Chesapeake Community Research Symposium 2024
Session 22: How do we achieve Fishable, Swimmable Urban Waters?

Allyson Kido, Eric Schott

Phytoplankton-Related Ecosystem Services of Bivalves in Baltimore Harbor

Baltimore Harbor, like many urban estuaries, faces challenges related to stormwater runoff. Runoff can lead to algae blooms, and in Baltimore Harbor these blooms are intense and frequent. While mitigation strategies focus on reducing nutrients from point sources, native bivalves provide an unexploited opportunity. Much of the work on ecosystem services of bivalves has focused on commercially important species like oysters, mussels, and clams. In the Chesapeake Bay, oysters can be traded for nutrient credits based on their size at removal. However, these species do not grow well in urban estuaries, so looking toward naturally occurring bivalves could provide an alternative solution. Mytilopsis leucophaeata is a small mussel native to the east coast and grows abundantly in Baltimore Harbor. Our research aims to better understand the potential ecosystem services of these mussels as they pertain to algae reduction. Preliminary lab work showed that M. leucophaeata can reduce cultured algae levels. Our goal was to learn more about how M. leucophaeata phytoplankton uptake responds to changes in temperature and salinity, as well as the mussels' ability to reduce algae levels of natural phytoplankton blooms from Baltimore Harbor. Our results show that the mussels can indeed efficiently reduce the algae levels of natural blooms. Further, temperature appeared to have a significant effect on the clearance rate of the mussels but salinity did not. Using these results, we are working with nutrient credit experts on how to incorporate using native species into nutrient trading credit policies. Our results support the use of the Dark False Mussel for nutrient removal ecosystem services.

Margaret R. Mulholland, Alfonso Macias Tapia, and Peter Bernhardt

Nutrient loading to a lower Chesapeake Bay estuary during tidal flooding: a heretofore unconsidered nutrient load jeopardizing Bay restoration.

Tidal flooding is a recurrent and increasing problem for coastal communities as sea levels continue to rise. While we have a good understanding of the mechanisms that cause tidal flooding, control its intensity, and its frequency, research on the effects of tidal flooding have focused primarily on threats to infrastructure on land. Few studies have examined the biochemical implications of flooding on receiving waters and even more scarce are those that do so with high spatial and temporal resolution. Here we present data from a multi-year (2017-2023) study in which community-based scientists were engaged to collect floodwater samples from an urban catchment during fall perigean spring tides (e.g., a King Tides). More than 150 floodwater samples were collected each year from the Lafayette River, an urban tidal tributary in the lower Chesapeake Bay. Estuarine samples were collected prior to flooding in

each year, to establish estuarine conditions prior to flooding, and from floodwaters to estimate nitrogen and phosphorus loads delivered from tidal flooding. During the King Tides, meteorological conditions varied between years and so flooding extent and intensity also varied. Results demonstrate that while inputs varied interannually, floodwaters were a large source of dissolved nutrients to the estuary. Calculations for individual flooding events showed that inputs of dissolved inorganic nitrogen during tidal flooding could be more than 100% of the annual federal load allocation established for the tributary as part of the EPA's total maximum daily load (TMDL). Results suggest that nutrient concentrations in floodwaters were not well-correlated with the specific land use in this urban, primarily residential sub-tributary of the Chesapeake Bay. Model results suggest that water temperature and water height are good predictors of inundation volume and nitrogen loading and that water temperature and wind speed were good predictors of the phosphorus loading.

Jim Uphoff

Managing expectations for fishable urban Chesapeake Bay waters

Urban fisheries may attract a variety of participants, from subsistence shore anglers to private boat anglers, commercial watermen, and professional guides. Environmental advocates and agencies may have interest as well. Expectations for highly productive fishable urban waters among and within groups may not align with habitat status. Urbanization imposes a myriad of stressors on fish habitat that determine the strength of fisheries supported. Accumulating urban stressors result in a habitat regime shift (passing a tipping point or threshold) from natural conditions too difficult to reverse, alternate stable states that limit fisheries. Limits may be imposed by consumption advisories, unsuccessful reproduction, dependency on migration from other productive areas, and diminishment or absence of key habitats. Urban watersheds stressed by difficult to control non-point pollution started as rural watersheds with productive fisheries that diminished as their watersheds transitioned to urban. Diminished productivity of some subestuary Yellow Perch fisheries has coincided with transition to suburban watersheds. Memories of these fisheries fuel expectations of full restoration that are unrealistic in the face of urban habitat issues that limit productivity. This habitat will support fisheries of a more limited or different nature that reflect habitat limitations. Urban fisheries developed after improvements in water quality in some subestuaries after major point source discharges of sewage and industrial waste were reduced. These locations exhibited a "reverse" regime change from decades of dire conditions. There were few, if any, fishery expectations beforehand. Fisheries such as the Striped Bass fishery in Baltimore and the upper tidal Potomac River Largemouth Bass fishery represent pleasant surprises.

Teresa Rodriguez

Urban Fishing; Connecting Diverse Audiences to Aquatic Resources

Introduction: Many urban environments are located by water bodies that provide the opportunity to introduce new audiences to the natural resources in their community. The District of Columbia

is a prime example of an urban city that is surrounded by water. There are three major water bodies in the District; the Potomac and Anacostia Rivers and Rock Creek. DOEE Fisheries & Wildlife biologists are creating opportunities to educate the public about their aquatic resources through the sport of fishing.

Method: The Wildlife Management Branch of the Fisheries & Wildlife Division manages the Aquatic Resources Education Center (AREC) located in Anacostia Park. The AREC exhibits over 40 species of native, non-native, and invasive species of fish, reptiles, and amphibians. The staff conducts free K-12 field trips, provides professional development workshops for teachers, and teaches community fishing clinics. In 2021, the agency received a stocked fishing trailer donated by the Recreational Boating and Fishing Foundation (RBFF) as part of RBFF's Mobile First Catch program.

Results: From 2021-2023, the AREC biologists conducted 50 Fishing in the District community fishing events for 2,193 participants. Events were conducted at several different locations in the city, including Anacostia Park, Diamond Teague Park, Hains Point, Kingman Island, the Tidal Basin reservoir, the SW Waterfront, the C & O Canal, and Fletchers Cove. Participants included families, school and community groups, fishing clubs, and festival attendees.

Conclusions
The Mobile First Catch trailer allowed the fishing program to reach various locations in the city, thus meeting participants in their neighborhoods to teach them about the wildlife living in the watershed and conservation measures that DOEE is addressing to improve this environment.

Abby Hileman

Keeping It Fresh: The Salt Watch Community Science Initiative

The Izaak Walton League of America launched the Salt Watch program in 2018 with the intention of mobilizing community scientists across the country to monitor chloride levels in their local waterways and to advocate for smarter road salting practices. The League provides free chloride test kits and all the tools and resources to easily take a sample and submit a reading to the national database. The crowdsourced data is accessible to anyone and gives the user access to real-time chloride test results across the country. Since the launch of the program, over 18,000 results have been collected from 32 states. Nationally, data is used by a network of over 50 partners and 500 participating organizations to educate and promote advocacy actions in local communities. Salt Watch also provides bulk kits to community partners and classroom teachers to engage wider audiences and boost data collection capacity.
The League also provides Salt Watch advocacy action resources for volunteers and groups to create change in their communities. Salt Watch monitors have submitted and published news articles, have written letters to the editor, are involved in local and state governments, and have written letters to their representatives. One Salt Watch volunteer has even included information about Salt Watch in a children's book he published about water quality in the Chesapeake Bay. Through expanded knowledge of chloride pollution, Salt Watch can empower volunteers to use

civic engagement strategies to advocate for more sustainable use of road salt in communities nationwide.

Maya Sterett, Maureen Mitchell

Encouraging informed recreation through DC citizen science water quality data

It has been illegal to swim in any of DC's waterways since 1971 due to safety concerns around water quality. This has not stopped the thousands of residents and visitors from participating in other types of water-based recreation, like boating in rivers, and hiking along the streams. With so much recreation around the waterways in DC, it is important to provide accessible and timely water quality data to the public, so they can make informed decisions.

In 2018 the DC Citizen Science Water Quality Monitoring program started with funding from The District of Columbia Department of Energy and Environment (DOEE). The goal of this program is to help track water quality in the District and provide up-to-date, weekly water quality data to residents and visitors. Coordinators from Anacostia Riverkeeper, the Alliance for the Chesapeake Bay, Rock Creek Conservancy, and Nature Forward work together to train volunteer monitors and educate the public on water quality in the Anacostia River, Potomac River, and Rock Creek during peak recreation months, May through September.

Now with five years of data, we can examine trends in *E. coli* bacteria levels, turbidity, pH, and water temperature. We've found three key takeaways: One, heavy rainfall is highly correlated with high levels of bacteria. Two, mainstem river sites have better water quality than streams. Three, effectiveness of the local wastewater infrastructure, affects bacterial load of the local waterways. Improvements to local wastewater infrastructure have been shown to reduce bacteria levels in some areas. Our aim is for the project to serve as a tool for achieving the goal to make all District waterways safe, swimmable, and fishable for people and animals to enjoy.

Dongmei Alvi, Amir Sharifi

Microbial source tracking to improve water quality in Rock Creek River

Significant investments in wastewater treatment, stormwater management, and watershed restoration have consistently enhanced water quality throughout the District of Columbia (DC). Despite these efforts, recent ambient water quality monitoring in Rock Creek River (RCR) and its tributaries have shown chronic levels of E. coli contamination that exceed DC's surface water quality standards. Presently, restrictions are in place prohibiting swimming and wading in the District's waterways due to heightened bacteria levels.
In this study, we implemented a Microbial Source Tracking (MST) study to identify the sources (human and non-human) of bacterial contamination using multiple lines of evidence in RCR. We examined four molecular markers (HF183, Rum2Bac, DG3, and GFD), conducted cultural E. coli testing, and analyzed various physiochemical parameters at three sites along RCR and its tributaries. The objectives were to investigate the sources of bacterial contamination over a

12-month period and assess the efficacy of an advanced digital polymerase chain reaction (dPCR) as a valid method for source tracking. The study consistently identified the presence of elevated E. coli levels across all sites during wet weather conditions. This highlights storm events as a primary contributor to the degradation of water quality.
During base flow conditions, E. coli levels consistently remained below the single sample value (SSV) threshold of 410 MPN/100ml for approximately 50% of the time. This resulted in observed periods lasting six to eight weeks, suggesting conditions suitable for recreation on the River.
Among the four molecular markers tested, HF183 (human-associated marker) was most frequently detected on one of the tributaries. HF183 was identified at elevated levels and with high frequency, appearing in 88% of samples from RCR. This underscores the necessity for additional investigations.
The avian-derived marker GFD showed a moderate to low frequency within the sites located on the River. The ruminant- and dog-specific markers were detected sporadically at all three sites.
Correlation and regression analysis involving E. coli, molecular markers, and physiochemical revealed statistical relevance, particularly in using turbidity and flow as a proxy for rapid assessment of bacterial contamination.

Trevor Needham

Evaluation of high frequency fecal indicator bacteria sampling to forecast swimmable conditions in Urban Waters

The Anacostia River has been closed to recreational swimming since 1971 due to elevated levels of fecal indicating bacteria (FIB) impacting recreational access of nearby historically underserved urban communities. A recent collaboration between the USGS and the Dept. of Energy and the Environment, Washington D.C. has incorporated near-real-time water quality data with high-frequency fecal indicator bacteria (FIB) sampling to identify which parameters best predict water-quality hazards in the Lower Anacostia River. The approach used in this study combined traditional sampling methods and novel in-situ bacteria sampling techniques to develop a better surrogate model to predict FIB levels with 66 different parameters. Multiple logistic regression models identified precipitation, tidal stage, and water quality parameters (turbidity and specific conductance) in select tributaries to be the best predictors of FIB exceeding safe limits. Further investigation into how the tidal cycle influences FIB is planned for the 2024 and 2025 recreational swimming seasons. The approach and outcomes of this study have broad implications for determining swimmability of urban waters throughout the Chesapeake Bay watershed.

Alicia Ritzenthaler, Jonathan Champion, Nicoline Shulterbrandt

MAPS: Making the Anacostia and Potomac Swimmable

The District Department of Energy and Environment (DOEE) has been collecting bacterial water quality data in the Anacostia and Potomac Rivers since the 1970s. In the past 5 years alone there have been over 1600 measurements of E. coli collected in the two rivers between the

months of May and September – when it is typically warm enough for people to consider swimming. These past data can't tell us when or where the water will be suitable for swimming at any specific moment in the future (i.e. water quality varies both temporally and spatially) but it can provide insight into water quality more generally and provide an informed basis for taking next steps towards swimming. Past data indicate that bacterial water quality conditions are not always safe for swimming everywhere but that there have been numerous days at many locations which bacterial water quality conditions may have been suitable for swimming.

DOEE, as the regulatory environmental agency in the District, encourages and supports a variety of projects that contribute to the goal of swimmable waters. As water quality improves, and although swimming in the Anacostia and Potomac Rivers is currently only allowed by special event permit, DOEE is working hard to establish the necessary foundation on which more robust swimming opportunities may be based in the future if/when existing local and federal regulations prohibiting swimming are lifted. In this presentation we will provide context for the unique, legal landscape of swimmability in the District, discuss outstanding scientific needs and the innovative monitoring tools that we're piloting, and share the draft roadmap guiding our activities towards more swimmable District rivers.

Dr. Eric Schott, Allison Blood

This is how we swim in the Baltimore Harbor, this summer.

Urban harbors have tremendous potential to be recreational assets, yet usually cannot meet this potential because of trash and sewage contamination. In 2010, the Waterfront Partnership of Baltimore's Healthy Harbor Initiative convened municipal, business and NGO partners to commit to making the Baltimore Harbor swimmable and fishable.

Through engagement, advocacy, legislation, and research, the water quality in the Baltimore Harbor has dramatically improved. In the last decade, Baltimore City has invested significantly in sewer system repairs and enhancements, WPB installed the innovative "Mr. Trash Wheel" project, and the University of Maryland Center for Environmental Science at the Institute for Marine and Environmental Technology has conducted 5 years of research studies. These studies demonstrated the use of DNA-targeted sewage detection that is more specific than traditional fecal indicator bacteria (FIB) methods and can identify other sources of FIB such as dog waste. Other DNA-based methods enumerated the presence of naturally-occurring Vibrio bacteria. A demonstration project explored the use of DNA-based detection of FIB to enable same-day water quality reports.

This past summer, WPB monitored for FIB 5 days a week at 5 locations. The daily results were highly informative, and showed that stormwater runoff was the main predictor of water exceeding the FIB threshold, and that high FIB dissipated 24-48 hours after a rain event. Based on the daily testing, and knowledge about the link between rainfall and FIB spikes, a pioneering group of Healthy Harbor members jumped into the Inner Harbor. Because of the abundance of

knowledge and data about the water quality, this was not a high-risk activity; instead, it was a data-informed celebration.
We will discuss some research questions that need to be explored and solutions needed to enjoy Baltimore's urban waters as recreational resources for water contact.

Lorena Kowalewski

DC BMP and EJ Screen Analysis

Stormwater best management practices (BMPs) are designed to treat stormwater and reduce pollutant loads to receiving water bodies, but they also provide a variety of additional benefits for local communities. Until recently, the District of Columbia has not taken explicit and measurable steps to account for DEIJ in how stormwater BMPs are distributed throughout the city. In this presentation, local government staff will share preliminary analyses of BMP distribution throughout the city through the lens of EPA's Environmental Justice Screening Tool. Results will inform future efforts to focus BMP implementation in more equitable ways to serve all District residents.

Mary Polacek

Looking for a new approach on resident illicit sanitary connections- The DC Sanitary Sewer Correction Pilot project

The DC Department of Energy and environmental have determined that there are residential properties that have their sanitary lines connected to the storm sewer, results in a constant flow of sewage getting into the Waters of the District. The Watts Branch and Nash Run watershed neighborhoods are EPA identified Environmental Justice communities and correcting these illicit sanitary connections identified during illicit discharge investigations would result in residents facing a heavy financial burden to address discharge issues. A new and innovative approach was needed as prior attempts at engagement have not been successful due to residents' distrust of government agencies and fear of the potentially harsh consequences associated with regulation enforcement. This project's goal is to mutually benefit the residents and the community of Ward 7 by incorporating participatory approaches that create shared ownership and involve the community in the design and implementation of the project. The project has selected a nonprofit organization grantee to act as a liaison and trusted messenger to residents participating in the program. The organization directly engages with DOEE identified residential property owners and work to involve residents in the project activities including selection of the contractor hired to complete the installation of the new sanitary sewer lines. This organization will also provide preventative outreach to educate residents of getting plumbing work properly done in the District. By correcting residential homes lateral sewer lines that are mis-connected to storm sewer the project will be reducing nitrogen, phosphorus, and sediment pollution to the Chesapeake Bay and its tributary rivers and streams.