2023 POTOMAC RIVER CONFERENCE: ONE RIVER'S PERSPECTIVE ON A CHANGING CLIMATE

Date: Thursday, September 21, 2023, 8:30 am - 3:30 pm
Location: Fairfax Water, 9600 Ox Road, Lorton, Va.

Agenda with Abstracts

Coffee and Registration (8:30 am)

Session 1: Opening (9:00 am)

Moderator - Michael Nardolilli, ICPRB

- In Memoriam Curtis Dalpra - Michael Nardolilli, ICPRB
- Welcome to Fairfax Water - Jamie Hedges, Fairfax Water
- Welcome to the 2023 Potomac River Conference - Robert Sussman, ICPRB Chair
- Keynote Speaker - Katie Blackman, Potomac Conservancy

Session 2: Trends in the Potomac Basin (9:45 am)

Moderator - Chris Jones, GMU

Background on climate change in the Potomac - Cherie Schultz, ICPRB

Temporal trends in Potomac River fish abundance indicate a changing flow regime - Nathaniel Hitt, USGS

Abstract: Fish species strategies for survival and reproduction are often closely linked to riverine flow regimes. We evaluated fish abundance data from the Potomac River collected from 10 sites over 4 decades to investigate (1) if fish populations were stable, decreasing, or increasing, and (2) to explore the links to temporal trends in river flows. Results revealed significant temporal changes for 13 of 28 species in the analysis (46%), of which 9 species increased and 4 species decreased over time. Temporal changes coincided with increasing peak flows during fish spawning, egg incubation, and larval development periods, suggesting important ecological effects of a changing flow regime in the Potomac River.

Using Cluster Analysis to Detect Changes in Seasonality of Estuarine Water Quality Over Time - Elgin Perry, Consultant to EPA CBP

Abstract: This presentation will present a graphical explanation of the water quality trend models used by the Chesapeake Bay Program and how cluster analysis of the seasonal component of these trend results can be used to detect the systems response to climate change. Examples will be developed using Potomac River water quality parameters including TN, TP, Chlorophyll, Water Clarity, and Dissolved Oxygen.

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Oligotrophication of the Tidal Freshwater Potomac River in a Changing Climate - Dann Sklarew and Chris Jones, GMU

Abstract: Eutrophication impacted the urban tidal freshwater Potomac River throughout the 20th Century. Management since the 1980s contributed to declining nutrient inputs, likely improving water quality. This study examines trajectories of oligotrophication in the Potomac River and factors that have contributed to this recovery.

Prior research examined potential factors affecting ambient Nitrogen, Phosphorus and algal blooms, such as wastewater nutrient loads, a regional ban on P in laundry detergents, and riparian buffer zone protection. Hydrometeorology was an important co-factor.

We apply similar methods to recent data (1997-2022) to assess when and how the ecosystem transitioned – or may transition -- to mesotrophic or oligotrophic states. We also postulate how such a change could affect estuarine Carbon sequestration.

Finally, we consider how rising tides, more punctuated and tropical weather could impact water quality. Appropriately "weatherized" nutrient management may be a viable approach to protecting this aquatic ecosystem from adverse effects of climate change.

CBP Tributary Summaries: Communication tool on water quality changes to inform management decisions - Alex Gunnerson, CRC CBP

Abstract: The Chesapeake Bay Program and its partners compiled tributary basin summaries for 12 major tributaries or tributary groups in the Chesapeake Bay Watershed. These documents summarize and compile the monitoring and research data federal, state, and academic partners do all in one place. They are technical documents made for technical managers within jurisdictions and local watershed organizations to help them answer the overall questions: 1) How tidal water quality changes over time; 2) How factors that drive those changes change over time; and, 3) Current state of the science on connecting change in aquatic conditions to its drivers. The tributary summaries include a suite of monitored tidal water quality parameters (i.e. surface total nitrogen (TN), surface total phosphorus (TP), spring and summer surface chlorophyll a, summer bottom dissolved oxygen (DO) concentrations, and Secchi disk depth) and associated potential drivers to those trends for the time period 1985 – 2018. They will be updated on a rotating basis to provide the up-to-date results that can drive the direction for future management actions. The tributary summaries are available on the Chesapeake Assessment Scenario Tool (CAST), and the CBP is looking to disseminate these documents to managers and planners to use as a tool to measure actual progress and transform the monitoring findings into actionable information. Continuing to track water quality response and investigating influencing factors are important steps to understand water quality patterns and changes in the Bay tributaries.

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Session 3: Regional Resilience (11:15 am)

Moderator - Pam Kenel, Loudoun Water

Climate Change Considerations for MS4 utilities: a District of Columbia case study - Anouk Savineau, LimnoTech and Matt Gallagher, DOEE

This presentation will provide a case study of how one MS4 utility in the Potomac River Basin – the District of Columbia – is assessing and preparing for future climate change conditions. The presentation will include:

- an analysis of predicted climate change impacts on meeting MS4 WLAs and NPDES permit requirements, and the impact on the predicted TMDL attainment timeline;
- an assessment of trends in MS4 outfall, ambient, and flow monitoring data in DC, and nexus to climate change;
- an assessment of what climate change may mean for peak-discharge and volume retention requirements; and,
- a discussion of DC's MS4 program management as seen through the lens of climate change, including discussions related to adaptive management, updating GI design standards, expected funding needs, infrastructure and social resilience, flooding, racial equity, etc.

MD's Forests and New Forest Conservation Legislation - Susan Minnemeyer, Nature Plus

The Maryland Forest Study found the state slowed net forest loss over the past 30 years, but the state is still losing and fragmenting forest, due largely to development in the metropolitan Washington and Baltimore regions. With slowing of forest loss, the study advised the state of the opportunity to reverse loss and achieve net forest gain. Maryland passed the Natural Resources Forest Preservation and Retention Bill (SB 526/HB 723) in April 2023. The new law revises and strengthens the 1991 Forest Conservation Act (FCA), increasing forest conservation and planting requirements for new development. For the first time, Maryland has set a statewide goal to achieve net forest and tree canopy gain and requires each county to achieve no net forest loss. This new law will contribute to state goals to protect water quality, reduce urban heat, provide wildlife habitat, mitigate climate change and support climate resilience.

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Lunch, Posters, and Networking (12:00 pm)

Reflections on Curtis Dalpra will occur during the lunch hour. We invite you to share your thoughts.

Session 4: Government Innovation (1:00 pm)

Moderator - Jeffery Seltzer, DOEE
Christopher Beck (MDE); Erin Garnaas-Holmes (DOEE);
Katherine Rainone (MWCOG); Megan Porta (PA DEP)

Session 5: Implementation (2:00 pm)

Moderator - Steve DeRidder, Berkeley County PSWD

Watershed Forest Management Challenges for Water Supply - Jenny Willoughby, Frederick, MD
Abstract: There is a big push for forest management and increased canopy to help improve water quality throughout the Chesapeake Bay region. But it's not a simple task. There are invasive species, mystery tree syndromes, aggressive user groups, and access issues that must be balanced with the water quality. Most of this work is done with very few resources and aging land managers that are not being replaced by young specialists. This will be a chance to hear from a land manager about the challenges we encounter in the field every day.

Water Quality Modeling and Monitoring in Vulnerable Communities within the Chesapeake Bay Watershed - Leah Staub, Andrew Sekellick, and Tristan Mohs, USGS
Abstract: The conditions that affect public health often disproportionately impact historically neglected and marginalized communities. The social vulnerability index (SVI) is a measure used by the Centers for Disease Control to quantify the factors that increase a community's vulnerability to disasters or environmental hazards. This index can be used alongside an existing SPAtially Referenced Regression On Watershed attributes (SPARROW) water quality model to examine stream health in vulnerable communities within the Chesapeake Bay watershed. For example, areas above the 90th percentile for select SVI factors, including minority status and English proficiency, can be compared with water quality predictions to determine if vulnerable communities are more likely to be exposed to degraded conditions.

Session 6: Closing (2:35 pm)

Michael Nardolilli, ICPRB Executive Director

Information on the poster session is on the following page.

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Poster Session (2:45-3:45 pm)

A New Primary Producer Enters the Tidal Freshwater Potomac: Seasonal Dynamics of the Benthic Cyanobacterium *Microseira (Lyngbya) wollei* - Chris Jones, GMU, and Sam Mohney, GMU
The increased water clarity in the tidal freshwater Potomac, especially in beds of submersed aquatic vegetation (SAV), has allowed an unexpected primary producer community, benthic algae, to develop to high abundances in parts of the river. In particular, the cyanobacterium *Microseira wollei* has annually formed large, coarse mats coating the bottom of SAV beds in certain parts of the river including the tidal Occoquan River in recent years. We report on two years of study including seasonal patterns of biomass dynamics and primary production of *M. wollei* in the tidal Occoquan as well as initial data on toxin and odor production as well as community analysis of the rich epiphyte community hosted by this cyanobacterium.

Assessing the sources of pesticides in the Potomac River Watershed through wastewater reuse modeling - Samuel Miller, USGS, and Daniel Burns, USGS
Abstract: Wastewater treatment plant (WWTP) discharges, although treated and in compliance of existing regulations, can be a continuous source of organic contaminants, including pesticides, to rivers. Because the contributions of individual WWTP discharges are accumulative in surface waters, the amount of wastewater in a given stream segment reflects all upstream discharges. Pesticides can be introduced to WWTPs through down-the-drain sources from households and businesses, including washing and disposal of food, urine/feces, source tap water, and pet treatments. Pesticides are not widely regulated or monitored in surface waters despite their proven acute and chronic ecotoxicological effects in multiple aquatic taxa. An integrated model was developed for the Potomac River watershed to determine the amount of accumulated wastewater (ACCWW) and calculate predicted environmental concentrations (PECs) for 14 contemporary pesticides in each non-tidal National Hydrography Dataset Plus Version 2.1 stream segment. The PECs were compared to measured environmental concentrations (MECs) from 32 stream sites spanning a range of ACCWW and land uses to assess possible landscape sources of pesticides in Potomac River stream waters beyond WWTPs. MECs were characterized by use classes (fungicides, herbicides, and insecticides) and compared to toxicity thresholds to evaluate potential ecotoxicological risk. Agreement between MECs and PECs was strongest for insecticides, followed by fungicides and herbicides. Insecticide PECs made up a greater proportion of MECs, followed by fungicides and herbicides; however, these percentages were generally low, indicating other dominant landscape sources beyond WWTP discharges. Estimated pesticide use in agricultural areas was correlated to herbicides, but not insecticides or fungicides, suggesting dominant sources beyond agriculture for these classes. Cumulative toxicity was generally higher for sites with greater ACCWW and/or located in developed areas. Imidacloprid and fipronil accounted for the majority of toxicity across most of the sites and frequently exceeded chronic aquatic life toxicity benchmarks for freshwater invertebrates. Our model can be used as a screening-level assessment to identify stream segments within the Potomac River watershed that are susceptible to cumulative WWTP discharges and associated risks to aquatic life from contaminants of emerging concern, including contemporary pesticides.

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A Tale of Two Embayments: Interaction of Nutrients, Water Clarity, Phytoplankton, and Submersed Aquatic Vegetation Drives Ecosystem Structure - Chris Jones, GMU
Shallow freshwater ecosystems have been shown to cluster in two foci: phytoplankton-dominated "turbid water" state or a SAV-dominated "clear water" state. Once established a system does not readily change from one state to the other, but significant changes in nutrient loading or in suspended sediment concentrations may lead to a state shift. Data collected on two embayments in the tidal Potomac River over the last 40+ years indicate that each has shifted state: one from turbid water to clear water and visa versa. We look at the factors responsible for the shifts and the impact on other ecosystem components and discuss management implications.

Chemical prioritization of contaminants in the Potomac River - Scott Glaberman, GMU
New approach methodologies are emerging to assess ecological and human health risks of contaminants in environmental matrices. We will present a series of projects we have been conducted looking at pharmaceuticals and personal care products, per and polyfluoroalkyl substances, and pesticides in the Potomac River and other tributaries of the Chesapeake Bay. We especially focus on influences of water treatment, combined sewer overflows, and agriculture on water quality.

Field surveys and comparative parasitology of freshwater native and invasive snails in the Potomac River and its watershed - Amy Fowler, GMU
Exotic freshwater gastropods, and their parasites, have invaded ecosystems through deliberate introductions and/or accidental transfer. We investigated whether Japanese mystery snails, *Heterogen japonica*, experience parasite release in introduced populations. Six locations from Richmond, Virginia to Washington, D.C. were surveyed in 2018 and 2019. A random subset of each snail species encountered was measured, dissected, sexed, and examined for trematode parasites. Brooding embryos were also counted. Populations of *H. japonica* have experienced a genetic bottleneck in the introduced range and were female skewed; brooding females were the largest in size. Trematode diversity was higher in indigenous snails but depended on site, snail sex, and snail species. *Heterogen japonica* had up to 34% prevalence of aspidogastrean trematodes at two sites where they co-occurred with indigenous snails (Elimia virginica). Females infected with aspigodastreans had signficantly fewer broods. Genetic data found two cryptic lineages of aspidogastreans; one was shared between *H. japonica* and *E. virginica*, suggesting host-switching has occurred. Parasites can play powerful roles in interspecific relationships, influence species interactions, and even impact ecosystem functioning. The ability of parasites to host switch could further influence community interactions in this system, particularly if *H. japonica* continues to spread.

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Phenology of Two-horned Water Chestnut (*Trapa bispinosa Roxb. var iinumai Nakano*) in Northern Va. Ponds - Sujata Poudel, GMU, Chris Jones, GMU, and Nancy Rybicki, USGS/GMU
Eurasian water chestnut have plagued the northeastern US, including the tidal Potomac for over 100 years. In 2014, a new variety of water chestnut was identified as two-horned water chestnut (*Trapa bispinosa Roxb. var iinumai Nakano*) in the Potomac River and in subsequent years it has spread to nearby waterbodies. *Trapa* depletes the dissolved oxygen of water , affects the water quality and displaces the native vegetation. To understand its phenology, structured observational studies were conducted at two ponds in northern Virginia in 2019 and 2020. *Trapa* initiated growth in late April, increasing rapidly to a maximum of 100% cover in June. Rosette diameters increased gradually from late April to a maximum in August and September. Flower counts were zero from April through June, then increased rapidly to maximum in late August. Fruit counts were zero from April through June; fruit started to appear in July, and counts increased to a maximum in early September. Since the species is annual and dependent on sexual reproduction, control efforts for *T. bispinosa* should be initiated before fruits are produced. Based upon our data, in the mid-Atlantic region, May would be an ideal time to begin the treatment process for its control.

Potomac Riverkeeper Network's Community Science Water Quality Monitoring Program and Public Health - Morgan Bench and Lisa Wu, Potomac Riverkeeper Network
Potomac Riverkeeper Networks Community Science Water Quality Monitoring Program was formed to fill a gap in water quality reporting to the public in high-use recreation areas along the Potomac River. Now in its 5th year, the program has expanded to more than 30 sites throughout both the upper and lower Potomac River, and the data has been viewed more than 131,700 times on Swim Guide. With outdoor recreation becoming increasingly popular, and the predicted negative impacts of climate change on water quality from increased frequency and severity of storms to rising temperatures, corrosion of infrastructure, and changes in migration along the watershed, it is increasingly important for organizations to share with the public when and where it is safe for primary contact recreation. Learn our latest findings and trends as we monitor the river and build a force of river stewards.

Shifts in the community structure of tidal freshwater fishes associated with alternate stable states - T. Reid Nelson, GMU
Tidal freshwater ecosystems are the most landward reaches of estuaries, providing valuable habitat for fishes, while experiencing multiple environmental stressors. Here, we assessed changes in the community structure of tidal freshwater fishes downstream of Washington DC throughout the last decade at Hunting Creek. Concurrent with a shift in primary producers from a state dominated by submerged aquatic vegetation (SAV, years 1 – 5) to a phytoplankton dominated state (years 6 – 10), the fish community changed from Banded Killifish dominance to one dominated by White Perch. We also found increased abundance of *Alosa sp.*, Gizzard Shad, and Blue Catfish in recent years. Our results mirror the response in Gunston Cove, where decreased nutrient loads resulted in SAV establishment concurrent with increased Banded Killifish and decreased White Perch abundance. These results support alternate stable states, a phytoplankton-dominated turbid water state or a SAV-dominated clear water state with clear differences in fish community structure.

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Short-term risk assessment for a newly introduced water chestnut, *Trapa bispinosa Roxb.*, entering the Potomac River, U.S. - Nancy Rybicki, USGS/GMU

A new species of water chestnut (*Trapa L.*) was discovered in the Potomac River basin in 2014 by USGS and Virginia Department of Wildlife Resources officials. This species was later determined to be two-horned water chestnut (*Trapa bispinosa Roxb.*). By 2021, a total of 75 colonies were verified in lakes and ponds in four counties of northeast Virginia, as well as in Pohick Bay on the tidal Potomac River and on the non-tidal reservoir of the Occoquan River. The *T. bispinosa* distribution map is available on the Nonindigenous Aquatic Species database (nas.er.usgs.gov). An early 20th Century introduction of Eurasian water chestnut (*Trapa natans L.*) in the Potomac River had detrimental impacts to native submerged vegetation and to commercial and recreational boat traffic along the river, and it took several decades and millions of dollars to eradicate the species from the basin. If it becomes established in the Potomac River, this introduction of *T. bispinosa* could be as detrimental as the previous introduction of *T. natans*. Thus, we assessed the short-term risk of *T. bispinosa* entering the Potomac River. We identified three potential vectors for dispersal of *T. bispinosa*: primarily epizoochory on waterfowl plumage, followed by hydrochory into downstream waterways and potentially hitchhiking on recreational boats and boat trailers. We determined the oldest and most centrally located of all the current populations was at Fairfax County Park Authority's Twin Lakes Golf Course. This location in the Lower Bull Run drainage, colonized since 2000, is considered the epicenter and likely source for waterfowl-dispersed introductions to nearby waterbodies. All other known introductions since 2000 were within 30 km from this source and this distance was thus assumed to be the maximum waterfowl dispersal risk radius. We analyzed the distribution of *T. bispinosa* with respect to geospatial parameters within the 30 km dispersal radius including waterbodies and streams from the USGS National Hydrography Dataset, active dams from the USGS National Anthropogenic Barrier Dataset, and public boat launches from Virginia state agencies. We also recognized the colonies that are likely to spread because they are in stream networks without impediments to downstream dispersal of floating plants and more likely to reach the Potomac River. The shortest unimpeded downstream distance from a colony to the Potomac River was 3.6 km in the Nichols Run drainage, with the next shortest distance of 12.3 km in the Cameron Run and Accotink Creek drainages. We located 1,063 waterbodies within 15 km and 3,745 waterbodies within 30 km of the epicenter. These at-risk waterbodies (mostly private ponds) were in one county in Maryland, in seven counties in Virginia, and in the District of Columbia. Twenty public boat launches were within 30 km of the epicenter, of which 18 were on the Occoquan and Potomac Rivers. Our results identify the number and locations of at-risk waterbodies and boat launches that state and local managers can prioritize outreach, management, signage, and monitoring efforts for early detection and rapid response of *T. bispinosa* in the U.S.

Why Viewsheds matter to planning for land use change - Lynn Crump and Jennifer Wampler, Scenic Virginia

Viewsheds create a sense of place and help with emotional and physical health. As the pressures for development, especially along rivers, increase and available land decreases where and how development happens can become a contentious discussion. Often the treasured viewsheds of a place are overlook until the development is well along the track to final design and layout. Identifying those scenic assets early and mapping them helps to provide an understanding of what is valued to localities and reduces the possibility of conflict thus insuring an outcome that highlights and acknowledges treasured views while allowing for development. The NPS and Virginia DCR worked together to map the significant views along the Potomac Heritage national Scenic Trail so future planning will address those views respectfully. Possible outcomes also include creating development policies that consider treasured views and add them early into the planning process.