-fold with stormwater bumpouts at the lowest average cost per Greened Acre and stormwater planter boxes at the highest average cost. Lessons learned included using refined GSI plant palettes, incorporating maintenance access requirements into GSI designs, and conducting checks for common construction issues during project closeout, as-built surveys.

RIPARIAN BUFFERS AND THEIR IMPACTS ON AQUATIC ORGANISMS

Angela Trenkle; angela.trenkle@maryland.gov; Maryland Department of the Environment, Forest Service (Chesapeake Conservation Corps)

Within the Chesapeake Bay watershed, there is an abundance of aquatic organisms that each plays a unique role in keeping the entire ecosystem in a state of balance. Unfortunately, many of these organisms are sensitive to various environmental parameters and have a higher mortality rate, which can disrupt the food chain and throw off the entire ecosystem balance. Riparian forest buffers play a key role in fixing these environmental parameters by acting as a filter and trapping excess sediment and pollutants that can cause significant damage to the organisms' health and to their spawning sites. They also provide shade, which cools down the temperature of the water, causing the dissolved oxygen levels to rise. In addition to playing a key role in fixing environmental parameters, they also contribute a number of other benefits, such as organic food sources for the aquatic invertebrates to eat, which in turn provides the fish and amphibians with a food source. They also provide shelter and places for the aquatic organisms to hide. Overall, riparian forest buffers are a necessity for the Chesapeake Bay watershed because they play a keystone role in keeping the aquatic ecosystem in balance.

WHO ENGAGES IN ENVIRONMENTAL STEWARDSHIP? PARTICIPATION IN THE MARYLAND WATERSHED STEWARDS ACADEMIES

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Co-authors: Dr. Dana R. Fisher and Anya M. Galli; University of Maryland, College Park

This poster focuses on the Maryland Watershed Stewards Academies (WSAs), a network of stewardship organizations that recruit, train, and support community members to serve as leaders on watershed restoration issues in their communities. Participation in the WSAs is volunteer-based: most individuals become certified as "Master Stewards" through WSA courses, which provide them with tools and support to lead restoration and education efforts in their own communities. Environmental stewardship activities carried out by WSA participants include installing of rain barrels and rain gardens, planting vegetation and trees, and removing non-native plants in addition to a range of other activities that contribute to watershed restoration efforts. WSA participants also engage in advocacy education campaigns aimed at educating members of their communities about watershed issues. This poster compares survey data on WSA participation to the demographics of local populations to understand better the social landscape of environmental participation and the connections between stewardship and civic engagement more broadly.

POTENTIAL CLIMATE CHANGE IMPACTS ON THE SPRING PHYTOPLANKTON BLOOM IN CHESAPEAKE BAY

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Co-author: Long Hang; UMES

Utilizing a calibrated hydrodynamic-biogeochemical modeling package (FVCOM-ICM) for Chesapeake Bay, we investigated the potential impacts of climate change on the phytoplankton bloom in May, 2010. Based on the projections, we ran a series of scenarios by making adjustments in winter-spring Susquehanna discharge, air-sea heat flux, open boundary sea level and tide amplitude, respectively. To delineate the vertical structure of circulation, nutrients and production, two model transects were selected along the main channel and across the productive mid-Bay. Our modeling results indicated that increased sea level and tidal amplitude could transport more surface riverine nutrients to the deep water via enhanced mixing, and greatly promote the overall phytoplankton growth. Their non-linear relationship resulted from the stratification condition, which controlled the delivery of nutrients down deep. To sum up, climate change is gradually altering the physical environment of Chesapeake Bay, which would very likely cause more severe spring algal bloom and worsen the eutrophication condition.

CONCENTRATION-DISCHARGE RELATIONSHIPS FOR NUTRIENTS AND SEDIMENT IN MAJOR TRIBUTARIES TO CHESAPEAKE BAY: TYPICAL PATTERNS AND NON-STATIONARITY

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Derived from river water-quality monitoring data, concentration-discharge (C-Q) relationships are a powerful tool for understanding nutrient and sediment dynamics. Here we first present a brief review of C-Q relationships documented in the scientific literature. Major categories of observed relationships include: (a) “dilution” patterns and (b) “concentration” patterns. In the second part of our work, we present a comprehensive evaluation of C-Q patterns for multiple water-quality constituents for the nine major non-tidal tributaries of Chesapeake Bay for the period between the 1980s and 2015. Separation of the monitoring data into non-overlapping decadal periods revealed clear non-stationarity in C-Q relationships for many site-constituent combinations. These temporal changes in C-Q relationships generally reflected changes in dominant watershed sources of nutrients and sediment (e.g., reduction in point-source dominance for total nitrogen in the Patuxent River due to wastewater treatment plants upgrade) and are consistent with trends observed in previous research. The findings also highlight the potential pitfalls of assuming stationary C-Q relationships when estimating riverine concentration and flux or analyzing their trends.

Annual Standing Committee Reports

Maryland Water Monitoring Council 2014-2015 Annual Report

This report summarizes MWMC activities from November, 2014 through October, 2015.

2015 marked the 21st year for the Council and it was an exciting one. 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 drew a record 450 attendees. Included were a host of exciting talks and posters and the inaugural post-conference social at the Heavy Seas Brewery. Committee work continued in earnest, including the formation of a new Student Committee that will, hopefully, engage students in Council activities. The Council will enter 2016 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

The MWMC Board of Directors went through leadership changes in 2015. Board Chair Mark Southerland (Versar) handed the Chair baton to the previeous Co-Chair, Clark Howells (Baltimore City). Clark's Co- Chair position was assumed by Sandy Hertz (Maryland State Highways Administration). The Board welcomed new members Chris Victoria (Anne Arundel Co.), Ellen Lathrop-Davis (CCBC), Chris Swan (UMBC), Tim Goodfellow (Frederick Co.), and Ken Staver (Univ. of MD) – all in 2014 - and Richard Mitchell (US EPA) and Jeff Reagan (Maryland Environmental Service) in 2015. Outgoing members Sue Veith (St. Mary's Co.), Cathy Wiss (Audubon Naturalists Society), and Michele Dobson (Harford Co.) were thanked for their service to the Council. Although 2014 would have been Mark Southerland's final year on the Board, he agreed to stay on into early 2015 until a Board Chair could be elected.

2014 Annual Conference

The 20th Annual Conference was once again held at the Maritime Institute on November 15 and the gathering was bigger and better than ever. With about 450 in attendance, the event's theme was "20th Annual MWMC Conference: Looking to the Past to Guide our Future". Water monitoring history was emphasized throughout the day as well as scenarios for the future of monitoring and water-related topics. Dr. Kent Mountford gave a stimulating keynote address while Mark Southerland (Versar, Inc.) provided an insightful retrospective on the Council with an eye on the future. Jim Long received the 8th Annual Carl Weber Award for his work with the Mattawoman Watershed Society. Session topics included stream restoration monitoring, Bay status and trends, urban stream monitoring, and groundwater. Forty-seven talks, 31 posters, 9 vendors and 18 "special interest" exhibits all contributed to a diverse and well-rounded agenda.

Workshops

MWMC sponsored the Eighth Maryland Stream Monitoring Roundtable at the USGS Water Science Center in Catonsville. The goals of the February 19, 2015 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 41 participants from state, federal, and local agencies, watershed associations, and consulting firms. Twenty-one groups presented on their programs. Prior to the gathering, presenters provided georeferenced site information to DNR to produce a statewide map of sampling sites in 2014. This map was displayed during the event so participants could examine site overlap, gaps, and sampling protocols to be used during 2014. For more information about the Roundtable, contact Dan Boward at dan.boward@maryland.gov.

On January 19, 2015 the MWMC Monitoring and Assessment Committee held a workshop titled "Monitoring for Climate Change in Maryland's Non-Tidal Streams" at the USFWS Wildlife Visitor's Center in Laurel. Workshop goals were: 1. Explore issues of climate change for non-tidal streams in Maryland, 2. Information sharing among agencies that collect data on non-tidal streams in Maryland, with focus on monitoring strategies for adaptation and mitigation of climate change, and 3. Build on the results of a 2009 MWMC workshop: Planning for the Future: Designing and Implementing a Climate Change Monitoring Network in Maryland's Nontidal Waters. About 100 people attended, despite the icy roads and harsh winter conditions. Workshop details can be found at the MWMC website (www.marylandwatermonitoring.org).

Committees (full committee reports can be found elsewhere in this program)

The **Information Management Committee** produced a draft online mapping tool that that will be used to track current and past water monitoring activities in Maryland. The tool will be made available on the MWMC web site in early 2016. This is a reincarnation of the "clickable map" that MWMC sponsored in the early-mid 2000s. In 2016, the Committee plans to increase the value of the online mapping tool on the MWMC website by expanding the number of collecting organizations and monitoring activities included in the database. Another goal is to develop an on-line database that allows users to search past 15 years of MWMC annual conference presentations by topic.

In 2015, the **Community Outreach and Citizen Science Committee** officially changed to the **Citizen Science and Community Stewardship Committee.** With the help of former Committee member Michele Dobson (Harford Co.), Committee members updated the MWMC watershed organization contact list that now contains over 250 names. Once the list is updated, the committee wants to send out an updated survey (through DNR's survey monkey account) to find out basic questions about monitoring throughout Maryland. The list will also be used to update the mapping project. The committee also continues to manage the MWMC Facebook page. Committee goals for 2016 include sponsoring up to two workshops, and completing a 3-year plan that with such activities as a "Volunteer Monitoring for Dummies" user guide, and creating a MWMC Linkedin Account for news content and professional networking within the water monitoring community.

It was a big year for the MWMC's Monitoring and Assessment Committee (MAC). Leadership was transferred in early 2015 from co-chairs Ron Klauda (MD DNR; retired) and Jim Cummins (ICPRB) to Co-Chairs Mike Pieper (KCI) and Chris Victoria (Anne Arundel Co.). In 2015, the MAC sponsored and held a Climate Change Workshop and Stream Monitoring Roundtable (see report above). The MAC is organizing a session at the 2015 annual conference detailing the monitoring related to the Inter-County Connector Project. The MAC is collaborating with the MWMC Groundwater Committee on a Road Salts workshop to be held in the winter 2015-2016. The Committee is planning a Technology Series of workshops for 2016. A new sub-committee of the MAC was formed in early 2015 to address monitoring questions related to stream restoration practices. The sub-committee, chaired by Scott Stranko (MDNR) and Scott Lowe (McCormick Taylor) is titled 'Stream Restoration Monitoring'. The sub-committee has organized two sessions at the MWMC Annual Conference focusing on stream restoration topics. Members of the sub-committee are reviewing stream restoration effectiveness studies and plan to invite researchers who have published pertinent data to present their findings at an event tentatively planned for spring 2016.

Submitted by Dan Boward

MWMC Executive Secretary

November 13, 2015

Maryland Water Monitoring Council
Information Management and Communication Committee

2015 Annual Report

Co-Chairs

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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; (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.

2015 Accomplishments

1. Maryland DNR completed work on an online mapping tool that that will be used to track current and past water monitoring activities in Maryland. The tool will be made available on the MWMC web site in early 2016.

2016 Goals

1. Following implementation of the online mapping tool on the MWMC website, increase its value by expanding the number of collecting organizations and monitoring activities included in the database.
2. Develop an on-line database that allows users to search past 15 years of MWMC annual conference presentations by topic.

Submitted by T. Parham, October 7th, 2015

Maryland Water Monitoring Council

Groundwater Committee

2015 Annual Report

Chair

Mat Pajerowski

U.S. Geological Survey

MD-DE-DC Water Science Center

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Committee Members	**Organization**
David Bolton	Maryland Geological Survey
John Grace	Maryland Department of Environment
Kevin Koepenick	Baltimore Co. Dept. of Environmental Protection and Sustainability
Tim Goodfellow	Frederick County Dept of Planning and Development Review
J. Ellen Lathrop-Davis	Community College of Baltimore County
Joel Moore	Towson University
Jeff Gernand	KCI

Committee Mission Statement

The Committee will promote and facilitate collaboration on issues related to the monitoring and assessment of the quality and available quantity of groundwater in the State. The committee will consider the current state of groundwater monitoring, and will explore the need for documenting and disseminating information on groundwater monitoring activities. The group may promote the sharing and accessibility of groundwater quality data; and may consider and make recommendations on the needs, protocols and quality standards for monitoring in relation to specific threats or stressors to groundwater.

2015 Accomplishments

The Committee met to discuss issues of concern related to groundwater monitoring in Maryland. Top issues identified were:

- Environmental impacts of road salt
- Adequacy of existing monitoring networks
- How monitoring can increase understanding of surface water/ groundwater interaction
- Making ground water level data from various sources/ agencies more accessible.

Of these issues, the Committee decided to focus first on the issue of road salt, and put their efforts towards helping to plan a proposed MWMC workshop on road salt impacts.

The committee held an open planning meeting in May at the USGS office, to begin planning for the workshop.

2016 Goals

1. Hold a workshop on environmental impacts of road salt early in 2016.

2. Identify issues related to groundwater and road salt as possible follow-up to the workshop.

3. Explore options such as a website or portal for increasing the availability and accessibility of groundwater monitoring data.

4. Expand membership to include representation from the Eastern Shore and southern Maryland.

Submitted by M.G. Pajerowski

November 13, 2015

Maryland Water Monitoring Council

Monitoring and Assessment Committee

2015 Annual Report

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Capt. Diana Muller	South River Federation
Andrew Muller	U.S. Naval Academy
Bryan Perry	Towson university
Stan Kemp	University of Baltimore
Mike Pieper	KCI Technologies, Inc.
Andy Becker	KCI Technologies, Inc.
Chris Victoria	Anne Arundel County
Ron Klauda	Retired
Jim Cummins	ICPRB
Cherie Miller	USGS
Mark Southerland	AKRF
Doug Redmond	Retired
Clark Howells	Baltimore City RNRS
Sherm Garrison	MD DNR
Alice Volpitta	Blue Water Baltimore
Dr. Hany Sobhi	Coppin State University
Tatiana Roth	Coppin State University
Jai Cole	MNCPPC
Rob Mooney	Triad Engineering, Inc.
Marian Norris	National Park Service

2015 Activities and Accomplishments

Leadership of the Monitoring and Assessment Committee (MAC) was transferred in early 2015 from co-chairs Ron Klauda and Jim Cummins to co-chairs Mike Pieper and Chris Victoria. *The MAC would like to thank Ron and Jim for their years of hard work and dedication to the Committee as well as the MWMC in general.*

The MAC sponsored and held a climate change workshop on January 27, 2015 at the Patuxent Wildlife Refuge National Visitors Center. The workshop, titled Monitoring for Climate Change in Maryland's Non-Tidal Streams, served to further the discussion and collaboration on climate change impacts and resiliency and served as a follow up to the previous MAC Climate Change Workshop held in 2009. The workshop, attended by approximately 100, included a variety of topics related to climate change and freshwater systems. Topics included a Regional Monitoring Network, the Chesapeake Bay Agreement, MBSS Sentinel Sites, Cold Water Taxa, Water Supply, Sediment Flux, Forests, Sensitive Species, and even Beavers. The workshop chair was Cherie Miller of the USGS.

The 8th annual Stream Monitoring Roundtable was held on February 19, 2015 at the USGS Science Center in Catonsville, MD. Forty-five attendees saw presentations from 21 monitoring organizations including volunteers, local and state governments. The session was organized by Andy Becker and Dan Boward. Andy developed an interactive display of over 1,000 data points to support the meeting and Rachel Beebe of the Howard County Office of Sustainability presented the County's stream monitoring app – so yes, there's an app for that.

The MAC is organizing a session at the annual conference detailing the monitoring related to the Inter-County Connector Project.

The MAC is collaborating with the MWMC Groundwater Committee on a Road Salts workshop to be held in the winter 2015-2016. The workshop will include an overview of salt usage in Maryland, road salt applications and practices, presentations of impacts to living resources, groundwater and discussions of strategies to reduce impacts.

The MAC is planning a Technology Series of workshops for 2016. Topics in the planned three part series may include continuous monitoring techniques, new technologies and methods, field applications, and best practices including calibration, standard operating procedures and quality assurance / quality control measures.

A new sub-committee of the MAC was formed in early 2015 to address monitoring questions related to stream restoration practices. The sub-committee, chaired by Scott Stranko of MD DNR and Scott Lowe of McCormick Taylor, Inc., is titled 'Stream Restoration Monitoring'. The group is comprised of individuals from a variety of organizations and backgrounds. The sub-committee's mission statement is:

> *The Stream Restoration Monitoring Sub-Committee 1) provide a forum for the exchange of data and information about the effectiveness of stream restoration practices in Maryland, 2) coordinates among those involved with stream restoration monitoring throughout the state, and 3) communicates stream restoration monitoring results. The group is made up of representatives from county and state agencies, environmental consulting firms, practitioners, and academia with diverse experience, knowledge, and expertise in the applying monitoring to stream policy and management.*

The sub-committee has been quite active in 2015, holding several meetings and taking on a number of topics from regulatory items to communication to methods and protocols. Lee Currey Director of MDE Science Services was an invited guest at a recent meeting. The sub-committee has organized two sessions at the MWMC Annual Conference focusing on stream restoration topics. Members of the sub-committee are reviewing stream restoration effectiveness studies and plan to invite researchers who have published pertinent data to present their findings at an event tentatively planned for spring 2016.

Sub-committee Members	**Organization**
Chris Victoria	Anne Arundel County
Colin Hill	KCI Technologies, Inc.
Emily Majcher	USGS
Jana Davis	Chesapeake Bay Trust
Jennifer St. John	Montgomery County
Michael Pieper	KCI Technologies, Inc.
Michael Trumbauer	Biohabitats
Michele Dobson	Harford County
Neely Law	Center for Watershed Protection
Robert Shedlock	USGS (retired USGS)
Nancy Roth	Versar
Sadie Drescher	Chesapeake Bay Trust
Sandy Hertz	State Highway Administration
Scott Lowe	McCormick Taylor
Stanley Kemp	University of Baltimore
John Gracie	Brightwater Inc.
Scott Macomber	Maryland Stream Restoration Association
Mark Secrist	U.S. Fish and Wildlife Service
Angela C Johnson	Maryland DNR
Scott Stranko	Maryland DNR

MWMC Citizen Science and Community Stewardship Committee

2015 Annual Committee Report

Committee members and affiliations

Caroline Donovan, UMCES, Chair

Jeff Reagan, Stormwater Consulting, Inc., Board Member

Diana Muller, Anne Arundel County STEM Advisor, Board Member

Dave Briglio, EA Engineering, Science, and Technology, Inc, Community Member

Marla Duley, Wallace Montgomery & Associates, Community Member

2015 accomplishments

• Changed committee name and charge in bylaws to Citizen Science and Community Stewardship Committee

o The original name of the committee did not reflect the current activities of the committee. Furthermore, we wanted to clarify the types of organizations we want to work with specifically (watershed organizations, volunteer monitors, etc).

• Updated watershed organization contact list

o For several years now, this committee has attempted to update the contact list of all the watershed organizations in Maryland. The list is over 250 names. The latest version of the list was passed on to me by the outgoing committee chair, Michele Dobson. Throughout 2015, we have tried to update the list, but have not finished it. This list will now help to inform a specific project, the EPA's Monitoring Integration project, so there is a push to have the list done by October 2015.

o Once the list is updated, the committee wants to send out an updated survey (through DNR's survey monkey account) to find out basic questions about monitoring throughout Maryland.

o The list will also be used to update the mapping project.

• Facebook

o The committee continues to run the MWMC Facebook page, posting at least once a week on a new item or reposting of "reminder" type posts. The page has 187 Likes, and posts with photos as the primary image get the most likes, followed by posts with links. While most people come to the MWMC Facebook page from Facebook, two websites have garnered engagement – the MWMC website and the Bing search engine. Demographically, 58% of our audience is women and 40% are men. There is a general bell curve for age, with the majority of our followers falling into the 25-54 year old range. While almost all Likes and People Reached are in the US, there is some international users as well.

o The Facebook page was used to create an Event for the MWMC Annual Conference when the MWMC website was temporarily unavailable. Using the Facebook page for this purpose was very useful. It should be something we do in the future as well.

2016 goals

• Have one or two workshops in 2016

o Workshop Ideas:

1. MDE Citizen Science Data Acceptance. A one day workshop for watershed groups to gain an understanding of the QA\QC Protocols required for data acceptance into the Integrated Report. Matt Stover has agreed to assist.

2. IDDE Rapid Assessment for Citizen Science. A half-day or evening workshop on the basics of assessing outfalls, and collecting samples. Understanding parameters measured and what they're indicators of.

3. Benthic Macroinvertebrate Workshop. A half-day or evening, fun and interesting class on benthic ID, life stages, and indices. Workshop to be timed around Spring Index and Streamwader Training.

4. BMP Effectiveness Monitoring for Citizen Groups. A workshop to inform watershed groups, community groups, HOA's, etc… on the function of BMPs, how to identify failures, and monitoring effectiveness.

5. Technology and Citizen Science. Perhaps a roundtable discussion of effective software, apps, maps.

6. Road Salt Monitoring for Citizen Scientists. A piggy-back workshop to follow the Road Salt Conference on how volunteers can monitor for changes in stream chemistry over time due to road salt applications.

7. The Chesapeake Bay Model De-Mystified. An overview of the model, the variables, uncertainties, and what it all means for the Chesapeake Bay.

• Write and implement 3 year plan

o Ideas for projects:

 Guidelines to establishing a citizen science program, or roadmap document. "Volunteer Monitoring for Dummies" kind of user guide. Create a QAPP template that can be easily used, or automated for ease of use by watershed groups.

 Establish a Linkedin Account for news content and professional networking within the water monitoring community.

 Submit articles for publication to raise profile and relevance of the MWMC. Dave Briglio, WEF Stormwater Magazine.

Maryland Water Monitoring Council

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