THE MARYLAND WATER MONITORING COUNCIL

in partnership with the

MARYLAND STREAM RESTORATION ASSOCIATION

presents

THE 29TH ANNUAL CONFERENCE

STEPPING UP OUR EFFORTS

NOW IS THE TIME

2023 MWMC Annual Conference Sponsors and Exhibitors

The Maryland Water Monitoring Council would like to express its gratitude to the Maryland Stream Restoration Association, without whom the Annual Conference would look very different this year.

We would also like to recognize the support of KCI, who again have sponsored the Student Poster Contest and the after-conference social at Heavy Seas Brewery.

Many thanks to our other sponsors and exhibitors.

Be sure to stop by their tables and thank them for their support of the 29th annual conference!

On the Cover - Snakehead Electroshocking – photo by Stephen Badger
Cover artwork by Katherine Hanna (MD DNR)

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Welcome from the Chair of the MWMC Board of Directors- Matthew Stover

Stepping Up Our Efforts – Now Is The Time

Greetings Maryland Water Monitoring Community! This year, we again have the privilege of holding the conference in-person, for which I'm very thankful! Speaking of being thankful, the Maryland Water Monitoring Council (MWMC) owes a debt of gratitude to the Maryland Stream Restoration Association (MSRA) this year who stepped in to help the Council (in a big way) secure a great venue and handle the registration process. This year's conference would not have been possible if not for the MSRA, so please be sure to stop by their table and say thank you to our magnanimous MSRA partners!

This year's conference promises another exciting lineup of sessions that will underscore the conference theme of "Stepping Up Our Efforts: Now is the Time". This theme reflects the sense of urgency that many of us feel as news comes forth of climate change tipping points, endangered species now declared extinct, and missed Chesapeake Bay restoration targets, just to name a few. However, it also captures the tremendous opportunities that we currently have with initiatives focused on climate change resiliency, environmental justice, water quality restoration, and enhanced protections through a variety of both regulatory and voluntary efforts. Effective water monitoring is critical to all of these. We have the ability to monitor our waters with greater spatial and temporal resolution than ever before and to synthesize these data into useful information for our decision-makers. Who would have predicted that we'd be using DNA collected from our waters to detect the presence of certain organisms? Or that we'd be using continuous logging devices for so many water quality parameters in so many locales? No doubt, we have better monitoring tools and more powerful assessment techniques than we've ever had. As a water monitoring community, let us not rest on our laurels but instead seize the moment!

To inspire us and kick off this year's conference, I'm excited to have Dr. Dorothy Merritts from Franklin & Marshall University and Adam Ortiz from EPA's Region 3 Office. Dr. Merritts has become a household name in the field of restoration science for her work studying new methods of restoration that focus on geomorphic aspects of stream ecosystems and, worth noting, she was recently elected as a member of the National Academy of Sciences in 2022. Adam Ortiz became EPA's Regional Administrator for Region 3 in 2021. Many of us know Mr. Ortiz from his deep roots in Maryland as a director for Montgomery County's and Prince George's County's respective Departments of Environmental Protection as well as the many other roles he's held throughout the State. Now as EPA's Region 3 Administrator, which covers the states of Maryland, Delaware, DC, Pennsylvania, Virginia and West Virginia, Mr. Ortiz is working on enhancing the region's focus on infrastructure, enforcement, climate change, environmental justice, and restoring the Chesapeake Bay.

In keeping with one of my favorite traditions from the conference, the MWMC will also be awarding the 17th annual Carl Weber award to the person who most exemplifies a longstanding dedication to collaborative leadership in the field of water monitoring. We will also be awarding the 7th annual Above and Beyond award to recognize the contributions of someone who is a more recent addition to the water monitoring community but who has had an outsized impact in volunteering and increasing watershed awareness, advocacy, educations, and stewardship. I won't provide any spoilers in these remarks but please join me in congratulating our winners at the conference!

Before closing, I'd like to highlight the fact that the MWMC doesn't just put on a great annual conference. Did you know that we also hold an annual Stream Monitoring Roundtable in late winter? Or that we plan and host other workshops and webinars on a variety of topics? One example is a day-long workshop we're hosting at the USGS Water Science Center on December 8th of this year that will discuss the evolving science of eDNA monitoring. In case you missed that announcement, please feel free to reach out to one of our session moderators for more information. Also in the works for 2024 are plans to host a series of

webinars on topics related to data quality and a workshop devoted to thermal impacts to Maryland's waters. Please stay tuned as a schedule and details will be forthcoming!

The MWMC currently has 6 standing committees that typically develop workshops, products, or other initiatives and then put them into action. Anyone can join one of these committees and we can always use some fresh ideas and energy in carrying out our mission of improving the effectiveness of our monitoring efforts, enhancing collaboration, and increasing our collective knowledge base. We hope that the conference and other Council-sponsored events will be useful to your ongoing work. I also want to encourage you to reach out to the MWMC to communicate your needs and to get involved with the Council to use it as a vehicle to enhance your water monitoring programs.

As a volunteer-led organization, we're proud of what the MWMC has accomplished thus far but also believe that we have much more to do to *step up our efforts*. Together, let's challenge ourselves to have the best conference yet and to keep the momentum going into 2024!

Cheers,

Matt Stover
Chair, Maryland Water Monitoring Council

The Carl S. Weber Awards

For Vision and Leadership in Monitoring Maryland's Waters

Our vision for monitoring 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 stake holders and will facilitate sound decision-making in environmental management and protection.

Dr. Carl S. Weber. Among 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 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 the 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

2022- Bruce Michael (Maryland DNR-Retired)

2021- Rupert Rossetti (Octoraro Watershed Association)

2020- Dan Boward (Maryland DNR-Retired)

2019- Jim Gracie (Brightwater Incorporated)

2018- Cathy Wiss (Audubon Naturalist Society)

2017- Dr. Walter Boynton (University of Maryland Center for Environmental Science)

2016- Bonnie Bick (Mattawoman Watershed Society)

2015- Frank Dawson (Maryland DNR-Retired)

2014- Jim Long (Mattawoman Watershed Society)

2013- Paul Kazyak (Maryland DNR)

2012- Charlie Conklin (Gunpowder Valley Conservancy)

2011- Bill Stack (Center for Watershed Protection)

2010- Sally G. Horner (Magothy River Association)

2009- Peter Bergstrom (NOAA)

2008- Ron Klauda (Maryland DNR)

2007- Susan "Abby" Markowitz (Tetra Tech) and Dr. Paul Massicot (Maryland DNR)

Above and Beyond Award

Many of the previous Carl Weber Award recipients have had lengthy careers and been a part of public agencies. The Above and Beyond Award allows the MWMC to recognize someone who represents the next generation of Maryland's water monitors and the future of the MWMC. Presented annually to recognize contributions of an up-and-coming member of the Maryland's environmental community, the Above and Beyond Award is presented to a member who has volunteered time and energy towards the monitoring of Maryland's waters and has made a significant contribution to increasing watershed awareness, advocacy, education and stewardship. The MWMC is proud to include this award at our annual conference.

Previous Winners

2021- Daniel Savoy (Wicomico Environmental Trust; Wicomico River Creekwatchers)

2020- Andrew Sarcinello (Maryland Trout Unlimited Citizen Science Initiative)

2019- Suzanne Etgen (Anne Arundel Watershed Stewards Academy)

2018- Joseph Davis and Matthew Budinger (Baltimore County Educators)

2017- Rebecca Kenyon-Sisler (Garrett County Educator)

2016- Ann Strozyk (Howard County Educator)

2023 Annual Conference Planning Committee

Andy Becker	KCI Technologies, Inc
Megan Brosh	Baltimore County Department of Environmental Protection and Sustainability
Lindsay DeMarzo	Howard County Office of Community Sustainability
Jason Dubow	Maryland Department of Planning
Katherine Hanna	Maryland Department of Natural Resources
Clark Howells	Baltimore City Department of Public Works
Ken Mack	Montgomery County Department of Environmental Protection
Mike McMahon	Maryland Department of the Environment
Becky Monahan	Maryland Department of the Environment
Mat Pajerowski	United States Geological Service
Nancy Roth	Tetra Tech, Inc.
Mark Southerland	Tetra Tech, Inc.
Matthew Stover	Maryland Department of the Environment

Additional thanks to:

Nancy Hofmann	Maryland Department of Natural Resources
Mike Mosser	Maryland Department of Natural Resources
Shane Mizelle	United States Geological Survey
Anna McClain	United States Geological Survey

Maryland Water Monitoring Council

29th Annual Conference – Friday, November 17, 2023

Stepping Up Our Efforts: Now is the Time

7:30 **Registration/Poster Set-up/Continental Breakfast – Registration in Room A-100**

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

8:30 ***MWMC Board Chair's Call to Order*** **– Matt Stover – Maryland Department of the Environment; Chair, MWMC Board of Directors**

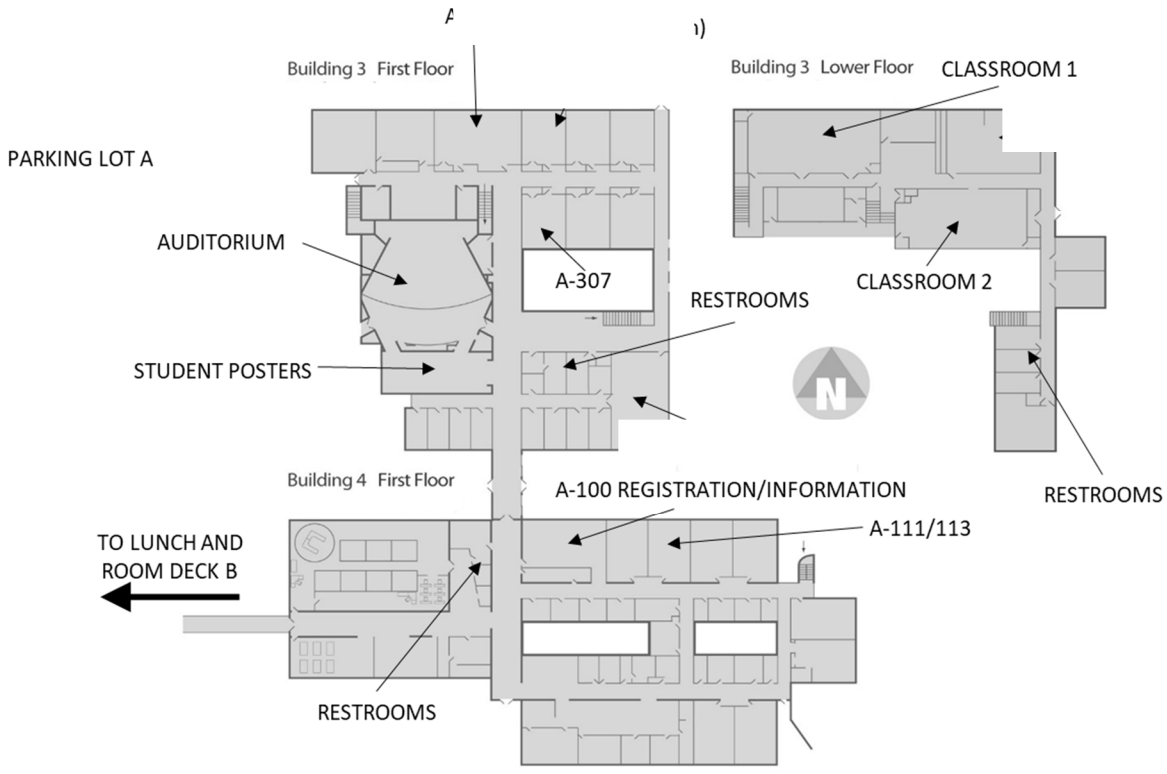
8:45 ***Plenary Speaker*** **– Dr. Dorothy Merritts – Franklin & Marshall University**

9:15 ***Plenary Speaker*** **– Adam Ortiz – Environmental Protection Agency Region 3 Administrator**

9:45 ***Carl S. Weber Award*** **– Clark Howells; City of Baltimore**

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

2023 MWMC Annual Conference Floorplan



Concurrent Sessions - 10:30 –12:00

AUDITORIUM – Restoration I - Moderator: Byron Madigan, Carroll Co. Government
RE-VISITING THE NATURAL RESOURCE RESPONSE ON ANNE ARUNDEL COUNTY STREAM AND WETLAND SITES POST-RESTORATION - Erik Michelsen, Anne Arundel County Department of Public Works
BIOLOGICAL RESPONSE TO STREAM RESTORATION - Mark Southerland, Tetra Tech
A POWER ANALYSIS TOOL IN R TO ENHANCE MONITORING STUDIES - Dong Liang, UMCES Chesapeake Biological Laboratory

Classroom 1 - Applying Data to Inform Protection of High Quality Waters and Watersheds - Moderator: Nancy Roth, Tetra Tech
GRASSROOTS EFFORTS TO RESTORE SOUTHERN MARYLAND WATERSHEDS - Mary Hoover, ACLT
ENVIRONMENTAL SITE DESIGN- AN ASSESSMENT OF EFFECTIVENESS IN MEETING WATER QUALITY PROTECTION GOALS - Eric Naibert, Montgomery Co. DEP
TARGETING AND RESTORATION EFFORTS - WHERE TO START? - Sarah McDonald, USGS Chesapeake Bay Program Office

Classroom 2 - Agriculture and Water Quality Approaching the 2025 Chesapeake Bay TMDL Deadline - Moderator: Ken Staver, UMD Wye Research and Education Center
MARYLAND AGRICULTURE'S APPROACH TO 2025 TMDL GOALS AND BEYOND - Elizabeth Hoffman, Maryland Department of Agriculture
CHANGES IN STREAM WATER QUALITY IN SMALL AGRICULTURAL WATERSHEDS BY EXPERIMENTAL BMP APPLICATION - Rebecca Fox, Washington College
AVOIDING NEGATIVE WATER QUALITY EFFECTS IN THE PURSUIT OF SOIL HEALTH - Ken Staver, UMD Wye Research and Education Center

Room A-300 - Polychlorinated Biphenyls (PCBs) - Moderator: Mat Pajerowski, US Geological Survey
MARYLAND'S PCB SOURCE TRACKDOWN STUDY IN LOWER BEAVERDAM CREEK - Elisabeth Green, MDE
PARTICULATE TRANSPORT OF LEGACY CONTAMINANTS IN THE ANACOSTIA RIVER WATERSHED - Trevor Needham, USGS
PCBS IN FISH AND WATER IN MD: LONG TERM AND SPATIAL TRENDS - Upal Ghosh, UMBC

Concurrent Sessions - 10:30 –12:00 ctd.

Room A-111/A-113 - Cutting Edge Biology: Ephemeral Streams, eDNA, and More - Moderator: Richard Mitchell, US Environmental Protection Agency
SOURCE WATER MACROINVERTEBRATES: INDICATORS TO INFER FLOW REGIMES IN TINY HEADWATERS - Greg Pond, EPA
IDENTIFYING THE POTENTIAL CO-BENEFITS OF BEST MANAGEMENT PRACTICES (BMPS) ON INSTREAM BIOLOGICAL CONDITION USING CAUSAL INFERENCE APPROACHES - Sean Emmons, USGS Eastern Ecological Science Center
USING METABARCODING DATA FOR BIOLOGICAL ASSESSMENT - Lester Yuan, EPA Office of Water

Room A-307 – Harmful Algal Blooms - Moderator: Clark Howells, Washington Suburban Sanitary Commission
THERE'S A NEW TOXIN IN OUR WATERS - Cathy Wazniak, Maryland DNR
WSSC WATER'S PROACTIVE HAB MONITORING PROGRAM - Steven Nelson, WSSC
HOW CAN HAB MONITORING SUPPORT DRINKING WATER TREATMENT? - Priscilla To, WSSC

Lunch A 12:00 – 12:45

Lunch B 12:45 – 1:30

Poster Session – 1:00 – 1:30

Student Posters to present to judges at 1:00 in the Memorabilia Room

Concurrent Sessions - 1:30 –3:00

AUDITORIUM – Restoration II – Moderator: Nancy Roth, Tetra Tech
DO ROOTS BIND SOIL? THE COMPLEX ROLE OF RIPARIAN VEGETATION IN BANK STABILITY – Tess Thompson, Virginia Tech
MARYLAND PORT ADMINISTRATION FOCUSES ON RESTORATION THROUGH THE BENEFICIAL USE AND INNOVATIVE REUSE PROGRAMS – Amanda Peñafiel, Maryland Port Administration

Classroom 1 – Charismatic Megafauna Monitoring – Moderator: Jason Dubow, Maryland Department of Planning
LONG TIME, NO SEA: BOTTLENOSE DOLPHINS IN CHESAPEAKE BAY – Jamie Testa, UMCES Chesapeake Biological Laboratory
ATLANTIC STURGEON RESEARCH ON THE NANTICOKE RIVER – Chuck Stence, Maryland DNR
COASTAL MIGRATIONS OF SHARKS AND STINGRAYS – Rob Aguilar, SERC

Concurrent Sessions – 1:30 –3:00 ctd.

Classroom 2 – Thermal Impacts: It's Getting Hot In Here! – Moderator: Matt Stover, Maryland Department of the Environment
THERMAL EVALUATION OF UPLAND STORMWATER BMPS – IMPACT OF DESIGN MODIFICATIONS TO BUFFER STREAM TEMPERATURES IN URBANIZED WATERSHEDS – Byron Madigan, Carroll County Government
RISING WATER TEMPERATURES IN CHESAPEAKE BAY: RECOMMENDATIONS TO SUPPORT AND ENHANCE MONITORING AND RESEARCH TO ADDRESS IMPACTS TO ECOSYSTEMS – Bruce Vogt, NOAA Chesapeake Bay Office
POTENTIAL BENEFITS OF POND REMOVAL FOR TROUT CONSERVATION AND RESTORATION IN MARYLAND – Zachary A. Kelly, USGS Eastern Ecological Science Center

Room A-300 – Contributed Talks I – Moderator: Megan Brosh, Baltimore County Environmental Protection and Sustainability
SAVING BIRDS FROM WINDOW COLLISIONS – Mark Southerland, Safe Skies Maryland
MD TEMPERATURE TMDL DEVELOPMENT – Anna Kasko, MDE
QUANTIFYING THE THERMAL REGIME OF A MARYLAND USE CLASS IV STREAM USING A HIGH-FREQUENCY TEMPERATURE SENSOR NETWORK – Claire Welty, UMBC CUERE

Room A-111/A-113 – Contributed Talks II – Moderator: Ken Mack, Montgomery County Department of Environmental Protection
AN EVALUATION OF THE IMPACT OF SEASON IN THE EXECUTION OF MULTIMETRIC HABITAT ASSESSMENT APPROACHES IN ANNE ARUNDEL COUNTY, MARYLAND – Chris Victoria, Anne Arundel Co. Bureau of Watershed Protection and Restoration
SAWMILL CREEK: EFFECTS OF URBANIZATION ON FISH BIOLOGICAL INTEGRITY AND COMMUNITY STRUCTURE OVER 30 YEARS – Bryan Perry, Anne Arundel Co. Bureau of Watershed Protection & Restoration
USING MBSS DATA TO IMPROVE OUR UNDERSTANDING OF FISH SPECIES OF GREATEST CONSERVATION NEED: STRIPED SHINER AND GLASSY DARTER – Tomas Ivasauskas & Greg Mathews, Maryland DNR

Room A-307 – Groundwater – Moderator: Mike McMahon, Maryland Department of the Environment
THE MARYLAND OBSERVATION WELL NETWORK – Andrew Staley, Maryland DNR
A PRELIMINARY ASSESSMENT OF DRINKING WELL WATER QUALITY ON FARMS IN MARYLAND – Andy Lazur, University of Maryland Extension
EXPLORING RECYCLED WATER USE FOR IRRIGATION: A POTENTIAL GROUNDWATER CONSERVATION STRATEGY IN MARYLAND'S COASTAL PLAINS – Azbina Rahman, UMD

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

3:00 Announcement of Student Poster Award Winners in the Auditorium

Concurrent Sessions - 3:30 –4:30

AUDITORIUM – Restoration III – Moderator: Brian Smith, Maryland Department of Natural Resources
APPLYING FLOATING WETLAND TECHNOLOGY TO POST-INDUSTRIAL WATERFRONTS – Charmaine Dahlenburg, National Aquarium
RESTORATION OF MASONVILLE COVE FROM AN ILLEGAL DUMP TO AN URBAN WILDLIFE REFUGE – Jessica Keicher, MES
MEMORIES OF THE SOILS: ASSESSMENT OF POST-RESTORATION FLOODPLAINS AND NITROGEN REMOVAL EFFECTIVENESS – Joe Galella, University of Delaware

Classroom 1- Reintroduction Projects – Moderator: Ken Mack, Montgomery County Department of Environmental Protection
RESULTS OF FAIRFAX COUNTY'S STREAM RESTORATION MACROINVERTEBRATE STOCKING PILOT STUDY – Jonathan Witt, Fairfax Co. Watershed Assessment Branch
FRESHWATER MUSSEL AUGMENTATION AND REINTRODUCTION IN MARYLAND – Matt Ashton, Maryland DNR

Classroom 2 – Waterkeeper Litigation Case Studies – Moderator: Jason Dubow, Maryland Department of Planning
REIMAGINE MIDDLE BRANCH: AUTHENTIC COMMUNITY ENGAGEMENT FOR ENVIRONMENTAL JUSTICE – Brad Rogers, South Baltimore Gateway Partnership
MONTIORING WATER POLLUTION WITH DRONE TECHNOLOGY – Brent Walls, Upper Potomac Riverkeeper
WATER QUALITY MONITORING AND THE CLEAN WATER ACT BALTIMORE WWTPS CASE STUDY - Angela Haren, Chesapeake Legal Alliance

Room A-300 – Per- and Polyfluoroalkyl Substances (PFAS) – Moderator: Becky Monahan, Maryland Department of the Environment
PFAS IN MARYLAND'S COMMUNITY WATER SYSTEMS – Diana Kremer, MDE
TOTAL OXIDIZABLE PRECURSOR ASSAY FOR PFAS: IMPROVING TRANSFORMATION, RECOVERY, AND THROUGHPUT FOR SOIL SAMPLES – Lee Blaney, UMBC
PFAS: ONGOING EFFORTS WITHIN THE TOXIC CONTAMINANT WORKGROUP OF THE CHESAPEAKE BAY PROGRAM PARTNERSHIP – Emily Majcher, USGS

Concurrent Sessions - 3:30 –4:30 ctd.

Room A-111/A-113 – Student Lightning Talks – Moderator: Lindsay DeMarzo, Howard County Office of Community Sustainability
THE IMPORTANCE OF PRE-RESTORATION MONITORING: DESIGNING THE MONITORING STUDY AT EMORY WATERS NATURE PRESERVE – Zoe Jarvis, University of Maryland, Jug Bay Wetlands Sanctuary
MODELING THE CATCHMENT-SCALE EFFECTIVENESS OF RESIDENTIAL RAIN GARDENS FOR STORMWATER MANAGEMENT – Benjamin Daniels, UMBC
FILTERING SOLUTIONS: SAND FILTERS VS. WET PONDS IN STORMWATER MANAGEMENT - Garrett Tucker, McDaniel College

A-307 – Stormwater – Moderator: Stewart Comstock, Maryland Department of the Environment
EFFECTIVENESS OF STORMWATER MANAGEMENT PRACTICES IN PROTECTING STREAM CHANNEL STABILITY – Tess Thompson, Virginia Tech
LONG TERM EFFECTIVENESS OF GREEN STORMWATER INFRASTRUCTURE AT PROJECT AND WATERSHED SCALES – Keith Eshleman, UMCES Appalachian Laboratory
REVERSING THE HYDROLOGIC LEGACY OF DISTURBED COMPACTED URBAN SOILS – Stu Schwartz, UMBC

4:30 Adjourn - SOCIAL AT HEAVY SEAS BREWERY STARTING AT 5:00 (registration required)

Poster List

ASSESSING AND UNDERSTANDING SPATIOTEMPORAL VARIATION IN STABLE HYDROGEN AND OXYGEN ISOTOPE VALUES OF MARYLAND'S RIVERS - Syeda Sadia Ali, UMCES Chesapeake Biological Laboratory

INFLUENCE OF HISTORIC AND CURRENT LAND USE PRACTICES ON PCB CONTAMINATION OF SOILS AND STORMWATER SEDIMENTS IN THE CHESAPEAKE BAY WATERSHED - Yongcheng Cao, University of Maryland

A SIX-YEAR FIELD CASE STUDY: DYNAMICS OF ENHANCED TCE DECHLORINATION - Shih-Huai (Lora) Cheng, University of Maryland

PATAPSCO RIVER REPORT CARD: AN ANNUAL EXPLORATION OF WATER QUALITY AND ENVIRONMENTAL STEWARDSHIP - Amanda DeLeo, Patapsco Heritage Greenway

NUTRIENT ANALYTICAL SERVICES LABORATORY - Jerry Frank, UMCES Chesapeake Biological Laboratory

CENTER FOR THE STUDY OF ANTHROPOGENIC CHANGES IN ESTUARINE SYSTEMS (ACES) - Michael Gonsior, UMCES Chesapeake Biological Laboratory

<STUDENT> THE IMPORTANCE OF PRE-RESTORATION MONITORING: DESIGNING THE MONITORING STUDY AT EMORY WATERS NATURE PRESERVE - Zoe Jarvis, University of Maryland, Jug Bay Wetlands Sanctuary

A BIOSUSTAINABLE MICROFLUIDIC ELECTROCHEMICAL SENSOR FOR REAL-TIME MONITORING OF NITRATE IN GROUNDWATER AND STREAMS - Revati Kadolkar, University of Maryland Baltimore County

PRESENCE OF POLYCHLORINATED BIPHENYLS AND PCB TRANSFORMING BACTERIA IN STORMWATER - Birthe V. Kjellerup, University of Maryland

CITY AND NEIGHBORHOOD SCALE WASTEWATER-BASED EPIDEMIOLOGY MONITORING AND MODELING OF SARS-CoV-2, INFLUENZA A, AND RSV IN MARYLAND - Yuzhu Mao, University of Maryland

QUANTIFYING HIGH-FREQUENCY STREAM WATER QUALITY ALONG AN URBAN-TO-RURAL GRADIENT - Mary McWilliams, UMBC/CUERE

MONITORING IMPACTS OF SUBURBAN DEVELOPMENT ON STREAM HEALTH IN THE CLARKSBURG SPECIAL PROTECTION AREA, MARYLAND - Marina Metes, U.S. Geological Survey

EVALUATION OF INTERNAL SOURCES OF NUTRIENTS IN MARYLAND RESERVOIRS EXPERIENCING HARMFUL ALGAL BLOOMS - Andrea Pain, UMCES Horn Point

IMPROVING FRESHWATER MUSSEL PROPAGATION WITH NITRIFYING BACTERIA - Katherine Philipp, MD DNR

A NEW TOOL TO EMPOWER CITIZEN SCIENTISTS AND STUDENTS IN WATER QUALITY RESEARCH - Dietrich Ruehlmann, GaiaXus LLC

CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS AT THE UMCES CHESAPEAKE BIOLOGICAL LABORATORY (CBL) - Johan Schijf, UMCES Chesapeake Biological Laboratory

CHESAPEAKE BAY WATER WATCH: CITIZEN SCIENTISTS ENABLING SATELLITE REMOTE SENSING OF WATER QUALITY - Tara Sill, Smithsonian Environmental Research Center

VISUALIZING THERMAL FLUCTUATIONS MEASURED BY A HIGH FREQUENCY SENSOR NETWORK IN A MARYLAND USE CLASS IV STREAM - Nick Simeone, UMBC/CUERE and GES

SEPTIC TO SEWER? JUSTICE-FOCUSED STRATEGIES FOR ADDRESSING COASTAL SEPTIC SYSTEM FAILURES UNDER SEA LEVEL RISE AND INCREASED FLOODING - Emily Speierman, University of Maryland

<STUDENT> MICROPLASTICS IN THE PATAPSCO RIVER - Olivia Sunde, McDaniel College

<STUDENT> FILTERING SOLUTIONS: SAND FILTERS VS. WET PONDS IN STORMWATER MANAGEMENT - Garrett Tucker, McDaniel College

PREVENTION AND TREATMENT OF PERSISTENT ORGANIC POLLUTANTS IN STORMWATER AND SEDIMENT - Chen Yuan, University of Maryland

Plenary Talks

Dr. Dorothy Merritts

Franklin & Marshall College

Dorothy Merritts is a geomorphologist recognized for her work on the history of landscapes and processes that shape them. She is known particularly for her research on landscapes perturbed by geologic events and climate change during the past ~130,000 years, and by human activities during the past ~400 years. Merritts grew up in the Appalachian Mountains in central Pennsylvania. She graduated from Indiana University of Pennsylvania with a degree in geology, from Stanford University with a M. S. in Engineering Geology, and from University of Arizona with a Ph. D. in geosciences in 1987. At University of Arizona, she focused on active tectonics, soil formation on tectonically uplifted landforms, and the response of streams and coastlines to rapid uplift along the northernmost tip of the San Andreas fault, which she and collaborators located from geomorphic evidence. She joined the faculty at Franklin and Marshall College Department of Earth and Environment (formerly Geosciences) in 1987. She was president of the American Geophysical Union Earth and Planetary Surface Processes Section, is a fellow of the Geological Society of America (GSA), was a co-recipient of the GSA Kirk Bryan award for outstanding scholarship, and received the Distinguished Career award from the GSA Quaternary Geology and Geomorphology Division in 2022. She was elected to the National Academy of Sciences in 2022.

Adam Ortiz

Environmental Protection Agency Region 3 Administrator

Adam Ortiz serves as EPA's Mid-Atlantic Regional Administrator where he oversees federal environmental and public health protections in Delaware, Maryland, Pennsylvania, Virginia, West Virginia, the District of Columbia, and seven federally recognized tribes. Working with state partners and local stakeholders, Adam is focused on infrastructure, enforcement, climate change, environmental justice, and restoring the Chesapeake Bay. Before coming to EPA, Adam was the Director of the Montgomery County, Maryland Department of Environmental Protection, where he launched programs boosting recycling, curbside compost collection, building energy efficiency standards, and watershed restoration projects with a focus on equity. Previously, Adam was the Director of the Department of Environment for Prince George's County, Maryland, where he led the county to the highest recycling rate in the state and led a $100M public-private green infrastructure construction program focusing on small and minority business development. He also oversaw the construction and operation of the region's largest organics composting facility. Before that he served in the Maryland Lt. Governor's Office and at the state's Department of Labor, Licensing and Regulation. As Mayor of the Town of Edmonston, Maryland for three terms, Adam ended years of chronic flooding through water infrastructure improvements, spearheaded the east coast's first "Complete Green Street" that successfully captures and filters stormwater runoff, enables bike and pedestrian access, and has improved the quality of life of the town's diverse residents. In his spare time, he enjoys getting outside to paddle and hike throughout the mid-Atlantic region. He grew up in New York's Hudson Valley and graduated from Goucher College in Maryland.

FRESHWATER MUSSEL AUGMENTATION AND REINTRODUCTION IN MARYLAND

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

Species augmentation or reintroduction (A/R) is an increasingly used tool for conservation or mitigation. The practice as used for freshwater mussels has changed greatly over the past thirty plus years as knowledge on the ecological requirements to implement successful A/R projects, the potential conservation benefits, and evolutionary and ecological risks have been better studied. The Maryland Department of Natural Resources has implemented two mussel A/R projects using a standard framework to scope and propose them in a scientifically defensible manner. Preliminary results from one of these projects, conducted in Town Creek with multiple species, will be presented along with a discussion on the when and where the tool should and should not be used.

Matt is the freshwater mussel assessment project leader for the Monitoring and Non-Tidal Assessment division of Maryland DNR. He leads and coordinates multiple projects for state and federal partners, including monitoring of freshwater mussel reintroduction and augmentation. He has been studying mussels for 20 years.

TOTAL OXIDIZABLE PRECURSOR ASSAY FOR PFAS: IMPROVING TRANSFORMATION, RECOVERY, AND THROUGHPUT FOR SOIL SAMPLES

Lee Blaney; University of Maryland Baltimore County; blaney@umbc.edu

Coauthors: Marriah Ellington, UMBC; Ke He, UMBC; Margaret Siao, UMBC; Jiabao Liang, UMBC

Per- and polyfluoroalkyl substances (PFAS) comprise more than 10,000 compounds with variable physicochemical properties. Targeted analytical approaches require standards that are limited, expensive, or unavailable. The total oxidizable precursor (TOP) assay represents one option to address the complexity associated with unknown PFAS precursors. The TOP assay transforms precursors into perfluoroalkyl acid (PFAA) end-products via hydroxyl and sulfate radical-driven reactions. The organic matter content in soil, sediment, and biosolids scavenges reactive species and inhibits precursor oxidation; furthermore, PFAS extraction from solid samples involves solvent addition, which increases reactive species scavenging and necessitates further processing steps. This project sought to improve the transformation efficiency, recovery efficiency, and throughput of the TOP assay for measurement of PFAS precursors in soil samples. With our modified TOP assay, recovery efficiencies ranged from 64 to 115%, and the precursor transformation efficiency was greater than 75%. The optimized method enabled ng g-1 quantitation of PFAS precursors in real soil samples, providing opportunities for a more complete analysis of the total PFAS pool at contaminated sites.

Lee received his BS and MS degrees in Environmental Engineering from Lehigh University. In 2011, he completed his PhD at the University of Texas at Austin and started as Assistant Professor at UMBC, where he is now Professor. Since then, Lee has established a vibrant research program focused on the occurrence, fate, transport, and toxicity of contaminants of emerging concern in natural and engineered systems. He is the recipient of the ES&T James J. Morgan Award and the NSF Career Award. Lee also serves as President-Elect of the Association of Environmental Engineering and Science Professors and Executive Editor at the Journal of Hazardous Materials.

APPLYING FLOATING WETLAND TECHNOLOGY TO POST-INDUSTRIAL WATERFRONTS

Charmaine Dahlenburg; National Aquarium; cdahlenburg@aqua.org

Coauthor: Jack Cover, National Aquarium

The National Aquarium is embarking on a project to implement 8,000 square feet of floating wetland technology in Baltimore's Inner Harbor, a 200-year-old post-industrial waterfront. The long-awaited project, to be completed in summer 2024, will mimic a Chesapeake Bay tidal wetland, functioning as a working ecosystem while providing a public space for Baltimore residents and visitors to connect with the natural world. The floating habitat features elevation changes hosting native marsh grasses and shrubs; aeration components; and a meandering channel representing shallow water habitat that once existed in the area. Join us to discover more about how floating wetland technology will be applied to benefit the future of the Inner Harbor.

Mrs. Dahlenburg holds a master's degree in environmental science and policy from Johns Hopkins University. As Director of Field Conservation at the National Aquarium (Baltimore, MD), she has 20 years' experience implementing community-based habitat restoration efforts, stabilizing sand dunes, and restoring tidal and non-tidal wetlands throughout the Chesapeake Bay watershed. Recently, she has been part of the planning committee to implement 8,000 square feet of floating wetland technology in Baltimore's Inner Harbor by summer 2024, an initiative to create a green district and working ecosystem along the post-industrial waterfront.

MODELING THE CATCHMENT-SCALE EFFECTIVENESS OF RESIDENTIAL RAIN GARDENS FOR STORMWATER MANAGEMENT

Benjamin Daniels; University of Maryland, Baltimore County; bdaniel2@umbc.edu

Coauthor: Alan Yeakley, University of Maryland, Baltimore County

Green infrastructure practices are increasingly implemented to manage stormwater quantity and quality, but uncertainty remains regarding the catchment-scale effectiveness and optimal locations of these features to meet environmental goals. In particular, the hydrologic effects of rain gardens in suburban catchments have been understudied. In this research, we developed a hydrologic model using the EPA Storm Water Management Model (SWMM) to test the effects of different levels of implementation and spatial distributions of residential rain gardens on storm event hydrology in a 3.1 km2 suburban catchment in Columbia, MD. For a SWMM model, ours is exceptional for its scale and detail, containing 382 subcatchments, 473 storm sewer inlets and manholes, and stream channels up to Shreve order 7. The catchment has 32% total impervious area, and 41% of its non-road area has a residential land use type, with 780 detached houses. Our research aims to quantify the effects of varying extents of residential rain garden implementation and spatial configurations on event runoff volume, peak flow, and lag time. We hypothesize that extensive implementation of rain gardens has a significant impact on event flow metrics, and that downstream and spatially dispersed practices provide better runoff control compared to upstream and clustered practices, respectively.

Benjamin Daniels is a Doctoral Candidate in the Department of Geography and Environmental Systems at the University of Maryland, Baltimore County, advised by Dr. Alan Yeakley. Mr. Daniels holds a bachelor's degree in physics and earth science from The College of New Jersey and a master's degree in geology from Boston College. Prior to entering the Graduate School at UMBC, Mr. Daniels was employed for eight years as a Project Geologist at AECOM Technical Services, a leading environmental consulting firm, and he has a Professional Geologist certification from the Commonwealth of Virginia.

IDENTIFYING THE POTENTIAL CO-BENEFITS OF BEST MANAGEMENT PRACTICES (BMPS) ON INSTREAM BIOLOGICAL CONDITION USING CAUSAL INFERENCE APPROACHES

Sean Emmons; U.S. Geological Survey Eastern Ecological Science Center; semmons@usgs.gov

Coauthors: Taylor Woods, U.S. Geological Survey, Eastern Ecological Science Center, Matthew Cashman, U.S. Geological Survey, Maryland-Delaware-District of Columbia Water Science Center, John Young, U.S. Geological Survey, Eastern Ecological Science Center, Greg Noe, U.S. Geological Survey, Florence Bascom Geoscience Center, Olivia Devereaux, Devereux Consulting, Scott Stranko, Maryland Department of Natural Resources, Jay Kilian, Maryland Department of Natural Resources, Katherine Hanna, Maryland Department of Natural Resources, Kelly Maloney, U.S. Geological Survey, Eastern Ecological Science Center

The primary objectives of Best Management Practices (BMPs) in the Chesapeake Bay Watershed are to reduce amounts of nonpoint source pollutants (nutrients and sediment) that enter streams. However, there is growing interest in whether BMPs generate co-benefits (i.e., unintended positive side effects) for instream biological endpoints. Yet, identifying co-benefits is hindered by traditional statistical inference that fails to control for confounding variables (i.e., those that influence both BMPs and biological endpoints). Here, we demonstrate how novel causal inference approaches (Propensity Score Matching and Bayesian Networks) can be used to address this challenge. First, we provide an overview of causal inference approaches and their application to ecology. Second, we illustrate how causal inference approaches can be used to test for BMP co-benefits through a case study leveraging the Maryland Biological Stream Survey's (MBSS) benthic macroinvertebrate and fish indices of biotic integrity (BIBI & FIBI). Preliminary results suggest that BMPs could offer co-benefits to benthic macroinvertebrate and fish endpoints in a subset of ecoregions and in catchments with poor biological condition. Future work will use instream temperature data to identify heating or cooling effects of BMPs on biological endpoints and scale-up causal analyses Chesapeake Bay-wide.

Sean Emmons is currently a research ecologist at the US Geological Survey's Eastern Ecological Science Center. Sean's work focuses on combining quantitative ecology with emerging topics like causal inference and social science. He completed his PhD at the University of Oklahoma where he studied the implementation of environmental flows to boost freshwater species conservation in the complex setting of the water-scarce south-central U.S. Sean is currently focused on developing actionable, partner-driven research in the Chesapeake Bay Watershed on BMPs, social science, global change, environmental flows, and spatial conservation planning.

LONG TERM EFFECTIVENESS OF GREEN STORMWATER INFRASTRUCTURE AT PROJECT AND WATERSHED SCALES

Keith N. Eshleman; UMCES Appalachian Laboratory; keshleman@umces.edu

Green stormwater infrastructure (GSI) is increasingly being used to address stormwater management problems in urban and suburban areas. Our field-based research on bioswales and bioretention systems is focused on answering three questions about the overall effectiveness of GSI that relatively few experimental studies have been able to address:

1) Does GSI effectiveness tend to diminish over time (i.e., multiple years)?

2) Can GSI effectiveness based on a few experimental studies be extrapolated to other systems of similar design?

3) Can the effectiveness of GSI be detected at the watershed scale?

Field data from multiple years of monitoring the performance of highway bioswales and grassed swales in Maryland will be presented to address question 1). Water quality data obtained during a synoptic survey of ~30 highway swales on US Rte. 40 in Ellicott City, MD will be used to address question 2). Finally, 3.5 years of continuous runoff and water quality monitoring of two suburban watersheds will be used to address question 3).

Dr. Keith N. Eshleman is Professor at the University of Maryland Center for Environmental Science and is based at Appalachian Laboratory in Frostburg, Maryland. Dr. Eshleman's research interests are primarily in the areas of watershed and wetlands hydrology, and his field-oriented research program has broadly focused on man's impacts on the hydrologic cycle, specifically on examination of the hydrological effects of acid deposition, forest disturbances, surface mining, shale gas development, urban stormwater management, and peatland drainage and restoration.

CHANGES IN STREAM WATER QUALITY IN SMALL AGRICULTURAL WATERSHEDS BY EXPERIMENTAL BMP APPLICATION

Rebecca Fox; Washington College; rfox3@washcoll.edu

Coauthors: Anne Gustafson, Horn Point Laboratory, University of Maryland Center for Environmental Science; Tom Fisher, Horn Point Laboratory, University of Maryland Center for Environmental Science; Erika Koontz, Horn Point Laboratory, University of Maryland Center for Environmental Science

Water quality in the Chesapeake Bay has declined due to N, P, and sediment loads from the watershed. On the Eastern Shore of MD, the dominant source of these pollutants is agriculture, and agricultural best management practices (BMPs) are often used to improve water quality. These BMPs have traditionally been tested on the plot or field scale, but rarely at the watershed scale. We tested whether experimental additions of agricultural BMPs in four small watersheds in the Choptank basin, a tributary to Chesapeake Bay, would impact water quality. We collected baseline data on farm fields, at road/stream crossings, and at the watershed outlets during 2003-2020. After 2014 we encouraged farmers to add additional BMPs in three experimental watersheds, with the fourth as a control. By the end of 2020, we detected a small increase in N concentrations at the control watershed outlet. Decreasing baseflow N concentrations were detected in two of the experimental watershed outlets, with the third showing increasing N concentrations. Baseflow P concentrations were low and increased in only one experimental watershed. The data suggest that in some cases, the addition of sufficient BMPs can improve water quality; however, the changes in water quality were small and will not make substantial contributions to the Bay Program's goals.

Rebecca Fox is an Associate Professor of Environmental Science and Studies at Washington College in Chestertown MD, and she is currently serving as Chair of the department. She has worked at Washington College for the past nine years. Rebecca did her PhD and then a post doc at the University of Maryland Center for Environmental Science's Horn Point Laboratory.

MEMORIES OF THE SOILS: ASSESSMENT OF POST-RESTORATION FLOODPLAINS AND NITROGEN REMOVAL EFFECTIVENESS

Joe Galella; University of Delaware; Josephgalella@gmail.com

Coauthors: Joseph G Galella, University of Delaware; Shreeram Inamdar, University of Delaware; Md Moklesur Rahman, University of Delaware; Alexis M Yaculak, University of Delaware; Marc Peipoch, Stroud Water Research Center.

Stream and floodplain restoration has been a growing industry in the Mid-Atlantic for the past 20 Years. However, limited long-term monitoring of those restorations has been conducted. Soil and water samples were collected from 15 stream restorations 1 to 22 years post restoration. The majority of restorations followed the principles of Natural Channel Design and were located in Maryland and Virginia. Replicate soil samples were collected in restored and unrestored reaches at each restoration. Results indicated increasing soil moisture, organic matter, organic carbon and microbial denitrification rates with restoration age at restored sties. Bulk density decreased with restoration age (likely recovering from restoration induced compaction) but not to a significant degree. 15N concentrations decreased with restoration age at restored sites possibly due to organic N accumulation from plant matter. As post-restoration monitoring is often compulsory for planned stream restorations this research will help guide project design choices and what factors can best be correlated with restoration goals.

Joe Galella earned his undergraduate degree in geology from Franklin and Marshall College in 2011, his masters in geoenvironmental studies from Shippensburg University in 2016, and his PhD in Geology at the University of Maryland College park in 2023. He is currently a post-doc at the University of Delaware studying post-stream restoration floodplain soils under Shreeram Inamdar.

PCBS IN FISH AND WATER IN MD: LONG TERM AND SPATIAL TRENDS

Upal Ghosh; University of Maryland Baltimore County; ugosh@umbc.edu

Coauthor: Nathalie Lombard, UMBC

Several waterbodies of Maryland continue to be impacted by PCBs with elevated concentration in fish tissue leading to numerous consumption advisories. Multiple PCB TMDLs in MD have been approved by the EPA with the objective of restoring the fishing designated use of the waterbodies. In collaboration with local government and federal agencies, UMBC has performed long-term monitoring of PCBs in fish, shellfish, water, and sediments across MD and DC. This presentation will first provide historical trends of PCBs in fish caught in MD waters over the last 2 decades. While some regions show decreasing concentrations over the years, many waterbodies close to Baltimore show little change of PCBs in fish. In collaboration with local agencies, we also performed spatial sampling of PCBs in water and sediments in several impacted waterways (Back River, Curtis Creek/Bay, Anacostia River) to begin identifying sources of PCBs. The PCB levels measured in the water column of those waterbodies will be reported and compared to PCB concentration in fish. Our work is helping identify PCB sources across MD and DC, refine the conceptual model of the impacted waterbodies, and beginning to control the sources.

Dr. Upal Ghosh is a professor in the department of Chemical, Biochemical, and Environmental Engineering at the University of Maryland Baltimore County. His group performs research in environmental engineering and science with a focus on the fate, effects, and remediation of toxic pollutants in the environment. They use multidisciplinary tools to investigate exposure and bioavailability of organic and metal contaminants to organisms and apply the new understanding to develop novel approaches for risk assessment and remediation. His work has been published in the leading journals in the field and the technology development has led to several US patents and commercialized technologies.

MARYLAND'S PCB SOURCE TRACKDOWN STUDY IN LOWER BEAVERDAM CREEK

Elisabeth Green; Maryland Department of the Environment; elisabeth.green@maryland.gov

Polychlorinated biphenyl compounds (PCBs) have been identified as the primary drivers of fish consumption advisories in the tidal Anacostia River. Since 2019, the Maryland Department of the Environment (MDE) has been conducting stream-based investigations of potential PCB sources in the Lower Beaverdam Creek (LBC) watershed, one of five tributaries of the Anacostia River. Through a variety of different monitoring techniques, MDE has identified two potential PCB source areas in LBC. One area, adjacent to an industrial area where development took place in the 1960s and 1970s, has outfalls that discharge to LBC with elevated concentrations of PCBs in sediment and stormwater. Work is ongoing to narrow down potential sources that contribute PCBs to these outfalls. The other PCB source area identified in LBC is a metal-recycling facility that straddles LBC just above the Anacostia River confluence. The facility completed site-wide characterization to develop a conceptual site model for PCB fate and transport, showing that process water and process material are elevated in PCBs compared to other media. MDE will use this information to guide future remediation at the site, with the ultimate goal of reducing or eliminating the on-going load of PCBs to LBC. Ongoing monitoring throughout LBC will track reductions in PCB loads to the creek and ultimately the tidal Anacostia River.

Dr. Elisabeth Green is a geologist and Remedial Project Manager in the Federal Facilities Installation Restoration Program at MDE. Elisabeth completed graduate work at the University of California, Berkeley studying low-temperature aqueous geochemistry before joining MDE in 2008. Since joining MDE, she has specialized in CERCLA remediation at federal facilities throughout Maryland, as well as ongoing work related to the fate and transport of historic and emerging contaminants across the state.

WATER QUALITY MONITORING FOR CLEAN WATER ACT ENFORCEMENT AT WASTEWATER TREATMENT PLANTS

Angela Haren; Chesapeake Legal Alliance; angela@chesapeakelegal.org

Earlier this month, Blue Water Baltimore, Maryland Department of the Environment, and Baltimore City announced a historic agreement to bring Maryland's two largest wastewater treatment plants back into compliance with federal and state water pollution control laws. In 2021, pollution violations at the facilities far exceeded all of the other wastewater treatment plants in the state, combined. The amount of pollution was so vast it jeopardized the state's ability to reach nutrient reductions under the Bay TMDL. As the lead attorney representing Blue Water Baltimore in this matter, Angela will discuss the unique role that water quality monitoring played throughout the enforcement action and how it helped to secure positive outcomes for reinvestment back into the communities that suffered the brunt of the pollution as well as new public notifications to protect public health.

Angela Haren is a Senior Attorney at Chesapeake Legal Alliance (CLA), a nonprofit dedicated to providing free legal services to protect the Chesapeake Bay watershed. Her role is to develop innovative strategies with partners and communities to address the worst sources of Bay pollution. Angela represents nonprofits in citizen suit enforcement actions under the Clean Water Act, including the landmark case against Baltimore City for violations of the state's two largest wastewater treatment plants. Angela has nearly two decades of non-profit experience and prior to joining CLA, she was the Baltimore Harbor Waterkeeper and directed advocacy, enforcement, and water quality monitoring programs.

MARYLAND AGRICULTURE'S APPROACH TO 2025 TMDL GOALS AND BEYOND

Elizabeth Hoffman; Maryland Department of Agriculture; elizabeth.hoffman@maryland.gov

Conservation is a cornerstone of the agricultural community in the state of Maryland where our farmers have been early adopters of practices that protect water quality as well as promote healthy soils, from conservation tillage to planting cover crops. Those efforts provided the foundation upon which the most recent phase of the Watershed Implementation Plan was developed – a locally driven approach that aimed to provide a workable plan based on the progress to date and new opportunities on the horizon. The Maryland Department of Agriculture brought together key stakeholders - farmers, industry leaders, technical assistance providers, and conservation partners - to discuss what had been learned along the way, address the navigation of known barriers, and highlight any potential collaborations and room for growth. New programs and partnerships are among some of the key tools being utilized in the current plan. Progress is steady and we are hopeful that by having built upon proven strategies as well as expanded our approach, our current framework will help us reach our goals during this next push in bay restoration efforts – reaching 2025, and beyond.

Elizabeth Hoffman serves as the Evaluation and Reporting Coordinator for WIP Initiatives within Program Planning & Evaluation at the Maryland Department of Agriculture. She manages the tracking and reporting of data across their Resource Conservation programs – providing data analysis to support their programs, as well as 23 soil conservation districts, in planning efforts related to TMDL goals and BMP implementation through tracking progress and highlighting additional needs. She also supervises the Field Assessment Team as they work to provide field level data related to conservation practices and resource needs on farms across the state.

GRASSROOTS EFFORTS TO RESTORE SOUTHERN MARYLAND WATERSHEDS

Mary Hoover; American Chestnut Land Trust; mary@acltweb.org

Coauthor: Ron Klauda, Friends of Hunting Creek

While top-down efforts to restore the Chesapeake Bay have been aggressively pursued for many decades, there is an enduring need for bottom-up approaches as well. The American Chestnut Land Trust (ACLT) and more recently the Southern Maryland Conservation Alliance (SMCA) have begun to address this need, hoping to implement grassroots watershed restoration in all major Southern Maryland watersheds. Because data is necessary to inform restoration, ACLT and SMCA have been facilitating a water quality monitoring program in several of Calvert County's largest watersheds for the past few years. In 2023, the program extended beyond Calvert, including efforts in St Mary's, Prince George's, and Anne Arundel counties. This presentation will explore ACLT and SMCA's water testing efforts, highlighting the initiatives shown by the Friends of Hunting Creek to expand water testing and advocacy in their watershed, namely through macroinvertebrate surveys and the recent use of eDNA technology. It will also touch on ACLT's nascent efforts to use the new Chesapeake Healthy Watershed Assessment data in the development of a Parkers Creek Report Card.

Mary Hoover graduated from Creighton University with a BS in Environmental Science. She worked with the American Chestnut Land Trust as a Chesapeake Conservation Corps intern. After working with the Southern Maryland Conservation Alliance as an intern, Mary was hired to coordinate the Alliance.

Ron Klauda has a BS degree in Zoology from Western Michigan University plus MS and PhD degrees in Biology from Penn State University. He retired in 2014 from the Maryland DNR. Ron serves on the Board of Directors for ACLT and on the Board of Trustees for the Cove Point Natural Heritage Trust. He helped organize the Friends of Hunting Creek in 2019 and is Co-Chair of their Water Monitoring Committee.

USING MBSS DATA TO IMPROVE OUR UNDERSTANDING OF FISH SPECIES OF GREATEST CONSERVATION NEED: STRIPED SHINER AND GLASSY DARTER

Tomas Ivasauskas; Maryland Department of Natural Resources Resource Assessment Service; tomas.ivasauskas@maryland.gov

Coauthor: Gregory Mathews, Maryland Department of Natural Resources Resource Assessment Service

We used historical sets of MBSS data to investigate Striped Shiner and Glassy Darter, listed in Maryland as In Need of Conservation and Threatened, respectively. We describe their geographic distributions within Maryland, summarize abiotic variables for sites where they are present and at watershed scales, examine the relationships between presence and absence of each species with relevant variables, examine presence and absence at sites that were resampled, and analyze co-occurrence with other fish species and benthic macroinvertebrate taxa. Striped Shiner was geographically restricted to the Casselman River watershed, within the Youghiogheny basin. It was observed most frequently and in the highest abundances in the mainstem of the Casselman River and its largest tributaries. Glassy Darter's historical records often coincide with significant urban corridors, stressing the importance of a strong riparian buffer. Within their ranges, Striped Shiner and Glassy Darter each co-occurred significantly with other fish species of greatest conservation concern, emphasizing the broad importance of promoting healthy ecosystems.

Tomas Ivasauskas joined Maryland DNR in 2017. He is integral in data collection, database management, and data analysis. His hobbies include keeping and maintaining a small collection of poison dart frogs and their terrariums. Gregory Mathews is a more recent addition to Maryland DNR, having joined as a natural resources biologist in 2022 after stints with the University of Kansas and then West Virginia's Fisheries.

THE IMPORTANCE OF PRE-RESTORATION MONITORING: DESIGNING THE MONITORING STUDY AT EMORY WATERS NATURE PRESERVE

Zoe Jarvis; University of Maryland, Jug Bay Wetlands Sanctuary; zoejessicajarvis@gmail.com

This presentation highlights the significance of pre-restoration monitoring in assessing the success of future stream restoration projects, using geomorphic data collected at Emory Waters Nature Preserve as an example. It showcases a variety of surveying methods (e.g., total suspended solids, cross-sectional surveys, water chemistry measurements, etc.) that can be used with limited time and resources. The presentation's main objective is to demonstrate how and why these methods were chosen and how they will be used to evaluate the success of the future restoration project.

No bio submitted.

MD TEMPERATURE TMDL DEVELOPMENT

Anna Kasko; Maryland Department of the Environment; anna.kasko@maryland.gov

Coauthors: Guido Yactayo, MDE; Jonathan Leiman, MDE

Water temperature exerts a major influence on the biological activity, growth and reproductive behaviors of the aquatic life assemblage of a particular river, stream, creek or lake, and it is influenced by human-driven alterations to hydrologic regimes. In Maryland, Use Class III waters are those considered appropriate for coldwater assemblages, including brook, brown, and rainbow trout. Coldwater streams may also support temperature-sensitive species of stoneflies, such as Tallaperla and Sweltsa. Thermal pollution alters the quality of coldwater resources and is detrimental to coldwater fisheries. State water quality modeling, both process-based and statistical, quantifies the reductions in point and nonpoint source thermal loads and increases in riparian forest buffers acreage needed to achieve and maintain water quality standards. In this presentation we provide an overview of Maryland temperature TMDL methodology, watershed prioritization, implementation strategies, and overall challenges in addressing thermal pollution.

Anna Kasko is a Senior Regulatory and Compliance Engineer at the Maryland Department of the Environment. For almost 20 years, she has been involved in the development of TMDLs, including sediment, nutrient, trash, and most recently temperature. The development of temperature TMDLs at MDE began in 2018. Temperature TMDLs are is especially important now due to the impacts of climate change.

She has a bachelor's in Chemical Engineering from New Jersey Institute of Technology and a master's in Environmental Engineering from Johns Hopkins university. She has worked at MDE since 2005 in the TMDL development program.

RESTORATION OF MASONVILLE COVE FROM AN ILLEGAL DUMP TO AN URBAN WILDLIFE REFUGE

Jessica Keicher; Maryland Environmental Service; jkeicher@menv.com

The Masonville Dredged Material Containment Facility (DMCF) is located four miles upstream of the Francis Scott Key Bridge and approximately one mile downstream of the Hanover Street Bridge. To compensate for the impact of construction of the DMCF a list of 20 mitigation projects were developed. Eleven out of the 20 mitigation projects focus on clean up and restoration to the adjacent Masonville Cove site. The Masonville Cove site historically had been undeveloped but was utilized for unauthorized dumping and fill activities. The site's soils were found to have elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and priority pollutant list metals. The restoration efforts at Masonville Cove resulted in approximately 52 acres of preserved wildlife habitat in the middle of Baltimore City and includes tidal wetlands, nontidal wetlands, terrestrial habitat, and 2,000 reef balls placed throughout the Cove. The presentation will discuss the ongoing efforts to monitor and maintain this urban oasis.

Jessica Keicher has eleven years of experience working for Maryland Environmental Service on the Masonville Dredged Material Containment Facility (DMCF) and the adjacent Masonville Cove in support of Maryland Port Administration. Her first six years included developing and implementing monitoring plans to ensure compliance with the various environmental requirements associated with the site's regulatory program as enforced by the Maryland Board of Public Works, Maryland Department of the Environment, Maryland Department of Natural Resources, and U.S. Army Corps of Engineers. She continues to oversee the onsite monitoring and to coordinate with the regulators on the site's development.

POTENTIAL BENEFITS OF POND REMOVAL FOR TROUT CONSERVATION AND RESTORATION IN MARYLAND

Zachary A. Kelly; USGS Eastern Ecological Science Center; zkelly@usgs.gov

Coauthors: Karli M. Rogers, USGS Eastern Ecological Science Center; Nathaniel P. Hitt, USGS Eastern Ecological Science Center

Management of headwater ponds is a high priority for trout conservation and restoration in the Chesapeake Bay watershed. We evaluated the thermal effects of Frank Bentz Memorial pond in Big Hunting Creek, Maryland, and explored the potential effects of pond removal on thermal habitat suitability for trout. Temperature surveys included 13 sites (3 upstream and 10 downstream from the pond) during 4 days in July 2023 at 15-minute increments. The pond increased mean downstream temperatures by approximately 1.9 C and exceeded a physiological thermal threshold for brook trout (20 C) in downstream sites. Fish community surveys further demonstrated increased density of brown trout above the pond than below the pond in Big Hunting Creek. Our results indicate removal of the pond could decrease mean downstream temperatures, but additional riparian restoration may be required to achieve thermal habitat suitability for brook trout.

Zachary Kelly is a Biological Technician at the USGS Eastern Ecological Science Center in West Virginia. He has supported research investigating thermal biology of fishes, groundwater-surface water interactions, fisheries restoration, and climate change.

PFAS IN MARYLAND'S COMMUNITY WATER SYSTEMS

Diana Kremer; Maryland Department of the Environment; diana.kremer@maryland.gov

In September 2020, MDE's Water Supply Program (WSP) initiated its multi-phased PFAS in Public Water System (PWS) study to better understand the occurrence of PFAS in state public drinking water sources. It was determined that community water systems (CWS) were at the highest risk of long-term exposure; therefore, the PWS study began by focusing on CWSs. In Maryland approximately 5.4 million individuals, representing 89% of the state population, are served by CWSs. During phases 1-3, every CWS that supplies its own water to its customers was sampled. Phase 4 was used to evaluate and confirm the occurrence of PFAS in the drinking water of CWSs that had previous detections of PFOA and PFOS during Phases 1-3. This talk will go into details about these Phases and how the WSP is using this data to help CWSs address their PFAS issues prior to the finalization and implementation of the EPA's proposed PFAS regulations.

Diana Kremer is the lead for PFAS in public drinking water for the Water Supply Program at the Maryland Department of the Environment. She has worked in the Water Supply Program at MDE for 8 years. Previously she worked in the private sector completing site investigations and groundwater remediation. She has a BS in Environmental Science from the University of Delaware and has a certificate in Geospatial Applications.

A PRELIMINARY ASSESSMENT OF DRINKING WELL WATER QUALITY ON FARMS IN MARYLAND

Andrew Lazur; University of Maryland (UMD) Extension; lazur@umd.edu

Coauthors: Cameron Smith, UMD School of Public Health; Rebecca Patterson, UMD School of Public Health; Alan Leslie, UMD Agricultural Experiment Station; Benjamin Beale, UMD Extension; Kelly Nichols, UMD Extension; Shannon Dill, UMD Extension; Sarah Hirsh, UMD Extension; Jeff Semler, UMD Extension; Andrew Kness, UMD Extension; Emily Healey, UMD School of Public Health; Jack Keane, UMD School of Public Health; Marina Costa, UMD School of Public Health; Julie Yang, UMD School of Public Health; Raul Cruz-Cano, Indiana University School of Public Health, Rachel Goldstein, UMD School of Public Health

In 1974 the Safe Drinking Water Act was passed to improve drinking water quality and set a limit for acceptable contaminant levels as provided by the U.S. Environmental Protection Agency (EPA). However, the EPA does not regulate or monitor the drinking water quality of private wells. EPA estimates that over 23 million households in the U.S. obtain drinking water from private wells, including those on farms. The possible presence of contaminants in private wells poses a public health risk. With a NE SARE grant our team collected 86 water samples from farms with private wells located in seven regions across 20 Maryland counties. Water samples for total coliform bacteria, Escherichia coli, and a subset of samples for heavy metals, and 29 pesticides. We also determined the impact of well conditions, location, precipitation, and ambient temperature on the presence of bacteria and chemicals in well water. Our preliminary results found that 41% and 9% of sampled wells were positive for total coliforms and E. coli respectively. 6% of water samples exceeded the arsenic and nitrate maximum contaminant levels (MCLs). No other MCLs for chemicals were exceeded, however 31% of water samples exceeded EPA recommended limits on sodium. Arsenic, sodium, and bacteria findings varied by region. Pesticides were not detected. These findings emphasize the importance of private well water testing.

Andy Lazur is a Statewide Water Quality Specialist with the University of Maryland Extension focusing on drinking water quality, private wells, groundwater protection, septic systems, and pond management education. His work is applied and collaborative in nature working directly with varied stakeholders to identify and solve issues.

Cameron Smith is a doctoral student in the Environmental Health Sciences program at the University of Maryland School of Public Health, Maryland Institute of Applied Environmental Health where she works as a graduate assistant at the Water Quality, Outreach, and Wellness Laboratory.

A POWER ANALYSIS TOOL IN R TO ENHANCE MONITORING STUDIES

Dong Liang; University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory; dliang@umces.edu

Coauthors: Lora Harris UMCES CBL, Solange Filoso UMCES CBL, Joshua Thompson, Anne Arundel County Department of Public Works.

The effectiveness of Best Management Practices (BMP) to achieve their intended ecosystem effects varies, which makes it difficult to link watershed restoration activities to reduced loads of nutrients and sediment to the Bay. We are developing an R tool to guide BMP monitoring studies and enhance restoration research. High frequency and stream restoration monitoring data collected by previous efforts were used to develop the package using commonly used monitoring and sampling designs. The software tool was co-developed by practitioners, scientists, and modelers. Statistical modeling results can inform monitoring designs and efforts required to quantify the load reduction from restoring urban watersheds.

Dr. Dong Liang is an Associate Research professor of statistics at the University of Maryland Center for Environmental Science with expertise in spatial statistics applied to address environmental questions. He has provided sampling design consultations regarding urban BMP effectiveness monitoring and others.

THERMAL EVALUATION OF UPLAND STORMWATER BMPS - IMPACT OF DESIGN MODIFICATIONS TO BUFFER STREAM TEMPERATURES IN URBANIZED WATERSHEDS

Byron Madigan; Carroll County Government; bmadigan@carrollcountymd.gov

Thermal pollution from urbanization and ponding of water in stormwater management facilities is a known detriment to the biological functionality of streams. Section 502(6) of the Clean Water Act considers heat as a pollutant, and temperature continues to be a focus of the category 5 listings within MDE's integrated report. Currently, typical stormwater retrofit designs address nutrient and sediment inputs, but do not necessarily include design elements that address thermal impacts, which likely increase stream temperatures during warmer months. Carroll County consists primarily of Use III and IV streams, and to generate a better understanding of what capacity specific BMPs have on reducing thermal impacts to the receiving waters, studies were initiated that looked at the efficacy of these practices at reducing thermal impacts to our waterways. Long-term monitoring was set up at a large sand filter BMP to understand how dry facilities buffered stormwater temperatures from pavement to tailwater. Additionally, an ongoing paired BMP study is comparing a traditional bottom release wet pond with one that incorporated a "gravel lens" around the dewatering pipe. Ideally, the "gravel lens" will provide better temperature buffering, reducing the thermal impact to receiving waterways than that of traditional bottom release wet ponds.

Byron has been with Carroll County's Bureau of Resource Management for the last 15 years and has overseen the groundwater, surface water and MS4 monitoring programs and requirements for the past 10 years as the Water Resources Supervisor for the Bureau's Water Resources Division. Byron has been an MWMC Board of Director since 2016 and recently assumed the role as Chairman of the Board's Monitoring and Assessment Subcommittee. Byron lives just outside of Catoctin Mountain Park and enjoys trail running with his Yellow Lab Bella, as well as rock climbing, paddleboarding, and snowboarding with his daughter.

PFAS: ONGOING EFFORTS WITHIN THE TOXIC CONTAMINANT WORKGROUP OF THE CHESAPEAKE BAY PROGRAM PARTNERSHIP

Emily H. Majcher; USGS MD-DE-DC Water Science Center; emajcher@usgs.gov

Coauthor: Greg Allen, USEPA Chesapeake Bay Program Office

One of the ten goals of the Chesapeake Bay (CB) Program Partnership is to reduce the effects of toxic contaminants in the CB, which includes emerging contaminants such as per- and polyfluoroalkyl substances (PFAS). Progress towards this goal is through efforts of the Toxic Contaminant Workgroup (TCW). PFAS have widespread occurrence, and may pose risks to fish, wildlife, and human health including potential biomagnification through the food web. Jurisdictions in the CB watershed have begun some studies on PFAS primarily related to drinking water, but information about PFAS in the Chesapeake Bay ecosystem remains limited and siloed. The TCW is working to promote knowledge transfer, consistency, and collaboration to improve the understanding of PFAS in the CB watershed. Ongoing workgroup activities to support these needs include 1) integration of PFAS studies into our Research Management Strategy, 2) Sponsorship of and reporting from a workshop that identified key science needs and recommendations, 3) Quarterly PFAS-focused TCW meetings on priority topics identified by our members, and 4) Compilation and assessment of ongoing monitoring efforts watershed-wide. The TCW is striving to keep pace with the rapid evolution of PFAS-related science and policy by providing a forum to pool resources, streamline methods and approaches, and share study findings in the CB watershed.

Emily is a hydrologist and licensed engineer working at the MD-DE-DC Water Science Center of the USGS in Baltimore, Maryland. She has more than 20 years of experience investigating the occurrence and fate, including PFAS in stormwater and wastewater, and developing approaches to remediate contaminants in various environmental media. She is currently the co-chair of the Toxic Contaminant Workgroup of the Chesapeake Bay Program Partnership and leads the workgroup efforts related to PFAS.

TARGETING AND RESTORATION EFFORTS - WHERE TO START?

Sarah McDonald; U.S. Geological Survey Chesapeake Bay Program Office; smcdonald@chesapeakebay.net

Coauthor: Peter Claggett, U.S. Geological Survey Chesapeake Bay Program Office

The Chesapeake Bay Program (CBP) has developed data and tools to identify areas for restoration and conservation. The CBP's targeting portal organizes tools and datasets developed to address program goals such as improving water quality, enhancing habitats, conserving land, and benefiting communities. One tool highlighted in the targeting portal is the Chesapeake Healthy Watersheds Assessment (CHWA) that contains over 100 metrics for 83,628 National Hydrography Dataset (NHD-Plus) catchments to assess current watershed conditions and vulnerability to future degradation. The CHWA features water quality metrics such as total nitrogen, phosphorus, and sediment loads as well as landscape metrics that influence water quality, such as percent impervious and percent forest at the catchment, upstream watershed, and riparian scales. The CHWA is complemented by 54-class, 1-meter resolution Land Use/Land Cover (LULC) for 2013/14 and 2017/18 that can be used to assess the status and trends in landscape condition for the 99,000 square mile, 206-county region within and around the Chesapeake Bay Watershed. The LULC data provide improved understanding of landscape configuration that is needed to target restoration and conservation efforts and can be coupled with data on riparian areas and protected lands to identify tree planting opportunities that provide the greatest environmental benefits.

Sarah McDonald (she/her/hers) is a geographer with the U.S. Geological Survey, located at the Chesapeake Bay Program Office. She is a member of the Chesapeake Bay Program's Geographic Information Systems (GIS) and Land Data teams. She specializes in land change science, including working on the Chesapeake Bay Land Change Model (CBLCM) and assisting the Chesapeake Conservancy to map 1-meter resolution Land Use/Land Cover (LULC) and LULC change for a 99,000 square mile region within and surrounding the Chesapeake Bay watershed. Sarah holds dual Bachelor's degrees in Computer Science and Environment Science and Geography from the University of Maryland, Baltimore County.

RE-VISITING THE NATURAL RESOURCE RESPONSE ON ANNE ARUNDEL COUNTY STREAM AND WETLAND SITES POST-RESTORATION

Erik Michelsen; Anne Arundel County Department of Public Works; pwmich20@aacounty.org

As the pace of stream and wetland restoration has exploded in Maryland and the surrounding region, concerns have been raised by some in the regulatory community, and in the community-at-large, about resource trade offs or losses associated with the work.

Initially focused on the ability of this work to credibly meet sediment and nutrient goals associated with larger regulatory imperatives, many implementation entities - including Anne Arundel County - have expanded their suite of pre- and post-restoration sampling, routinely adding biological metrics to that work.

This presentation will do a deep dive into the restoration-driven changes at two sites in Anne Arundel County, employing a specific approach to restoration - the creation of integrated stream and wetland systems - and discuss the broader implications of that work for the restoration community.

Erik is a Deputy Director for Anne Arundel County's Department of Public Works, heading its Bureau of Watershed Protection and Restoration. He works to facilitate the recovery of the Chesapeake Bay and its tributaries through supporting robust restoration projects and rigorous scientific monitoring efforts, bolstered by diverse stakeholder partnerships. Erik guides the County's efforts to achieve the its clean water obligations under the Municipal Separate Storm Sewer System (MS4) permit and the Chesapeake Bay Total Maximum Daily Load (TMDL). Erik also serves as Anne Arundel County's Senior Environmental Policy Officer.

ENVIRONMENTAL SITE DESIGN- AN ASSESSMENT OF EFFECTIVENESS IN MEETING WATER QUALITY PROTECTION GOALS

Eric Naibert; Montgomery County Dept. of Environmental Protection; eric.naibert@montgomerycountymd.gov

Coauthor: Thomas Jones, Versar, Inc.

The application of Environmental Site Design (ESD) is intended to be a holistic approach that is incorporated into new developments to minimize the effects of stormwater on receiving water quality and stream channel stability. Montgomery County determined that the Clarksburg Premium Outlets (CPO) development site was a good candidate for a case study to monitor the effectiveness of ESD. Elements of ESD were compared to conventional Stormwater Best Management Practices (BMPs) by evaluating the conditions in receiving stream channels and groundwater affected by the treated surfaces in both scenarios. Subsequent to mass-grading and soil compaction, substantial changes to the original site plan required this project to comply with the new ESD goals established by Maryland law. To prevent destabilization, infiltration capability was purposefully omitted from the structural design of the bioretention array within the CPO parking lots. The results from the five-year study show increased hydrological connectivity to surface and groundwater and efficiency in trapping suspended solids and associated pollutants compared to conventional SWM during storm events; however continued stream channel degradation and lack of attenuation of storm flows during precipitation events suggest the ESD practices used here were not adequate to improve, or at least halt declines in stream health.

Eric Naibert, Water Quality Specialist for Montgomery County Maryland, has over 20 years of experience in conducting biological assessments and characterizing stream condition and over 10 years of experience in best management practices monitoring for assessment of success in meeting performance goals.

Thomas Jones, Sr. Project Manager for Versar, Inc., has over 25 years of experience in directing and conducting stream characterization, restoration effectiveness, and BMP efficiency projects in 7 counties in MD and VA. He has managed several monitoring projects in Clarksburg, ranging from specific BMPs to comprehensive assessments.

WSSC WATER'S PROACTIVE HAB MONITORING PROGRAM

Steven Nelson; Washington Suburban Sanitary Commission; steven.nelson@wsscwater.com

Coauthor: Clark Howells, WSSC Water

Proactive monitoring is the foundation of the WSSC Water's multi-barrier approach to the protection of its drinking water resources. As a part of this monitoring effort, a harmful algal bloom (HAB) monitoring program was implemented to alert treatment staff to changes in source water quality and any potential introduction for cyanotoxins to the system. While not a regulatory requirement, this monitoring program was implemented in 2015 to address growing concerns related to HAB's and expanded in 2018 to protect the public from the effects of HABs in the recreational waters managed by WSSC Water.

WSSC Water uses many tools in its monitoring toolbox to assess harmful algal bloom concentrations and to assess the potential for a cyanotoxin release. The ELISA method for total and extracellular Microcystin, LC/MS/MS speciation of microcystin, Anatoxin-a and Cylindrospermopsin are all used to measure cyanotoxin levels. These techniques along with a robust sampling program, initiated by average water temperature within the Patuxent Reservoirs, are combined to assess risk and to optimize/enhance treatment strategies to reduce the impact of HAB's on the drinking water quality for over 1.9 million people served by WSSC Water. This presentation will focus on WSSC Water's approach to HAB monitoring and future program enhancements designed to better protect the public and our system.

Steve Nelson has worked for WSSC Water as an Environmental Scientist since 2009. Steve manages WSSC Water's Reservoir Monitoring Program that includes routine sample collection from three reservoirs along with a harmful algal bloom monitoring component and the collection of high frequency data using vertical profiling systems at the Patuxent Reservoirs. Steve also participates in two source water collaboratives for both of WSSC Water's water sources. Steve earned a Master of Environmental Management degree from Duke University in 1993.

COASTAL MIGRATIONS OF SHARKS AND STINGRAYS

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

Coauthors: Kimberly Richie, Smithsonian Environmental Research Center; Robert Aguilar (PRESENTER), Smithsonian Environmental Research Center; Charles Bangley, Dalhousie University; Mariah Livernois, University of New Hampshire; Nathan Furey, University of New Hampshire

The Chesapeake Bay and adjacent coastal ocean are home to numerous species of sharks and stingrays that are ecologically important and provide opportunities for commercial and recreational fishing. Smithsonian scientists have tagged and tracked several of these species using acoustic telemetry including the Dusky Shark, Smooth Dogfish, and Cownose Ray. Data were obtained from researchers in Atlantic Cooperative Telemetry (ACT) Network and FACT Network, revealing long-distance seasonal migrations. These migrations connect habitats, people, and fishery management jurisdictions from Massachusetts to Florida. Study results to date have indicated the possible need for changes in the timing of a winter shark closure to better protect Dusky Sharks and the need to manage cownose rays cooperatively among the states and federal government as is the case for many other coastal migratory species.

Dr. Matt Ogburn is a Marine Ecologist and Senior Scientist leading the Fisheries Conservation Lab at the Smithsonian Environmental Research Center. His research focuses on the ecology and fisheries of species ranging from sharks and rays to blue crabs, oysters, and river herring. He also serves as the Coordinator of the Atlantic Cooperative Telemetry Network and is a co-founder of the Smithsonian-led Movement of Life Initiative.

MARYLAND PORT ADMINISTRATION FOCUSES ON RESTORATION THROUGH THE BENEFICIAL USE AND INNOVATIVE REUSE PROGRAMS

Amanda Peñafiel; Maryland Port Administration; apenafiel@marylandports.com

Coauthor: Darren Swift, Maryland Port Administration

The Maryland Port Administration (MPA) was established in 1956 with the mission to stimulate the flow of waterborne commerce through the state of Maryland in a manner that benefits the citizens of the State. In support of that mission, the MPA's Office of Harbor Development works to maintain the navigation channels that serve the Port of Baltimore to provide safe passage. This session will provide information on MPA's Innovative Reuse and Beneficial Use Program, which focuses on the management of dredged material from the navigation channels while promoting environmental stewardship to benefit the Chesapeake Bay. The discussion includes the progress MPA has made in developing the Innovative Reuse and Beneficial Use program. Projects to be discussed include the Paul S. Sarbanes Ecosystem Restoration Project at Poplar Island (Poplar Island) in Talbot County Maryland and the Mid-Chesapeake Bay Island Ecosystem Restoration Project located at James and Barren Islands in Dorchester County Maryland. MPA will also highlight several projects that use dredged material in the restoration of green spaces such as parks along a greenway and the results from research and development projects that include concrete shoreline protection devices and more.

Darren Swift and Amanda Peñafiel are employees at the MPA's Office of Harbor Development. Darren worked for SHA for 27 years In the Office of Materials Technology Division. His experience with soils and aggregate led him to MPA where he is the Chief of Innovative Reuse Strategies and Partnerships. He oversees the IR Program including research and development projects. Amanda has supported the Port's dredged material management program for over 17 years. She is a Senior Project Manager overseeing construction projects, permitting, compliance and monitoring at the dredged material containment facilities and restoration sites.

SAWMILL CREEK: EFFECTS OF URBANIZATION ON FISH BIOLOGICAL INTEGRITY AND COMMUNITY STRUCTURE OVER 30 YEARS

Bryan Perry; Anne Arundel County Bureau of Watershed Protection & Restoration; pwperr85@aacounty.org

Coauthor: Janis Markusic, Anne Arundel County, Bureau of Watershed Protection and Restoration

Urbanization is a major environmental concern today, but what effect does the urbanization have on the biological community once the watershed is built out. It could be assumed that continuous exposure to steady levels of urbanization over an extended period would degrade the biological integrity of a stream network to an increasingly poor state. To test this hypothesis a watershed was selected that was sampled after a period of widespread development, Sawmill Creek a stream in northern Anne Arundel County. Using a combination of historical topographic maps and aerial photography it was determined that the Sawmill Creek watershed went through a period of intense development from the 1950s through the 1970s. Since then, much of the remaining undeveloped land has not seen significant alterations. Sawmill Creek was sampled for fish as part of the Maryland Targeted Watershed Project from 1989 to 1995. Data collect during that time period was compared with data collected by Anne Arundel County from 2018 to 2020 to determine what, if any, change in the fish biological integrity and/or community composition occurred between the two sampling periods.

Bryan Perry is an Environmental Scientist and Program Specialist with Anne Arundel County Bureau of Watershed Protection & Restoration. He has Bachelor's Degrees in biology and environmental science from the University of Maryland Baltimore County and a Master's Degree in environmental science from Towson University.

CANCELLED - SHORELINE/WETLAND RESTORATION AND MANAGEMENT FOR WILDLIFE

***Christopher Perry**; Bourn Environmental; cbperry@bournenvironmental.org*

The management of wildlife can be an essential factor to consider in any shoreline or wetland restoration project that should not be overlooked. If the project is going to be a success in the long-term, there has to be an ecological balance for wildlife and water quality.

He is the owner of Bourn Environmental an ecological construction firm in Prince George's County, MD. He was previously an officer in the United States Army and graduated from the Military Academy at West Point.

SOURCE WATER MACROINVERTEBRATES: INDICATORS TO INFER FLOW REGIMES IN TINY HEADWATERS

Greg Pond; U.S. EPA, Region 3; pond.greg@epa.gov

Coauthors: Kelly Krock, US EPA, Region 3; Leah Ettema, US EPA Region 3

Classifying flow regimes of source headwater streams is critical for both scientific and regulatory purposes. These "branches" do not appear on standard maps and local physiographic and climatologic factors can control their origins. Field indicators to determine flow class can include physical, hydrological, and biological measures. We investigated macroinvertebrates in relation to flow duration, catchment and habitat variables within 14 source headwaters (<1 ha) in the Allegheny Plateau over a 19-mo period. Several biological and trait-based metrics could distinguish flow class but few instream physical measures could. Macroinvertebrate metrics and assemblage dispersion responded strongly to gradients of total flow duration and maximum continuous dry duration. Indicator species analyses generated 22 genera and 15 families with affinities to perennial streams. We estimated a flow duration changepoint at 75% (2 indicator families) followed by a sharp increase in richness. Two rapid field-based flow duration methods could distinguish upstream ephemeral sites from flowing sites. Our findings highlight that diverse macroinvertebrate assemblages inhabited extremely small, low-discharge streams in the region, and responded along a gradient of flow duration.

Greg Pond is an aquatic biologist with U.S. EPA, Region 3 in Wheeling, WV and has been a state or federal biologist for 28 years. His duties have ranged from coal mine permit reviewer, fish contaminants analyst, and river and stream researcher. He holds a BS in Ecology from Unity College in Maine and a MS in Biology from Eastern Kentucky University. He has served as the macroinvertebrate expert for EPA Region 3 since 2004, performing bioassessments throughout the Mid-Atlantic for various CWA programs. He assists states in developing/refining bioassessment and stressor identification tools for CWA programs and provides taxonomic training and sample QAQC for state and federal partners.

EXPLORING RECYCLED WATER USE FOR IRRIGATION: A POTENTIAL GROUNDWATER CONSERVATION STRATEGY IN MARYLAND'S COASTAL PLAINS

Azbina Rahman; University of Maryland; azbinar@umd.edu

Coauthors: Masoud Negahban-Azar, University of Maryland; Adel Shirmohammadi, University of Maryland

Although in the mid-Atlantic region of the U.S. agriculture has been rainfed, farmers started to irrigate from confined aquifers in the past couple of decades, because of changes in rainfall patterns and required profitability. To reduce the water stress on the groundwater, our research presents a robust approach utilizing the Soil Water Assessment Tool (SWAT) and agent-based modeling to evaluate the use of recycled water from Waste-Water Treatment Plants (WWTPs) for agricultural irrigation. Our model is integrated into a Diagnostic Decision Support System (DDSS), designed to forecast crop water needs at climatic variabilities. Our investigation compared the total water supply of recycled water and the water requirements of the major crops in different weather scenarios at two watersheds in Coastal Maryland. It is found that the total water supply by the WWTPs can meet the need of crop water requirements during a wet year, and partially meet the water needs during years with average precipitation and dry years by 75% and 40%, respectively. The framework aims to bolster crop yields while conserving groundwater from the confined aquifers. The implementation of this model as a decision support tool provides stakeholders with the capacity to assess the feasibility of using recycled water for supplemental irrigation and to quantify the potential reduction in groundwater extraction.

Dr. Azbina Rahman is a postdoctoral associate at the Department of Environmental Science and Technology. Her research interest focuses on hydrologic and land surface modeling, data assimilation, and water resources management. She received her Ph.D. in environmental engineering from George Mason University. She is currently working with Dr. Masoud Negahban-Azar and Dr. Adel Shirmohammadi to investigate the use of recycled water use for irrigation in the Coastal Plain of Maryland.

REIMAGINE MIDDLE BRANCH: AUTHENTIC COMMUNITY ENGAGEMENT FOR ENVIRONMENTAL JUSTICE

Brad Rogers; South Baltimore Gateway Partnership; brogers@sbgpartnership.org

Reimagine Middle Branch is transforming the Middle Branch of the Patapsco into Baltimore's next great waterfront, with 11 miles of parks and environmental restoration. Achieving these goals in low income minority communities requires particular attention to authentic collaboration and earned trust. This has made RMB, not a capital project with environmental justice elements, but an environmental justice project with capital elements. In this talk, we will share important lessons learned, and strategies for successful and respectful collaboration.

No bio submitted.

REVERSING THE HYDROLOGIC LEGACY OF DISTURBED COMPACTED URBAN SOILS

Stu Schwartz; UMBC; stu_schwartz@umbc.edu

Modern cut-and-fill mass grading and standard landscaping practices leave a pervasive legacy of disturbed compacted urban soil profiles that limit infiltration and vegetation success, and amplify stormwater runoff. Vegetation success and dramatic increases in hydrologic services can be purposefully restored using sustainable grading practices, but current standards and impervious area removal credits offer no incentive to adopt superior sustainable practices. This presentation describes means and methods to reliably restore superior sustainable urban landscapes, as well as the stormwater credit and life cycle cost incentives that can incentivize and institutionalize the standard use of these practices. Disturbed compacted soil profiles represent a significant overlooked hydrologic legacy and a significant opportunity to improve hydrologic design, stormwater management, and restore urban hydrologic function to the urban pervious landscape.

Stu Schwartz is a Senior Research Scientist at CUERE at UMBC. His research focuses on water resources management, green infrastructure, and urban hydrologic science. Before joining UMBC, he directed the Center for Environmental Science Technology and Policy at Cleveland State University; was Associate Director of the Water Resources Research Institute at the University of North Carolina, and Directed the Section for Cooperative Water Supply Operations (COOP) at the Interstate Commission on the Potomac River Basin.

BIOLOGICAL RESPONSE TO STREAM RESTORATION

Mark Southerland; Tetra Tech; mark.southerland@tetratech.com

The history of biological response to stream restoration includes notable successes but many instances of little or no improvement in the resident biological communities. Following stream restoration, both fish and benthic macroinvertebrate communities typically resemble non-restored streams, rather than high-quality streams or stream-wetland complexes. Examples of biological uplift include frogs in stream-wetland complexes, benthic macroinvertebrates where riparian areas have been improved, fish where blockages have been removed, and hyporheic taxa. The factors limiting biological uplift are many and often elusive, given that monitoring is also rare or inadequately designed. Instream habitat is frequently improved without biological uplift because water quality (e.g., temperature, dissolved oxygen, conductivity) remains limiting. Biological outcomes may improve if restorations target sites with single or few stressors that can be remediated. Ultimately, watershed condition (including past land uses) determines uplift potential and should set the expectations for stream restorations. Therefore, the rules for intervention should include (1) avoiding sensitive species and communities, (2) using least invasive approaches first, (3) filling gaps in good landscapes, (4) removing physical barriers, (5) adding missing or diverse habitats, and (6) giving restorations time to mature.

Mark Southerland, Ph.D., is ninja-ecologist at Tetra Tech and was primary author of the EPA national program guidance on biological criteria, lead consultant on the MBSS for Maryland DNR, and consultant to MDE on impaired waters, stressor identification, and TMDL programs. He has helped 18 counties and cities in Maryland, Virginia, Delaware, and South Carolina develop stormwater programs and comply with the Chesapeake Bay and local TMDLs. Mark has chaired or served on the boards of Maryland Water Monitoring Council, Science Council of the Maryland Academy of Sciences, Patapsco Heritage Greenway, Howard County Environmental Sustainability, Howard County Conservancy, and Safe Skies Maryland.

SAVING BIRDS FROM WINDOW COLLISIONS

Mark Southerland; Safe Skies Maryland; mark.t.southerland@gmail.com

One billion birds die every year in the U.S. colliding with building glass. Collisions are a major cause of the 29% decline in birds in the U.S. since 1970. This has severe impacts on the health of watersheds and their biodiversity. Fortunately, ornithologists and architects have identified effective building design features and window treatments that reduce collisions by more than 90%. Both legislative and grass roots efforts are needed to protect the ecosystem of air or bird declines will continue. We will discuss techniques for monitoring bird collisions, recent successes in passing state and local bird safe building laws, as well as retrofitting National Aquarium, Maryland DNR headquarters, nature centers, and private homes.

Mark Southerland has a Ph.D. in ecology and has spent the last 30 years working as a consultant to monitor, assess, and restore ecosystems in the Chesapeake Bay watershed. Mark has also led the Maryland Water Monitoring Main Presenter/ Speaker Bio Council, Patapsco Heritage Greenway, and Howard County Environmental Sustainability Board, while also serving on the Howard County Conservancy Board and Science Council of the Maryland Science Center. He is co-founder of Safe Skies Maryland and was instrumental in passing bills in Howard County and Maryland General Assembly to require bird safe buildings.

THE MARYLAND OBSERVATION WELL NETWORK

Andrew Staley; Maryland Geological Survey, Maryland Department of Natural Resources; andrew.staley@maryland.gov

The Maryland Geological Survey (MGS) partners with the U.S. Geological Survey, Maryland Department of the Environment, and local governments to maintain and operate a network of approximately 475 observation wells across the state. Both water-level and water-quality data have been collected from the network for many decades, contributing to a valuable historical time-series dataset. Data from these wells are critical for both regulatory needs (water appropriation permitting and drought monitoring) and scientific needs (aquifer properties, natural water quality, and groundwater-flow model calibration). Many of the wells used to collect water-level data are valuable long-term data sources (the average age of the wells is 41 years old), but for this reason they are also vulnerable to deterioration or blockage related to their old age and lack of pumping. In recent years, MGS has conducted well integrity testing with funding through the USGS National Groundwater Monitoring Network grant.

Andrew Staley currently serves as the Maryland Geological Survey's Hydrogeology & Hydrology Program Chief. He and his team conduct applied hydrogeology research, primarily focused on the development of hydrogeologic datasets for assessment of the water resources of Maryland. His recent work includes aquifer framework and hydrologic characterization through the collection and analysis of field data such as water levels, hydraulic test data, drill cuttings, cores, and borehole geophysical logs. He also serves on the program board of the National Groundwater Monitoring Network.

AVOIDING NEGATIVE WATER QUALITY EFFECTS IN THE PURSUIT OF SOIL HEALTH

Ken Staver; UND, Wye Research and Education Center; kstaver@umd.edu

Recently a national effort has emerged promoting soil health on agricultural cropland. Maryland has been a leader in promoting soil health and was the second state in the country to pass soil health legislation when the Maryland Healthy Soils Program (House Bill 1063) was passed in 2017. The bill required the Department of Agriculture to provide incentives for practices that contribute to healthy soils. The healthy soils effort was superimposed on the decades long effort to reduce nutrient losses from MD cropland as part of the Chesapeake bay restoration effort. The bay restoration effort has a 2025 deadline for taking the actions necessary to meet nutrient reductions goals. While there is considerable overlap in the water and soil quality efforts, there also are some key points of potential conflict where rigid pursuit of soil health objectives will undermine nutrient reduction efforts. This talk will present field results related to two key soil and water quality practices, tillage and cover crops, where potential conflicts exist, and potential optimization strategies.

Ken Staver has worked at the Wye Research and Education Center since 1984 conducting research on water, nutrient, energy and carbon flows in Coastal Plain watersheds. The focus of his work has been on the development of strategies to minimize negative environmental impacts of agricultural activities while maintaining productivity and enhancing soil and water resources. His current research activities include: 1. assessment of nutrient flow patterns in grain/poultry production systems at field, watershed, and regional scales; 2. assessment of cover crop strategies to reduce phosphorus losses in field drainage and increase climate resiliency of production systems; 3. development of land placement options for sediment dredged from Chesapeake Bay shipping lanes; and; 4. incorporation of research findings into large scale watershed nutrient transport models. He has been actively involved in varying roles as a technical advisor to Maryland state agencies and the US EPA Chesapeake Bay Program to bring research findings into the watershed management process. He also is an owner/operator of a grain farm in the headwaters of the Choptank River watershed where he lives with his family.

ATLANTIC STURGEON RESEARCH ON THE NANTICOKE RIVER

Chuck Stence; Maryland Department of Natural Resources; chuck.stence@maryland.gov

Life history models demonstrate that Atlantic sturgeon recovery is most sensitive to measures that protect and improve spawning and nursery habitats. The recovery potential for the endangered Chesapeake Bay Atlantic sturgeon DPS is ranked "1C" by NMFS, indicating highest recovery priority owing to demographic risk, comprehensive understanding of threats, and the effectiveness of management. Within the Nanticoke River, Atlantic sturgeon spawn in exceptionally small-volume tributaries. These "skinny" waters are more reactive than larger spawning rivers to climate change, invasive species, and shoreline development. Proposed research uses molecular and acoustic technologies to evaluate juvenile occupancy, predation pressure by blue catfish, and spawning run sizes in all parts of the upper Nanticoke River system.

Is a native of Pennsylvania that earned his B. S. degree in Wildlife & Fish Management from Lincoln Memorial University in Tennessee. He accepted a position with Maryland DNR in December 1989 as a Conservation Associate at the Joseph Manning fish hatchery in Waldorf Maryland during the Striped Bass restoration effort. He then relocated to Maryland's Eastern Shore in 1993 to work as a fisheries biologist then later the project leader for the departments Anadromous Restoration project. The project focused not only on American and hickory shad, but a grant funded by the National Marine Fisheries Service permitted for their current research on Atlantic sturgeon in the Nanticoke River.

LONG TIME, NO SEA: BOTTLENOSE DOLPHINS IN CHESAPEAKE BAY

Jamie C. Testa; UMCES Chesapeake Biological Laboratory; JCTesta@umces.edu

Coauthors: Lauren Rodriguez, University of Innsbruck; Amber Fandel, NOAA; Kirsten Silva, UMCES CBL; Ben Colbert, UMCES CBL; Helen Bailey, Blue Wave Consulting

Chesapeake DolphinWatch (ChesapeakeDolphinWatch.org) launched its app in 2017 to engage Bay residents and visitors in a research program studying when dolphins visit Chesapeake Bay and where they go. Since then, the DolphinWatch team has gathered incredible information on dolphin presence, distribution, and behavior in our estuary. In this talk, Project Coordinator Jamie Testa will discuss the research findings from the first 5 years of DolphinWatch, how graduate students at UMCES Chesapeake Biological Laboratory have advanced dolphin research in Chesapeake Bay, and future plans for the project.

Jamie Testa is a Faculty Research Assistant at UMCES' Chesapeake Biological Laboratory. She began working on Chesapeake DolphinWatch in 2017 and now serves as the project coordinator for Chesapeake DolphinWatch. Jamie is also an analyst on the TailWinds project analyzing data from the real-time whale buoy off of Ocean City, Maryland (https://tailwinds.umces.edu/). She has been living and working around Chesapeake Bay since 2005 and recently became a certified Maryland Master Naturalist. She began her work with marine mammals in 2009, when she served as the Marine Mammal and Sea Turtle Stranding Coordinator for MD DNR.

DO ROOTS BIND SOIL? THE COMPLEX ROLE OF RIPARIAN VEGETATION IN BANK STABILITY

Tess Thompson; Biological Systems Engineering, Virginia Tech; tthompson@vt.edu

Coauthors: Daniel Smith, Virginia Tech; Mark Stremler, Virginia Tech; Mark Williams, Virginia Tech; John Seiler, Virginia Tech; W. Cully Hession, Virginia Tech

The role of vegetation in reducing soil erosion by water is frequently attributed to the roots "binding" the soil. However, in addition to providing fiber reinforcement, roots promote the growth of soil microbes and increases in extracellular polymeric substances (EPS), which act as a soil "glue." Additionally, roots extending out of the face of streambanks also affect the hydraulic shear stress. To evaluate the significance and interaction of these different mechanisms, soil treatments were created to represent unamended and organic matter (OM)-amended soil, without roots (bare soil), with synthetic polyester/plastic fibers, or with living roots (Panicum virgatum). Grassed clippings (< 1 mm) were used as the OM additions to increase microbial growth. Erosion rates were tested in a flume and velocity profiles along the flume walls were measured to estimate differences in wall shear stress. Study results showed that roots extending from the streambanks increased near-bank turbulence and shear stress. However, the combination of both synthetic roots and OM-amended soils reduced erosion rates by 86% to 100%; this reduction was identical to the live rooted treatments. This study shows the synergistic relationship between roots and soil microbes can significantly increase soil erosion resistance due to the physical presence of fibers and microbial production of EPS.

Tess Wynn Thompson is an associate professor in biological systems engineering at Virginia Tech. She has degrees in agricultural, civil, and biological systems engineering and worked as an engineer in state government and private consulting. Her research in stream and wetland restoration focuses on the role of vegetation in flow resistance and streambank erosion, mitigating the impacts of urban development on stream systems, and predicting the onset and rate of streambank fluvial erosion. Dr. Thompson teaches university courses in fluvial geomorphology and stream restoration. She currently serves on the Scientific and Technical Advisory Committee (STAC) for the Chesapeake Bay Program.

EFFECTIVENESS OF STORMWATER MANAGEMENT PRACTICES IN PROTECTING STREAM CHANNEL STABILITY

Tess Thompson; Biological Systems Engineering, Virginia Tech; tthompson@vt.edu

Coauthors: David Sample, Biological Systems Engineering, Virginia Tech; Mohammad Al-Smadi, Stantec; Sami Towsif Khan, Biological Systems Engineering, Virginia Tech; Mina Shahed Behrouz, Stantec; Andrew Miller, Geography and Environmental Systems, University of Maryland, Baltimore County; Jon Butcher, TetraTech

The goal of this project was to compare the impacts of different types of stormwater management on watershed hydrology and channel stability under both the current and future climate. Tributary 109 (Trib 109) to Little Seneca Creek near Clarksburg, MD was developed from 2006 to 2017, with impervious cover increasing from 5% to 38%. Both distributed and end-of-pipe stormwater management practices were utilized to minimize stream impacts. Monitoring of precipitation, stream discharge, repeated channel cross sections, and bed particle size started in 2004 and is ongoing. The watershed was modeled using the Storm Water Management Model 5.3 (SWMM) and the Hydrologic Engineering Center River Analysis System 6.3 (HEC-RAS) to simulate changes in watershed hydrology and channel stability, respectively, due to different levels of stormwater management. Study results show that while the stormwater system maintained overall runoff volumes similar to the forested control, the fraction of runoff that occurred as storm flow increased and the maximum flow more than doubled. While implementation of both distributed and storage practices reduced the extent of channel degradation over the 15-yr simulation period, it is anticipated the channel will continue to incise until bedrock is reached. Channel incision is expected to increase as climate change continues.

Tess Wynn Thompson is an associate professor in biological systems engineering at Virginia Tech. She has degrees in agricultural, civil, and biological systems engineering and worked as an engineer in state government and private consulting. Her research in stream and wetland restoration focuses on the role of vegetation in flow resistance and streambank erosion, mitigating the impacts of urban development on stream systems, and predicting the onset and rate of streambank fluvial erosion. Dr. Thompson teaches university courses in fluvial geomorphology and stream restoration. She currently serves on the Scientific and Technical Advisory Committee (STAC) for the Chesapeake Bay Program.

HOW CAN HAB MONITORING SUPPORT DRINKING WATER TREATMENT?

Priscilla To; WSSC Water; priscilla.to@wsscwater.com

WSSC Water has developed experience with Harmful Algal Bloom (HAB) monitoring, response and treatment since 2015. This presentation will provide an overview of drinking water treatment technologies for HABs and algal toxins, and some of the challenges faced in making treatment decisions. With this introduction, you will be more equipped to design your HAB source water monitoring to support drinking water treatment.

Priscilla To is Senior Scientist with WSSC Water. She focuses on WSSC Water's two drinking water treatment plants, providing treatment process and optimization support to meet safe water quality objectives.

AN EVALUATION OF THE IMPACT OF SEASON IN THE EXECUTION OF MULTIMETRIC HABITAT ASSESSMENT APPROACHES IN ANNE ARUNDEL COUNTY, MARYLAND

Christopher J. Victoria; Anne Arundel County Bureau of Watershed Protection and Restoration; pwvict16@aacounty.org

Multimetric habitat assessment methods are commonly used during the execution of biological assessment activities as habitat conditions impact the response of biological communities in wadeable streams and rivers. Many factors impact habitat conditions in stream systems. This talk evaluates one of those factors: the season in which the assessment is performed. The Anne Arundel County Biological Monitoring Program has employed two assessments since its inception in 2004: the US EPA's RBP habitat assessment for low gradient streams and the MBSS's Maryland Physical Habitat Index. For its Round 3 sampling work, Program procedures allowed for these habitat assessments to be performed at all sites in both spring and summer. Some differences were observed between seasons, mostly confined to the individual metrics rather than the overall summed habitat scores. In general, summer scores were lower than scores collected in the spring. However, it is unclear if the differences are meaningful as related to observed biological responses, thus possibly reducing the need to perform particular assessments in particular seasons, as is currently done when using these techniques in Maryland.

Christopher Victoria is an Environmental Scientist in the Anne Arundel County Bureau of Watershed Protection and Restoration. He received his B.S. in biological sciences from Florida State University in 1989. He has approximately 30 years of experience in water quality and watershed assessment work, with both the private and public sector. He currently manages Anne Arundel County's Biological Monitoring Program.

RISING WATER TEMPERATURES IN CHESAPEAKE BAY: RECOMMENDATIONS TO SUPPORT AND ENHANCE MONITORING AND RESEARCH TO ADDRESS IMPACTS TO ECOSYSTEMS

Bruce Vogt; NOAA Chesapeake Bay Office; bruce.vogt@noaa.gov

Coauthors: Jamileh Soueidan, Chesapeake Research Consortium; Julie Reichert-Nguyen, NOAA Chesapeake Bay Office

Tidal water temperatures are rising in the Chesapeake Bay as surface air temperatures increase with global climate change. This leads to various ecosystem impacts, including changes in water quality, habitats (e.g., oyster reefs, seagrasses), and fisheries. The NOAA Chesapeake Bay Office, alongside the Chesapeake Bay Program, supported the identification of management implications and development of recommendations related to monitoring, research, and collective action to address the effects of rising water temperatures on the Bay's ecosystem. Recommendations focused on several interrelated strategies to build resilience to the effects of rising temperatures in tidal waters including, integrating ecosystem-based management, maximizing nature-based, adaptation strategies in the nearshore environment, assessing extreme stressors (e.g., marine heatwaves) on living resources, reducing vulnerabilities through societal response, and preparing for future climate conditions and the associated ecosystem changes through targeted monitoring and communication efforts. This presentation will share recommendations from the Rising Water Temperatures report and provide examples of ongoing work such as marine heatwave analyses, new climate change research, and ecosystem synthesis products related to assessing change in environmental conditions and potential effects on fisheries.

Bruce is with the NOAA Chesapeake Bay Office and holds a Masters degree from the Virginia Institute of Marine Science. He currently works to support and translate science that informs management of living resources. Bruce hails from a small fishing community in Gloucester County, Virginia where he developed a passion for science, marshes and the animals that live in estuaries.

MONITORING WATER POLLUTION WITH DRONE TECHNOLOGY

Brent Walls; Upper Potomac Riverkeeper; brent@potomacriverkeeper.org

The collection of data is an important component in assessing pollution levels in our environment. Water sample collection and testing can also provide evidence of violations to State and Federal pollution control laws. That evidence can then be used to advocate for stopping the violations through state agency involvement or Clean Water Act enforcement actions. This presentation will highlight the use of Drone Technology as an unconventional monitoring tool to gather evidence of water pollution that can be used to advocate for clean water.

Shortly after joining Potomac Riverkeeper, Inc. in 2009, Brent Walls now works as the Upper Potomac Riverkeeper and is responsible for defending the public trust of the rivers and streams in the Upper Potomac by advocating for clean water and ensuring the the virtues of the Clean Water Act are enforced. With an Environmental Science background in fresh water ecology, Brent has brought a valuable scientific perspective to Potomac Riverkeeper since 2009. His experience in water quality sampling has ensured defensible enforcement actions and has been a unique advising asset with local watershed groups. Brent brings expertise in GIS mapping and Drone Technology to PRKN.

THERE'S A NEW TOXIN IN OUR WATERS

Cathy Wazniak; MD DNR; catherine.wazniak@maryland.gov

Coauthors: Chris Luckett, MDE; John McCoy, Columbia Association

Anatoxin, is a potent neurotoxin that until this year has only been found at very low concentrations in Maryland. Anatoxin has been responsible for dog deaths in 18 States. In 2021, the US EPA concluded there was not enough data to recommend an anatoxin threshold. Three cases of elevated anatoxin were detected in 2023. The first was in the non-tidal Potomac River. Reports of taste and odor issues prompted State Agencies to test benthic algal mats in the region. The highest anatoxin level was recorded in benthic mats (>1000 ug/gram of wet weight). This led to a no contact advisory place on this section of the river. State agencies and drinking water facilities implemented toxin testing and no anatoxin was found. Second, anatoxin was detected in Lake Elkhorn in Columbia (max 39 ppb). Since there is no swimming, an animal safety alert was issued and the Columbia Association continued to monitor. Last, a bloom in Hunting Creek Lake led to a no contact advisory issued on the lake for microcystin. Follow up monitoring of the drinking water treatment plant that provides water for park visitors indicated low levels of anatoxin leading to a public health alert (max 0.68 ppb). Implementation of UV radiation and addition of hydrogen peroxide to the water treatment process, in addition to adding fresh water from 3 tanker trucks to the storage tanks, enabled the advisory to be short lived.

Cathy Wazniak manages the Phytoplankton Monitoring and HAB response program for MD DNR. She earned her masters degree with UMD Marine Estuarine and Environmental Sciences program where she studied community metabolism. She was a Sea Grant Knauss Fellow under the Assistant Secretary of the Navy. She has been with the department for 27 years. Chris Lucket is project leader for the fish kills and algal response division with the Maryland Department of the Environment Science Services Division. He has expertise in stream ecology, fish community assessment, benthic ecology, bioaccumulation and phycology. He has over 30 years experience in environmental assessments.

QUANTIFYING THE THERMAL REGIME OF A MARYLAND USE CLASS IV STREAM USING A HIGH-FREQUENCY TEMPERATURE SENSOR NETWORK

Claire Welty; UMBC, Center for Urban Environmental Research and Education; weltyc@umbc.edu

Coauthors: Mary McWilliams, UMBC CUERE; Nick Simeone, UMBC CUERE; John J. Lagrosa IV, UMBC CUERE; Andy Miller, UMBC CUERE and GES

To gain insight into the impacts of stormwater facilities versus land cover on thermal regime of a Use Class IV stream, we have deployed 204 HOBO TidbiT MX 2203 temperature data loggers over all 16 km of daylighted segments of Dead Run in Baltimore County, MD as a case study. Sensor spacing varies between 50 and 100 m, with additional sensors placed ~2 m downstream of every stormwater management facility. Data are recorded every 5 minutes, with data collection having started in December 2021. All downloaded data are stored at UMBC in a relational database. A GIS-based algorithm has been developed to video-animate the data. Video animation dramatically illustrates heat pulses entering and traveling down the stream network during summer storm conditions. Quantitative analysis reveals that the greatest contrast between baseflow temperature and peak runoff temperature is observed at stormwater pipe outfalls draining buried headwater streams, where the drainage system collects hot runoff via street inlets during storms. The stream temperature variability due to storm runoff collapses moving toward the main stem outlet. Contributions to stream thermal load from stormwater management facilities appear to be no greater than that from the abundant outfalls from pipes draining directly connected impervious area. This work has been supported by Chesapeake Bay Trust.

Dr. Claire Welty is Director of the Center for Urban Environmental Research and Education and Professor of Chemical, Biochemical, and Environmental Engineering at University of Maryland, Baltimore County (UMBC). Her research focuses on quantifying the urban water cycle and biogeochemical fluxes at multiple scales, using a combination of mathematical modeling and field observations. She hosts the field headquarters of the Baltimore Ecosystem Study Long-Term Ecological Research project. Dr. Welty is the lead PI on the Urban Critical Zone Cluster in NSF's Critical Zone Collaborative Network and co-PI on the DOE's Baltimore Social-Environmental Collaborative Integrated Field Laboratory.

RESULTS OF FAIRFAX COUNTY'S STREAM RESTORATION MACROINVERTEBRATE STOCKING PILOT STUDY

Jonathan Witt; Fairfax County Watershed Assessment Branch; jonathan.witt@fairfaxcounty.gov

Stream restorations have a poor track record for improving benthic macroinvertebrate communities, but discerning why is difficult given the numerous factors that impact urban streams and changes resulting from restoration. Restocking macroinvertebrates into urban stream restorations allows us to test if upstream source populations are a primary factor that limits biological improvement or if habitat and water quality still limit potential, and whether artificial habitats are optimal for capturing and moving macroinvertebrates between streams. Using a BACI design, Fairfax County (Virginia) ecologists restocked macroinvertebrates into stream restorations between 2017 and 2018 using leaf pack bags. Surveys of benthic macroinvertebrates found small significant improvement in the Fairfax County IBI, percent EPT, percent predators, and percent shredders at stream restorations that were stocked, but these changes were driven by increases in three common, pollution tolerant genera. We also found fewer EPTs, fewer predators, and lower richness in artificial habitats compared to the streams. Stream restorations also tended to be warmer and have higher specific conductance than the donor stream. These results suggest that artificial habitats only moved part of the biological community, and that stocking may benefit urban tolerant taxa that can handle poorer physiochemical conditions.

Jonathan Witt is an ecologist with Fairfax County's (Virginia) Stormwater Planning Division in the Watershed Assessment Branch. His background is in freshwater ecology, urban ecology, and ecological statistics. Before joining the County in 2015, he worked in EPA's Office Research and Development. When not working, he's herding two young children and fighting whatever virus they've brought home from daycare.

USING METABARCODING DATA FOR BIOLOGICAL ASSESSMENT

Lester Yuan; EPA; Yuan.Lester@epa.gov

Environmental DNA provides a new way to identify the biota that are present in a stream, and these data can potentially improve the accuracy and precision of biological assessments. The EPA collected periphyton samples at the continental spatial as a component of the National Rivers and Streams Assessment, and from these samples, extracted metabarcoding data for diatoms. Here, we describe the initial results of analyses to use these data to better understand relationships between the diversity of stream diatoms and different anthropogenic stressors. We also consider methods for using metabarcoding data and diversity endpoints for biological assessment.

Lester Yuan has worked in EPA's Office of Water on nutrient criteria issues for over 10 years. His work focuses on statistical analyses of environmental monitoring data to inform decisions on how best to manage nutrient pollution. Prior to working in the Office of Water, he worked in EPA's Office of Research and Development to develop approaches for identifying causes of biological impairment in streams and rivers.

ASSESSING AND UNDERSTANDING SPATIOTEMPORAL VARIATION IN STABLE HYDROGEN AND OXYGEN ISOTOPE VALUES OF MARYLAND'S RIVERS

Syeda Sadia Ali; Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science; ssali@umces.edu

Coauthors: Lee Cooper, Professor, University of Maryland Center for Environmental Science Chesapeake Biological Laboratory; Keith Eshleman, Professor, University of Maryland Center for Environmental Science Appalachian Laboratory; David Nelson, Professor, University o

We have investigated the stable hydrogen and oxygen isotope composition at 22 non-tidal USGS gaging stations of Maryland streams and rivers over the past year, through cooperative sampling by Maryland Department of Natural Resources personnel. One goal is to obtain baseline isotopic data that can be applied to water resource management, particularly with expected changes in precipitation and runoff in the context of climate change. Samples have been collected both during typical baseflow and high-flow storm events. For the most part, stream samples with δ2H and δ18O values falling on the Global Meteoric Water Line (δ2H=8*δ18O +10) are indicative of relatively little evaporation following precipitation. presumably due to relatively short residence times for surface waters in watersheds. However, results also show seasonal and elevation variations affecting the isotopic values in warmer months and at lower altitudes, which had less negative δ18O values due to increased evaporation at lower elevations and warmer temperatures associated with precipitation. This isotopic variability is potentially of value in the context of understanding changes in water resource use and availability in Maryland's streams and rivers.

INFLUENCE OF HISTORIC AND CURRENT LAND USE PRACTICES ON PCB CONTAMINATION OF SOILS AND STORMWATER SEDIMENTS IN THE CHESAPEAKE BAY WATERSHED

Yongcheng Cao; Department of Civil and Environmental Engineering, University of Maryland, College Park; scao0727@umd.edu

Coauthors: Allen P. Davis, Department of Civil and Environmental Engineering, University of Maryland, College Park; Birthe V. Kjellerup, Department of Civil and Environmental Engineering, University of Maryland, College Park

Polychlorinated biphenyls (PCBs) are a group of chlorinated compounds derived from biphenyl which are classified as persistent organic pollutants (POPs). PCBs were banned in 1976 by the Toxic Substance Control Act in the United States but still can be found in numerous water bodies. Total Maximum Daily Loads (TMDLs) have been developed in many cases. Local soils and roadway sediments may be mobilized in stormwater and may contain attached PCBs. Soils and sediments have been collected from different sites in Maryland, with different land uses and eras of development. Concentrations of 209 PCB congeners are determined and analyzed in these soils and sediments samples by gas chromatography/electron capture detector. Non-legacy PCB 11 has been the most frequently detected congener in stormwater sediments and soils and has been found in yellow road paints. Sediment PCB concentrations will be correlated to land use and era of development. It is expected that industrial land uses and pre-1979 developments will have the highest PCB contaminated soils and sediments, relative to residential land uses and post 2005 developments. Information on PCB concentrations in sediments from different land uses can be used as an estimation of PCB load removal in various stormwater controls. Stormwater control measures can be targeted to land uses with the highest sediment PCB concentrations.

A SIX-YEAR FIELD CASE STUDY: DYNAMICS OF ENHANCED TCE DECHLORINATION

Shih-Huai (Lora) Cheng; University of Maryland, College Park; scheng37@umd.edu

Coauthors: Birthe Kjellerup, University of Maryland, College Park; Alba Torrents, University of Maryland, College Park

Trichloroethylene (TCE) is a chlorinated volatile organic compound widely detected in groundwater. The persistence of TCE and its ability to migrate over long distances often lead to incomplete dechlorination, resulting in an accumulation of intermediate dechlorination products, e.g., cis-dichloroethylene (cDCE) and vinyl chloride (VC). TCE, cDCE, and VC are carcinogenic to humans. To assess potential factors that may influence TCE dechlorination, we analyzed six-year monitoring data from an in-situ bioremediation site facing incomplete dechlorination. The non-parametric Spearman's rank correlation analysis revealed a positive relationship between sulfate levels and concentrations of TCE, cDCE, and VC. The findings suggest that sulfate-reducing bacteria may affect the efficiency of dechlorinating bacteria in breaking down TCE.

PATAPSCO RIVER REPORT CARD: AN ANNUAL EXPLORATION OF WATER QUALITY AND ENVIRONMENTAL STEWARDSHIP

Amanda DeLeo; Patapsco Heritage Greenway; coordinator@patapsco.org

In April of 2021, Patapsco Heritage Greenway began collecting water quality data on the Patapsco River and tributaries. Since that time, PHG has involved scores of community members in regular monitoring of their waterways. This volunteer-assisted monitoring program has expanded to include not only a range of physical and chemical parameters measured twice each month at 11 sites, but also a biannual biological assessment of the macroinvertebrate community. After a year of collection, data were analyzed and coalesced into the first ever Non-Tidal Patapsco River Report Card (2021-2022). Working closely with UMCES/IAN, a report card was designed that conveys the data in a user-friendly format that makes the results accessible to a wide audience. Sharing protocols and quality assurance procedures of the Chesapeake Monitoring Cooperative allows the data to be compared across the region and to be used by state agencies. The report card is not only a source of information for local citizens and decision makers, it is also a source of pride for the volunteer stewards who were integral to its creation and a recruitment tool in itself. Additionally, results from the report card have led to community engagement around the investigation of high conductivity and a Salt Snapshot Event where baseflow levels of chloride in our streams were documented.

NUTRIENT ANALYTICAL SERVICES LABORATORY

Jerry Frank; University of Maryland Center for Environmental Science Chesapeake Biological Laboratory; frank@umces.edu

The Nutrient Analytical Services Laboratory (NASL) is a nationally-accredited laboratory and a national center of excellence in nutrient chemistry. We are part of the University of Maryland Center for Environmental Science Chesapeake Biological Laboratory (UMCES-CBL), located in Solomons Maryland. NASL specializes determining nitrogen, phosphorus, carbon, chlorophyll, and silica concentrations in natural waters, sediments, and the tissues of plants and animals. Utilizing an array of high capacity instrumentation, we employ standard methodologies in spectrophotometry, colorimetry, chromatography, and elemental analysis. NASL is especially suited to analyze samples across wide salinity and concentration ranges, with experience processing samples from oligotrophic lakes to hyper-saline lagoons. NASL maintains a robust quality assurance and quality control (QAQC) program, and demonstrates a commitment to high-quality data production with performance in various cross-calibration and proficiency testing exercises, both within the Chesapeake Bay region and at the national and international levels. NASL is dedicated to providing analytical support to research scientists, and local, state and federal agencies, as well as NGOs and the private sector. We welcome opportunities to provide our services to projects of any scale, from a few samples to large, on-going monitoring programs.

CENTER FOR THE STUDY OF ANTHROPOGENIC CHANGES IN ESTUARINE SYSTEMS (ACES)

Michael Gonsior; UMCES-CBL; gonsior@umces.edu

Coauthors: Andrew Heyes, UMCES-CBL; Carys Mitchelmore, UMCES-CBL

Recognizing the laboratory's long-standing tradition of working on chemicals of environmental concern, a generous gift to the UMCES Chesapeake Biological Laboratory (CBL) from Brian Hochheimer and Marjorie Wax supports the new Center for the Study of Anthropogenic Changes in Estuarine Systems (ACES). New state-of-the art mass spectrometry instruments will enable UMCES scientists to identify new contaminants and assessing their risk to environmental and human health. Initial activities will evaluate the impacts of point sources including wastewater facilities, recreational activities as well as the impact of indirect sources. CBL is inviting state agencies, non-profit organizations, industry and federal agencies, and other stakeholders to discuss contaminants. We envision developing multiple new methods, which will be the task of new postdoctoral research associates at CBL. Some examples for such new methods may include whiteners in effluent, disinfection by-products, algal toxins, and other emerging contaminants of interest to the state, Nation and worldwide. Furthermore, this center will enable us to provide professional development opportunities and train our next generation of scientists through hands on learning graduate courses and certificate programs.

<STUDENT POSTER> THE IMPORTANCE OF PRE-RESTORATION MONITORING: DESIGNING THE MONITORING STUDY AT EMORY WATERS NATURE PRESERVE

Zoe Jarvis, University of Maryland, Jug Bay Wetlands Sanctuary

This poster highlights the significance of pre-restoration monitoring in assessing the success of future stream restoration projects, using geomorphic data collected at Emory Waters Nature Preserve as an example. It showcases a variety of surveying methods (e.g., total suspended solids, cross-sectional surveys, water chemistry measurements, etc.) that can be used with limited time and resources. The poster's main objective is to demonstrate how and why these methods were chosen and how they will be used to evaluate the success of the future restoration project.

A BIOSUSTAINABLE MICROFLUIDIC ELECTROCHEMICAL SENSOR FOR REAL-TIME MONITORING OF NITRATE IN GROUNDWATER AND STREAMS.

Revati Kadolkar; Department of Chemical, Biochemical and Environmental Engineering, University of Maryland Baltimore County (UMBC); Center for Advanced Sensor Technology (CAST), University of Maryland Baltimore County; revatik1@umbc.edu

Coauthors: Sai Kiran Mani, CAST, UMBC; Tithi Prajapati, CAST, UMBC; Preety Ahuja, CAST, UMBC; Mike Tolosa, CAST, UMBC; Mary McWilliams, Center for Urban Environmental Research and Education (CUERE), UMBC; Claire Welty, CUERE, UMBC; Venkatesh Srinivasan, CAST, UMBC; Sanjeev Kumar Ujjain, CAST, UMBC; Govind Rao, CAST, UMBC.

Nitrate contamination of groundwater and streams is prominent in the Chesapeake Bay watershed. Nitrate levels need to be closely monitored, since elevated amounts can lead to deleterious human health and environmental consequences. Many of the existing EPA-certified sensors used for environmental monitoring are expensive, bulky, labor-intensive and require complex electronics. To address these concerns, we have successfully developed a low-cost, wood-based microfluidic electrochemical sensor, which consists of a nitrate-binding nickel complex immobilized on a polyaniline/carbon-based nanocomposite matrix. The sensor has a sensitivity of 2.31±0.09 Ω/(mg/L)/cm2 across a wide concentration range of 0.14 to 23 mg/L of nitrate. It has a lower detection limit of 0.56 mg/L of nitrate and a swift response time of less than 20 seconds. Its performance was consistent over a wide temperature range, and it showed reproducibility over multiple (>100) sensing cycles. In testing stream samples collected from tributaries of the Gwynns Falls watershed in Baltimore County, Maryland, comparable measurements were observed with commercially available optical sensors. These results look promising, while the sensor also offers additional advantages such as cost-effectiveness, biodegradability, and portability.

PRESENCE OF POLYCHLORINATED BIPHENYLS AND PCB TRANSFORMING BACTERIA IN STORMWATER

Birthe V. Kjellerup; University of Maryland; bvk@umd.edu

Coauthors: Siqi Cao, University of Maryland; Allen Davis, University of Maryland

Samples from stormwater bioretention soil and surface stormwater sediment samples were assessed for the presence of polychlorinated biphenyls (PCBs) and biotransformation activity potential. Abundance of putative organohalide-respiring bacteria was studied in these samples using DNA based methods. The concentration of PCBs in soil and stormwater was determined after solvent extraction and GC-ECD analyses. Concentrations of 209 PCB congeners in the bioretention soil were determined and the results showed that the total PCB concentration ranged from 38.4 ± 2.3 ng/g at the top layer of the inlet soil to 11.6 ± 1.2 ng/g at 20–30 cm depths 3 m away from the inlet. Bacterial groups that can perform anaerobic organohalide-respiration were detected together with bacteria containing the genes encoding for biphenyl 2,3-dioxygenase (bphA) or 2,3-dihydroxybiphenyl 1,2-dioxygenase (bphC), which can perform aerobic degradation and complete mineralization of PCBs. These results show that bacteria capable of PCB transformation are present and active in the bioretention soil.

CITY AND NEIGHBORHOOD SCALE WASTEWATER-BASED EPIDEMIOLOGY MONITORING AND MODELING OF SARS-CoV-2, INFLUENZA A, AND RSV IN MARYLAND

Yuzhu Mao; University of Maryland, College Park; yuzhu@umd.edu

Coauthor: Birthe Kjellerup, University of Maryland, College Park

Wastewater-based epidemiology is a cost-effective and unbiased tool that can provide warnings about viral spread before large-scale outbreaks. However, most research was conducted at large-scale wastewater systems, and the modeling analysis was conducted during high infection rates with accurate clinical data. Therefore, the goal of this study was to compare PMMoV concentrations in different sizes of sewer systems; analyze the concentration of SARS-CoV-2, RAV, and IAV in wastewater; and develop a time-series model to estimate case counts pre and post the global health emergency period. To address these objectives, samples were collected from 5 WWTPs and 5 pumping stations in Montgomery County, concentrated, and analyzed for the presence of viruses by RT-qPCR. The results showed a weak correlation between PMMoV concentrations and served populations. However, significant correlations were found between the concentration of the three viruses and the clinical data respectively in corresponding catchment areas, and PMMoV normalization greatly enhanced the correlation. The VAR model successfully applied and predicted clinical data using wastewater data after the CDC stopped the emergency for SARS-CoV-2. These findings provide a better understanding of the real clinical situation and offer a reference for neighborhood-scale research, with important implications for public health.

QUANTIFYING HIGH-FREQUENCY STREAM WATER QUALITY ALONG AN URBAN-TO-RURAL GRADIENT

Mary McWilliams; UMBC/CUERE; mmcwill1@umbc.edu

Coauthors: Claire Welty, UMBC; Jon Duncan, Penn State; Peter Groffman, CUNY; and John Lagrosa, UMBC

The Baltimore Ecosystem Study has been collecting weekly stream chemistry grab samples since 1998 along an urban-to-rural gradient in Baltimore, MD. Co-location of data collection points with USGS stream gaging stations allows computation of mass fluxes and loads. As a complement to this work, we recently installed sensor stations at the same sites consisting of YSI EXO2 sondes outfitted with temperature, specific conductance, turbidity, dissolved oxygen, and pH sensors collecting data at a 5-minute interval. In addition, we will soon be deploying s::can v3 Spectro::lysers measure nitrate-nitrogen and dissolved organic carbon at a 15-minute interval. This high-frequency data enables investigations of storm event-scale responses of water quality including consistency in water quality patterns across storms, improved quantification of storm contributions to annual loads, and contributions of groundwater to storm flow. Event-scale response analysis is increasingly important with climate change that is delivering more intense storms. This project is part of the new initiative, the "Baltimore Social-Environmental Collaborative", one of a network of DOE-funded Integrated Field Laboratories.

MONITORING IMPACTS OF SUBURBAN DEVELOPMENT ON STREAM HEALTH IN THE CLARKSBURG SPECIAL PROTECTION AREA, MARYLAND

Marina Metes; U.S. Geological Survey; mmetes@usgs.gov

Coauthors: Kristina Hopkins, U.S. Geological Survey; Aditi Bhaskar, University of Colorado Boulder; Rosemary Fanelli, U.S. Geological Survey; Natalie C. Hall, U.S. Geological Survey; Daniel Jones, U.S. Geological Survey; Charles Stillwell, U.S. Geological Survey; Brianna Williams, U.S. Geological Survey; Sean Woznicki, Grand Valley State University

Long-term monitoring in the Clarksburg Special Protection Area (CSPA) in Clarksburg, MD provides a rare example of data spanning before, during, and after the conversion of an agricultural landscape to suburban development with a high density of stormwater management practices. For the last 20 years, streamflow, water quality, geomorphology, and benthic communities were monitored in five small watersheds (< 4 sq. km) in the CSPA. Monitoring design consisted of a forested control, an urban control with centralized stormwater controls, and three suburban treatment watersheds featuring a high density of distributed infiltration-focused stormwater controls. Distributed stormwater controls were associated with decreased runoff volumes and peak flows, and increased baseflow compared to pre-development. Water quality changes after development varied, with declines in baseflow nitrate concentrations but increases in specific conductance. Substantial topographic change occurred during construction in the treatment watersheds, including within protected riparian areas. Ecological monitoring indicated benthic biotic integrity scores rebounded after development in some cases, but sensitive benthic macroinvertebrate families did not fully recover. While distributed stormwater controls can be beneficial, results of this study indicate they cannot eliminate the effects of all urban stressors.

EVALUATION OF INTERNAL SOURCES OF NUTRIENTS IN MARYLAND RESERVOIRS EXPERIENCING HARMFUL ALGAL BLOOMS

Andrea Pain; UMCES Horn Point; apain@umces.edu

Coauthors: Jeff Cornwell, UMCES Horn Point; Mike Owens, UMCES Horn Point

Harmful algal blooms (HABs) occur in Maryland reservoirs and negatively impact water quality, lake ecosystems, and the use of water bodies for recreational use. HABs result from high nutrient loading (nitrogen; N, and phosphorus; P) that support large populations of cyanobacteria such as Microcystis and may fueled by internal nutrient loading from remineralized sediments. Our study objective is to determine the magnitude and controls of internal nutrient sources to three Maryland reservoirs: Clopper Lake, Lake Habeeb, and Hunting Creek Lake. We will evaluate seasonal differences in water column nutrient concentrations in addition to sediment sources of nutrients through incubation experiments. Preliminary data from Clopper Lake suggest that remineralized benthic water was a source of P to surface waters in August and September of 2023 and may contribute to HAB development. Continued assessments of water and sediment chemistry into 2024 will allow us to evaluate the role of internal nutrient loading in HAB dynamics that will improve our ability to understand HAB-induced water quality degradation in Maryland reservoirs.

IMPROVING FRESHWATER MUSSEL PROPAGATION WITH NITRIFYING BACTERIA

Katherine Philipp; Maryland Department of Natural Resources; katherine.philipp@cornell.edu

Coauthors: Matthew Ashton, Maryland Department of Natural Resources; Zachary Taylor, Maryland Department of Natural Resources

Freshwater mussels engineer aquatic environments by filtering water, creating habitat, and altering the surrounding sediment. They are the most imperiled group of animals in North America and their populations in Maryland are reduced. To tackle this issue, the Maryland Department of Natural Resources (MDNR) has begun a mussel propagation program to restock habitat that has recovered. Mussels are sensitive to elevated ammonia concentrations, especially as juveniles. High mortality in hatchery culture is often associated with elevated ammonia levels. I will test if applying commercially available nitrifying bacteria to hatchery culture will reduce ammonia by oxidizing it to nitrite and therefore increase growth and survival rates of juvenile mussels. To test this, I will treat two experimental groups of juvenile mussels with nitrifying bacteria and culture them in upwellers with sediment and without. I will measure growth and survival rates in treatment and control groups. I predict that survival and growth will be highest when juvenile mussels are cultured in sediment dosed with nitrifying bacteria because the sediment may support bacterial colonization. If application of nitrifying bacteria to the culture system is associated with increased growth and/or survival, MDNR's mussel propagation efforts could be greatly improved by increasing the number of mussels they can stock.

A NEW TOOL TO EMPOWER CITIZEN SCIENTISTS AND STUDENTS IN WATER QUALITY RESEARCH

Dietrich Ruehlmann; GaiaXus LLC; dietrich@gaiaxus.com

Coauthors: Abigail Koelsch, GaiaXus; Lee Brindel, GaiaXus

Engaging students in environmental STEM (eSTEM) education programs is fundamental nationwide, integrating traditional STEM topics within their local communities. Field-based eSTEM, as a pedagogical approach, enhances student engagement, improves learning outcomes, and fosters STEM career interest. GaiaXus, funded by the US Department of Education, has developed a novel water quality monitoring system tailored for STEM education and citizen science involvement. This system comprises a newly designed sensor platform, amalgamating the precision of scientific probes with consumer electronics' user-friendliness. A secure mobile app provides teacher-controlled context, securely storing results in the cloud, mapped with ESRI ArcGIS. Rigorous testing, including formal (IRB) studies and informal demonstrations, confirms its modernity and accuracy, raising awareness of water quality in environmental STEM education. Phase II now involves redesign based on community feedback, teacher and student experiences, and the incorporation of new features, encouraging collaborative testing within the DMV region to revolutionize water quality monitoring.

CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS AT THE UMCES CHESAPEAKE BIOLOGICAL LABORATORY (CBL)

Johan Schijf; UMCES/Chesapeake Biological Laboratory; schijf@umces.edu

Coauthors: The CBL Biogeochemistry Group

The CBL biogeochemistry group, Nutrient Analytical Services Laboratory (NASL), and new center for the study of Anthropogenic Changes in Estuarine Systems (ACES) have instrumentation to conduct measurements on a wide variety of environmental samples, comprising freshwater, seawater, hypersaline brines, solids, (nano)particles, and atmospheric gases. We will highlight some of our advanced capabilities in elemental, nutrient, and isotope analysis; organic and gas mass spectrometry and chromatography; electrochemical titration, spectrophotometry, and colorimetry; and solid sample digestion. Our particular specialties include concentrations and speciation of technology-critical elements, mercury, and other (ultra)trace metals; characterization of complex organic compound mixtures; stable isotope analysis of H, O, C, and N; concentrations and isotopic ratios of methane and other greenhouse gases; analysis and interpretation of geochemical records of climate change; identification and stability of organic and inorganic metal-ligand and metal-particle complexes; and broad-spectrum analysis of water quality parameters. Methodologies can be tailored for individual applications and are available to external users by prior arrangement. Although routine analyses can be accommodated, our primary focus is on more challenging samples and novel method development.

CHESAPEAKE BAY WATER WATCH: CITIZEN SCIENTISTS ENABLING SATELLITE REMOTE SENSING OF WATER QUALITY

Tara Sill; Smithsonian Environmental Research Center; sillt@si.edu

Coauthors: Shelby Brown, Smithsonian Environmental Research Center; Patrick Neale, Smithsonian Environmental Research Center; Alison Cawood, Smithsonian Environmental Research Center; Maria Tzortziou, The City University of New York; Jieun Park, The City University

Water quality monitoring programs employ a variety of indicators to track ecosystem conditions. However, certain regions in the Chesapeake Bay lack comprehensive coverage. While satellite remote sensing provides a valuable synoptic monitoring tool, in-situ measurements are needed for algorithm validation. The Chesapeake Water Watch project leverages the efforts of citizen scientists who use smartphone apps and basic instruments to gather data for comparison with satellite images, focusing on variations in tidal tributaries. Expanding from Anne Arundel Co in the pilot phase 2021-22, to all the N. Bay in the implementation phase 2022-23, we have validated citizen science approaches to measuring Chl a, colored dissolved organic matter and turbidity, and improved satellite remote sensing of the same. While project observations are establishing a climatology of conditions in the tributaries, citizen scientists also occasionally encounter anomalous data the causes of which need further exploration. The project implementation phase will continue through 2025 and we are now recruiting volunteers to expand the project throughout the Chesapeake Bay.

VISUALIZING THERMAL FLUCTUATIONS MEASURED BY A HIGH FREQUENCY SENSOR NETWORK IN A MARYLAND USE CLASS IV STREAM

Nick Simeone; UMBC/CUERE and GES; wn95497@umbc.edu

Coauthors: John J. Lagrosa IV, UMBC; Claire Welty, UMBC; Mary McWilliams, UMBC; and Andrew J. Miller, UMBC

The aim of this research is to create an automated process that generates maps and video animations to display spatial and temporal variability in temperature throughout a stream network from collected sensor data. We are using Dead Run in Baltimore County, MD as a test bed, where 204 temperature sensors have been deployed for over 18 months recording data every 5 minutes, periodically downloaded, and data stored in a relational database. Stream temperature data were pulled from specified time intervals and brought into ArcGIS Pro to display spatial temperature distributions for each time step. Using raster data created through Inverse Distance Weighting, stream temperature sensor data were interpolated along tributaries and displayed using a RGB color scale. An automated process coded with Python allowed for a large number of maps to be produced, each representing a timestamp between specified time bounds. These maps were then stitched together using video editing software to allow for a fluid transition that makes it easy to visualize the rise and fall of temperature at each location in the drainage network. This video product can help audiences understand the data by providing a striking visual display to highlight the severity of temperature spikes in urban tributaries resulting from summer storms. This work is supported by Chesapeake Bay Trust.

SEPTIC TO SEWER? JUSTICE-FOCUSED STRATEGIES FOR ADDRESSING COASTAL SEPTIC SYSTEM FAILURES UNDER SEA LEVEL RISE AND INCREASED FLOODING

Emily Speierman; University of Maryland, College Park Department of Civil & Environmental Engineering; espeierm@terpmail.umd.edu

Coauthor: Dr. Birthe Kjellerup, University of Maryland, College Park Department of Civil & Environmental Engineering

This study focuses on Maryland's Chesapeake Bay Critical Area, where at least 52,000 septic systems are within 1,000 feet of the Chesapeake Bay's tidal waters. As climate change drives sea level rise, increased flooding, and a rising groundwater table, our coastal communities are at increased risk for septic system failure. Most properties that rely on septic systems for their wastewater treatment also rely on personal wells for their drinking water, increasing the public health risks associated with septic system failure. In this study, well water and soil samples will be collected from residential properties. Well water and soil surrounding the well will be sampled and analyzed for fecal indicators (i.e. E. coli and total coliforms). Soil samples from around the well head will also be analyzed for septic system tracers (i.e. artificial sweeteners) to determine if septic system effluent could be the source of contamination. Additional pathogen analysis will be done of surface-level soil samples from the septic drainage field to gain a better understanding of the public health risks associated with humans having direct contact with failed septic drainage field soils. This study will inform a larger project which aims to develop a reliable model for predicting the rate of septic system failure in Maryland under various climate change scenarios.

<STUDENT POSTER> MICROPLASTICS IN THE PATAPSCO RIVER

Olivia Sunde; McDaniel College; oks0100@mcdaniel.edu

In recent years, microplastics has become ubiquitous and increasingly more of an issue. These are defined by NOAA as any plastic particle less than 5mm in length. Microplastics can travel easily through the ecosystem due to their lightweight. One way that this occurs is runoff into a body of water. Due to this, it is important to identify the amount of microplastics that are entering Maryland's rivers. This study focuses on the upper part of Patapsco River in Maryland that feeds into the Liberty Reservoir. Two locations on the Patapsco River were chosen as data collection sites, one site before the reservoir and the other after to see if the Liberty reservoir was acting as a microplastic sink. The samples were collected on days of rain events and no rain events to see if there was a difference in microplastic composition. It was found that there was a higher amount of microplastics in the water samples on days when rain events occur compared to no rain events. This was found at both collecting sites across all samples taken. Data collected at the site before the reservoir was found to have higher amounts of microplastics compared to the site after the reservoir across all the samples. These results suggest that some of the microplastics are entering the Patapsco River through surface runoff and that the Liberty Reservoir may act as a sink for some microplastics.

<STUDENT POSTER> FILTERING SOLUTIONS: SAND FILTERS VS. WET PONDS IN STORMWATER MANAGMENT

Garrett Tucker; McDaniel College, Carroll County Government; gtucker4mail@gmail.com

The first stormwater management law in Maryland was passed in 1982 and it focused on mitigation of flooding in areas with increased urban development. Since then, the selection of stormwater BMP's has increased immensely; but selecting the appropriate BMP for each situation is also increasingly cumbersome. Therefore, this project examines two of the more popular stormwater BMP's used in Carroll County Maryland: wet ponds and underground sand filtration techniques. Focusing on the topics of cost efficiency, temperature regulation, and depth management, this project aimed to determine which stormwater BMP is best under similar contextual circumstances. Temperature data and depth measurements were collected using Onset HOBO depth loggers, waterproof shuttles, and HOBO software. A water level logger was placed in the outfall stream and an additional logger was tied to a tree to account for changes in barometric pressure. The costing data was estimated using other sources available online. The data analysis determined that, on average, the wet facility produced higher temperature and depth peaks compared to the sand filtration system. Therefore, this project concludes that the underground sand filtration system was more effective at maintaining discharge consistency and regulating outflow temperature during storm events.

PREVENTION AND TREATMENT OF PERSISTENT ORGANIC POLLUTANTS IN STORMWATER AND SEDIMENT

Chen Yuan; University of Maryland; chenyuan5635@gmail.com

Coauthors: Ran Jing, Kristen Croft, Allen P. Davis, Birthe V. Kjellerup, University of Maryland

Polycyclic aromatic hydrocarbons (PAHs) and Polychlorinated biphenyls (PCBs) are toxic, carcinogenic, and teratogenic persistent organic pollutants (POPs). They can enter aquatic systems via stormwater, challenging to manage with conventional stormwater control measures (SCMs), which cannot effectively remove dissolved PAHs and PCBs. This study aims to mitigate PAHs and PCBs' environmental impact by sediment dechlorination using biofilm, enhancing SCM efficiency with a subsequent polishing step, and reduce PAH and PCB accumulation by bioaugmentation. Dechlorination results show that biofilm helps survival of inoculated bacteria in the environment, and both biochar and DF1 biofilm helps improve dechlorination, surpassing controls. The results of polishing treatment showed that all black carbon materials, namely biochar, granular activated carbon (GAC), and regenerated GAC (RAC), were effective to remove dissolved PAHs and PCBs, and RAC have the longest lifetime which > 147 years, and lowest cost <3.79 $/m3·yr-1. Polishing column can effectively improve PAHs and PCBs removal after traditional bioretention. Bioaugmentation of polishing column with Pseudomonas putida and Paraburkholderia xenovorans targets PAHs and PCBs accumulation showed limited biodegradation, which may be caused by the low bioavailability and lack of survival of inoculated bacteria.

Annual Standing Committee Reports

Maryland Water Monitoring Council 2022-2023 Annual Report

This report summarizes MWMC activities from December 2022 through November 17, 2023.

2022 marked the 28th year for the Council. The Board of Directors continued to guide the Council toward its goals and new members provided fresh ideas that helped move the Council forward. The 2022 Annual Conference drew a record 340 attendees. Included were a host of exciting talks and posters and the seventh post-conference social was held at Checkerspot Brewing in Baltimore. Committee work continued in earnest, including some worthy projects and workshops.

Board of Directors

The MWMC Board of Directors continued its work under the leadership of Matt Stover (MDE) and Mat Pajerowski (USGS) serving as Chair and Vice-Chair, respectively. The Board welcomed John Denniston (MDOT), Matt Harper (M-NCPPC), Rupert Rosetti (Octoraro Watershed Association), and Brian Smith (MDNR) to their ranks at the start of 2023. Board member Byron Madigan (Carroll County) has agreed to Chair the Monitoring and Assessment Committee. MWMC Board of Directors information can be found at http://dnr.maryland.gov/streams/Pages/MWMC/BoardofDirectors.aspx.

2022 Annual Conference

The 28th Annual Conference marked a return to the in-person conference! It was again held at the Maritime Institute on December 15 and the gathering was buzzing with excitement. With 340 in attendance, the event's theme was What Are You Drinking? Protecting the Source. An informative plenary session started with a talk by Mike Nardolilli (Executive Director, Interstate Commission on the Potomac River Basin) on efforts to safeguard the Potomac River Basin as a sourcewater supply. Lee Currey (Director, Water and Science Administration, Maryland Department of the Environment) presented on the history, risks, and management of PFAS (per- and polyfluoroalkyl substances) in Maryland. Bruce Michael (MDNR-retired) received the 16th Annual Carl Weber Award for his forty-two years working on and managing various projects that assessed and monitored the health of the Chesapeake Bay and Maryland's waterways. Session topics included water contaminants, restoration strategies, vernal pools, total maximum daily loads (TMDLs), Maryland Biological Stream Survey findings, and environmental justice. Forty-five talks, twenty-four posters (including 5 student posters), and seventeen vendors, sponsors, and "special interest" exhibits all contributed to a diverse and well-rounded agenda.

Workshops

Stream Monitoring Roundtable

The 15th Annual Stream Monitoring Roundtable was virtually on March 15, 2023. About 35 people attended and there were 14 presentations by staff from agencies, consulting firms, academic institutions and NGOs. Andy Becker (KCI) and Mark Trice (MDNR) collaborated to produce an online map of all submitted point data for 2023 monitoring. This map was used to locate areas of overlap and identify potential opportunities for collaboration. The map will be updated annually. For more information about the Roundtable, contact Andy Becker at andy.becker@kci.com.

What's in store for 2024?

2024 will be the 30th year for the Council and this year's annual conference will continue the tradition of offering an excellent opportunity for anyone in the water community to share their research, ideas and contacts. The Conference Planning Committee will commence its planning for the 30th annual conference in February.

The newly-Chaired Monitoring and Assessment Committee will hold their eDNA Workshop on December 8, 2023. They plan to hold another Stream Monitoring Roundtable in February 2024.

Full committee reports can be found elsewhere in this program.

Submitted by Katherine Hanna
MWMC Executive Secretary
November 7, 2023

Maryland Water Monitoring Council Groundwater Committee 2023 Annual Committee Report

Chair
Mat Pajerowski
U.S. Geological Survey MD-DE-DC Water Science Center
5522 Research Park Drive Baltimore, MD 21228
(443) 498-5506
mgpajero@usgs.gov

Co-Chair
Jason Dubow
Maryland Department of Planning
301 West Preston Street Suite 1101 Baltimore, MD 21201
(410) 767-3370
jason.dubow@maryland.gov

Committee Members	Organization
Andrew Staley	Maryland Geological Survey
Kirk Marks	Maryland Geological Survey
John Anthony	Maryland Department of the Environment
Cody Matteson	Maryland Department of Natural Resources
Kate McClure	University of Maryland Sea Grant
Patricia Fenn	Montgomery County Branch-NAACP
John Denniston	Maryland Department of Transportation

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.

2023 Accomplishments:

The groundwater committee met twice in 2023 to provide an overview of *Maryland's Plan to Adapt to Saltwater Intrusion and Salinization*, the legislative requirement to update it by the end of 2024, and to request and discuss needed changes to the Aquifers and Infrastructure chapters of the plan from committee members. The committee also initiated discussions about a new legislative requirement for MDE to conduct a study on long-term funding options for the detailed monitoring and analysis of groundwater resources in Maryland, and PFAS monitoring of groundwater in Maryland.

Submitted by Jason Dubow
November 3, 2023

Maryland Water Monitoring Council Information Management and Communication Committee 2023 Annual Committee Report

Chairperson:

Najma Khokhar
Maryland Department of the Environment
Najma.Khokhar@maryland.gov

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) 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; (3) Promote the use of quality assured procedures for sample collection, data management, analysis and assessment; (4) provide a platform for better communication within Maryland Water Monitoring Council.

Accomplishments:

Our committee had completed two successful meetings through conference calls as scheduled for 2023 with average 15 attendees where we discussed the implementation of the quality assurance protocols for data management for different projects. We invited presenters from different organizations to share their experiences and best practices for quality assurance for their projects.

In addition, the committee is planning to start a webinar series for quality assurance and quality control topics for all MWMC members.

All members agreed to adapt procedural changes as they learned during the meetings for best practice.

Submitted by Najma Khokhar
November 3, 2023

Maryland Water Monitoring Council Monitoring and Assessment Committee 2023 Annual Committee Report

Chair
Byron Madigan
Carroll Co. Government

Co-chair
Michael Williams
University of Maryland

2023 Activities and Accomplishments:

The 15th (mostly) Annual Maryland Stream Monitoring Roundtable took place virtually on March 15, 2023. There were 43 people registered; an exact count of attendees was not taken as people dropped in and out of the virtual meeting throughout the day. There were 14 presentations given about the 'what, where, when' of planned 2023 monitoring. This was a low water mark for the number of registrations and presentations over the last 10 years. Mark Trice (DNR) and Andy Becker (KCI) collaborated to produce an online map of all submitted point data for 2023 monitoring. The roundtable was organized by Andy Becker.

Submitted by Andy Becker
November 8, 2023

Maryland Water Monitoring Council Citizen Science and Community Stewardship Committee 2023 Annual Committee Report

Chair
Jeff Reagan
Green Trust Alliance

Co-chair
Rupert Rossetti
Octoraro Watershed Association

No report submitted.

Maryland Water Monitoring Council Student Committee 2023 Annual Committee Report

Chair
Lindsay DeMarzo
Howard County Office of Community Sustainability

Committee Members	Organization
Tomas Ivasauskas	Maryland Department of Natural Resources
Nancy Roth	TetraTech
Bob Hilderbrand	University of Maryland Center for Environmental Science, Appalachian Laboratory
Jason Dubow	Maryland Department of Planning
Brian Smith	Maryland Department of Natural Resources

The committee hosted the student career chat held during the 2022 conference lunch session which included a panel of experts in a variety of fields providing a short overview of their most influential lessons learned as they built their careers in water quality. Networking activities with the students to build relationships with MWMC members followed the professional panel. The students were very engaged and asked insightful questions. The committee also assisted in providing outreach for the student poster session and in judging.

The committee met several times to discuss opportunities for student involvement and volunteering, as well as the potential for a mentorship program.

In 2023 the student committee will host a lightning round of student talks during the conference to encourage students otherwise intimidated by a full length presentation to share their work in 5 minutes, followed by a Q&A panel session for all the student participants.

Submitted by Lindsay DeMarzo
November 9, 2023

Maryland Water Monitoring Council 2023 Board of Directors

Matt Stover – Board Chair
Maryland Department of the Environment

Mat Pajerowski - Board Vice Chair
United States Geological Survey

Katherine Hanna - Executive Secretary
Maryland Department of Natural Resources

Andy Becker
KCI Technologies, Inc.

Megan Brosh
Baltimore County DEPS

Lindsay DeMarzo
Howard Co. Office of Community Sustainability

John Denniston
Maryland Department of Transportation

Jason Dubow
Maryland Department of Planning

Matt Harper
Maryland – National Capital Park & Planning Commission

Bob Hilderbrand
University of Maryland Center for Environmental Science

Ken Mack
Montgomery Co. Department of Environmental Protection

Byron Madigan
Carroll Co. Bureau of Resource Management

Richard Mitchell
United States Environmental Protection Agency

Jeff Reagan
Green Trust Alliance

Rupert Rossetti
Octoraro Watershed Association

Nancy Roth
Tetra Tech, Inc.

Brian Smith
Maryland Department of Natural Resources

Ken Staver
Univ. of MD Wye Research & Education Center

Chris Victoria
Anne Arundel Dept. of Public Works

Alice Volpitta
Blue Water Baltimore

Michael Williams
University of Maryland College Park