Proceedings of the 2017 St. Louis River Estuary Summit

St. Louis River Estuary Science Summit 2017
Tuesday, March 14 – Wednesday, March 15
University of Wisconsin – Superior
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The 2017 St. Louis River Estuary Summit continued to show success in bringing people together to share information relevant to the St. Louis River and Lake Superior. Participation included over 224 people registered. Participants were largely from the Twin Ports, but people also attended from throughout Wisconsin and Minnesota, as well as from as far away as New York. This year the Summit included over 60 oral and poster presentations. Also, an evening community talk was held in conjunction with the monthly River Talk series. This event would not be possible without the presenters volunteering to share their work or without the support from event sponsors.

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[1] *UW – Madison/UW – Extension*

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[1] *Lake Superior Research Reserve;* [2] *UW – Superior*

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[1] *ERG (NOAA OCM)*

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[1] *USGS*

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[1] *Fond du Lac Band of Lake Superior Chippewa*

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[1] *US EPA – MED*

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[1] *WI DNR*

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[1] US EPA – MED

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[1] *UMD*

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[1] *NRRI – UMD*

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[1]*NRRI – UMD*

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[1] *US EPA*

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[1] *US EPA*

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[1] *NRRI – UMD*

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[1] *MPCA*

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[1] *Fond du Lac Tribal and Community College*

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[1] *Lake Superior Research Reserve* [2]; *UW – Superior*

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[1] *US EPA*

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[1] *LSRI; UW- Superior*

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[1] *MPCA*

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Joe Graham[1]
[1] *WI DNR*

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Megan Grove[1]
[1] *NOAA*

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Jon Gumtow[1]
[1] *Stantec Consulting*

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Chelsea Hatzenbuhler[1, 2, 3,4]
[1]*ORISE;* [2]*US EPA;* [3] *NHEERI/MED;* [4] *Duluth, MN*

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[1] *MPCA*

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[1] *UW – Superior*

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[1] *US EPA*

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[1]*NRRI – UMD*

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Carol Reschke[1]
[1] *NRRI – UWD*

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[1] *UMD*

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[1] *UW – Superior*

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Molly Wick[1]
[1] *Oak Ridge Institute for Science*

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Emily Wilmoth[1]
[1] *Lake Superior Regional Citizen Science Collaborative (LSRCSC)*

Oral Presentation Abstracts

The Power of Connection: Sparking Creativity and Innovation by Re-Building our Relationship to the St. Louis River

Kris Eilers[1]
[1] *St. Louis River Alliance*

February 14, 2017, 9:50 AM – 10:00 AM

Humans have built their communities next to rivers since time immemorial and understood their integral connection to it for their survival. Over time, many civilizations have become more and more separated from that knowledge, and as a result the rivers and water we rely on for life itself have become degraded. The St. Louis River Estuary is a story of life and hope, of lost connections, and now, of resilience. The St. Louis River Alliance and the partners of the Remedial Action Plan of 2013 have made significant progress to help restore a significantly degraded St. Louis River. The River Communities are beginning to realize the benefits of a cleaner river that is now creating a ripple effect of hope. The SLRA continues its 21-year mission of creating stewards of the River by focusing on relationship-building to each other and to the River. While the River is being restored physically, the SLRA is engaged in propelling the momentum forward by celebrating the story of the river through art, music, on-the-water activities and providing opportunities for people to get involved and work together for a common goal. As these relationships are being restored, we will see land-use changes, innovative approaches to problems we face as a community, and we will see transformation as we come together over a common primal connection to our River, our source of life.

A Community Runs Through It

Molly MacGregor[1]
[1] *MN DNR*

February 14, 2017, 10:00 AM – 10:20 AM

When participants in the 2016 St Louis River Summit identified their roles and described their interactions with the estuary on the 50-year timeline, they were illustrating the community that built and is now implementing the Remedial Action Plan. From its inception, the Great Lakes Water Quality Agreement required that AOCs be collaborations between technical experts on remediation and restoration and the concerned public. Together, experts and the public form the community that runs through each AOC. Without such a community there is no way to gauge the success of BUI removal or AOC delisting in terms of associated social and health benefits. Community interactions are necessary in all stages of the journey to delisting to foster agreements, resolve conflicts, and to mobilize resources necessary to solve pressing environmental challenges. A social network analysis of the timeline responses was used to describe interactions of the community that runs through the SLRE. Self-identified managers and scientists were less likely than citizens and educators to form social networks. When social networks were present they typically included recreation as a major node. This suggests that while interactions among community members and the resource were diverse and widely distributed, a segment of the community remained professionally cloistered. These people clearly make important contributions to the science or management of the estuary, but constrain their further interactions. This may represent some dis-investment in community interactions in the RAP implementation phase compared to RAP formulation phase. Managers are well-advised to sustain, and, if necessary re-engage, the collaborative framework as our work moves forward from today's RAP implementation to tomorrow's management of a restored estuary. The St Louis River Estuary is a unique landscape made more so by the tradition and practice of community engagement.

Designing Sediment Remediation Projects that Account for the Physical and Environmental Condition of Adjacent Structures in the St. Louis River Area of Concern

Chad Scott[1]
[1] *AMI Consulting Engineers*

February 14, 2017, 10:50 AM – 11:10 AM

Assessment of the physical condition and structural design of adjacent structures, are critical to designing a successful sediment remediation project. Hundreds of thousands of cubic yards of clean dredged materials are scheduled for reuse as part of remediation projects in the St. Louis River (SLR) Area of Concern (AOC). One of the challenges of sediment remediation is preventing re-contamination following remediation. Re-contamination can result from erosive forces or releases from ongoing point sources. Ongoing point sources could include storm or sanitary discharges, ongoing industrial activities, or migration of contaminants from adjacent structures Years of heavy industrial use and neglect have left many Duluth-Superior Harbor dock walls and structures in a state of decay or failure. Historic dock wall designs and years of erosion have created underwater voids that can extend well into the fill used to create the pier or structure. This connection between fill of unknown origin with industrial impacts, and the waterway creates a migration pathway for contaminants into the Harbor.

Current pre-remediation assessments for the SLR AOC focus on the identification of legacy contamination within the accessible public water sediments, and do not consider sediments under dock walls or on adjacent lands. While the assessment of dock wall design and integrity, the sampling of sediments beneath dock walls, and the assessment of adjacent soil conditions (sometimes on private land) come with a high degree of complexity; all are imperative to designing a lasting sediment remediation project. A comprehensive engineering and environmental assessment of the adjacent structures, sediment and soil includes: historic plans review, structural assessment, engineer dive inspections, side scan sonar assessments, test pits and soil borings. A remediation design must also consider the potential future land use or changes to the adjacent structure. Only with this degree of assessment will effective and long-term remediation designs be possible.

Are We Ready? Lower St. Louis River Basin Community Climate and Extreme Weather Perceptions and Preparedness: Mixed Methods Study Findings

Vanessa Perry[1]
[1] *UMN – Twin Cities*

February 14, 2017, 11:10 AM – 11:30 AM

From summer of 2015 through fall of 2016 researchers from the Natural Resources Research Institute (NRRI) of Duluth and University of Minnesota (UMN) Twin Cities conducted a mixed methods study funded by Minnesota Sea Grant in the Mission Creek and Miller Creek watersheds of the St. Louis River Basin of Minnesota. Study questions centered on key decision maker perceptions of climate change and extreme weather, and community preparedness for potential future impacts. Social science researchers from UMN conducted 27 interviews and held 2 focus groups. NRRI scientists developed many bio-physical model scenarios depicting a range of potential futures in the watersheds under different conditions.

The models included a range of precipitation scenarios and implementation of various green infrastructure practices. Outputs from the models were used to support conversations with stakeholder participants.

Social science findings suggest that while decision makers largely are aware and concerned about future climate change impacts, there is significant divergence as to community need and ability to respond. Further, there is a great deal of uncertainty as which actions to prioritize and how to apply available data and research to decision making. That said, study participants expressed a strong identity around and value of natural resources and ongoing restoration efforts' perhaps offering a path toward other cohesive community initiatives.
This presentation includes an overview of findings, recommendations for future action, and a discussion of the potential for mixed-methods interdisciplinary research to contribute to addressing biophysical and human dimension problems.

Working Together to Manage Duluth's Urban Watersheds

Jesse Schomberg[1]
[1] *MN Sea Grant*

February 14, 2017, 11:30 AM – 11:50 AM

The State of Minnesota is moving towards a watershed framework for managing water quality. Because the urban watersheds of the Duluth Metropolitan Area share unique development characteristics and are more similar to each other than to the more rural surrounding watersheds, the Minnesota Pollution Control Agency, and UM-Duluth's MN Sea Grant and Natural Resources Research Institute are exploring a process for managing these urban watersheds separately. An advisory committee consisting of representatives from all communities included within these watersheds, as well as other agencies and organizations, was created to inform the watershed process and provide recommendations for ways to manage these watersheds more holistically. Over the past two years, representatives from the 5 townships, 4 cities, St. Louis County, state agencies, and others have met to explore the benefits and drawbacks of different watershed management models for this area, including watershed district, joint powers board, and voluntary cooperation. After in-depth consideration and individual community meetings, a voluntary cooperation model is being pursued and will be developed over the next two years.

Update on NOAA Habitat Focus Area for the St. Louis River

Liz Mountz[1]
[1] *NOAA Office of Coastal Management*

February 14, 2017, 11:50 AM – 12:00 PM

Since 2012, as part of its Habitat Blueprint, NOAA has been identifying Habitat Focus Areas (HFA). These focus areas represent high priority areas for long-term habitat science and conservation, and allow NOAA to maximize the benefits of investments in marine resources and coastal communities within targeted areas. In 2014, NOAA selected the St. Louis River (SLR) estuary as one of two HFAs in NOAA's Great Lakes region. The SLR Implementation Plan was finalized in 2016.

Staff from NOAA's SLR Implementation Plan (IP) Team will present on the team's ongoing activities and current projects, as well as projects planned over the next two to four year period of time.

Through the SLR HFA, NOAA will strengthen and expand its work with partners and local communities, and engage the wide range of offices across NOAA, on these efforts. Science Summit participants will have an opportunity to ask questions of the NOAA IP Team, as well as engage in discussion on partnership opportunities to meet the Plan's objectives throughout the meeting. From summer of 2015 through fall of 2016 researchers from the Natural Resources Research

Integrating Health and Fairness into Duluth's Comprehensive Plan

David Bolgrien[1]
[1] *US EPA – MED*

February 14, 2017, 1:30 PM – 1:40 AM

Cities of the Great Lakes are innovators in comprehensive ecosystem-focused urban planning. Beginning with the Plan of Chicago, comprehensive plans have been expressions of a community's vision for the future, particularly regarding the use of waterfronts. Like Chicago in 1909, Duluth is currently using comprehensive planning (Imagine Duluth 2035) to reclaim its riverfront and estuary for the public good. In addition to traditional issues of land use, transportation, housing, and economic development, Duluth is integrating principles of fairness and health into Imagine Duluth 2035. The challenges are to 1) understand health and fairness as both determinants and outcomes of environmental, social, and economic conditions, and 2) connect health and fairness to the City's sphere of influence. The City has actively sought to meet these challenge with 70 community meetings, 1 public meeting, and 2 surveys (on-line with 4300 responses and in-person by the Health in All Policies Coalition). Results from a structured exercise showed that access was the most frequently used descriptor common to both health and fairness. Access to health care, transportation, housing, and employment were critical common elements that are well established determinants of health. Access to information was more important to fairness than to health. Fairness thrives where communities are empowered to accept information from and provide information to decision making. Access to the environment was more important to health than to fairness. This suggests that people understand and desire the physical and mental health benefits from a clean environment, public green space, recreational amenities, and ecosystem services. Multi-agency remediation, restoration, and revitalization projects in the St. Louis River AOC and corridor can apply the lesson of Imagine Duluth 2035 that fairness and health in a community depend on access to information and a clean environment, respectively.

Decoding Ecosystem Services in the Neighborhood through the Development and Utilization of a Framework

Kathleen Williams[1]
[1] *US EPA Office of Research and Development*

February 14, 2017, 1:40 PM – 2:00 PM

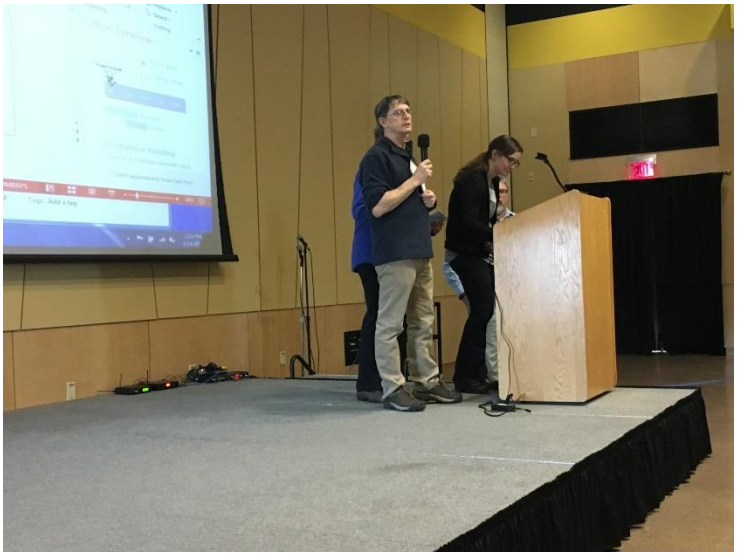
Remediation to Restoration to Revitalization (R2R2R) is a place-based practice that requires ongoing communication amongst agencies, local governments, and citizens. One of the challenges is that each of these entities have different relationships with and responsibilities to sites where R2R2R unfolds. Sediment remediation and habitat restoration project goals, community planning, and lived experiences diverge in scale, focus, and interaction depending on the agency or individual. In order to address this disconnect, we developed a framework to sort and classify data and identify ecosystem services collected through inductive methods like participant observation and document analysis. Data were collected between June 2015 and December 2016 and analyzed through content analysis as a first step. Participant observation was conducted in relation to the City of Duluth St. Louis River Corridor planning process at park planning public meetings, community group meetings, and City of Duluth technical advisory meetings. Document analysis was conducted on a variety of City of Duluth plans. The framework that emerged from the analysis includes neighborhood components that individuals, organizations, and local governments may discuss in the context of their community. The characteristics are a mix of built environment types, structural dimensions, personal experiences, and human-environment relationships and include: parks/open spaces, trails or connections, housing, schools, infrastructure, local businesses, macro-economy, natural features, governmental rules or regulations, demographics/crime statistics/health care facilities, safety, self-determination or participation, identity, social cohesion, sustainability, and aesthetics. We intend this framework to be utilized as a decoder ring to interpret distinct values and facilitate communication or comparison.

St. Louis River AOC Water Quality Data Visualization Tools

Rich Axler[1]
[1] *NRRI – UMD*

February 14, 2017, 2:00 PM – 2:10 PM

As we enhance our ability to assess Great Lakes AOC environmental conditions and consolidate real-time, historical, and modeled data on central Web sites, it is critical that the resulting data ends up in the hands of citizens and decision-makers in a format that is truly accessible, easily interpretable, timely, and relevant. Critical management decisions affecting AOC health are made at the community and local government level as well as at the state and federal level, but data and resources that might improve decision-making are often scattered among a number of widely-distributed, and often difficult to integrate sources. As environmental data collected for the St. Louis River Area of Concern (SLR AOC) continues to increase, lagging behind the data are the user-friendly interfaces and data visualization and assessment tools needed to allow local stakeholders and decision-makers to discern patterns and trends, as well as to simply explore the data to better understand the system. Our project involved 1) compiling and integrating historic surface, main channel water quality data from WLSSD, MPCA, WDNR, EPA-MED, LSNERR, UM-Twin Cities, and NRRI-UMD from the 1950s through 2015 into a common database; and 2) developing a new web application that would allow users to view and explore these data via bubble plots. The tool also allows users to explore the 2012 and 2013 synoptic data collected by EPA-MED using a probabilistic sampling design. During its development we generated a laundry list of additional features that would add further value to the tool, such as: scalable axes; importing additional biological and contaminants data; expanding the geographic area to include the entire length of the St. Louis River thalweg and the entire watershed; providing multiple panels for comparing data from different sites and comparing different parameters for the same site (partially available in the current tool); providing graphing tool(s) to allow for exploring associations between water quality, physical, biological, and perhaps weather data; and many others. The tool and its documentation are available at www.lakesuperiorstreams.org/streams/SLRE.



2016 AOC Progress and Updates

Rick Gitar[1]
[1] *Fond du Lac Band of Lake Superior Chippewa*

February 14, 2017, 2:10 PM – 2:30 PM

AOC Coordinators from the Fond du Lac Band, Wisconsin and Minnesota will provide AOC background and the status of Beneficial Use Impairments in the St. Louis River. The presentation will cover updates on key projects and a look at what is in store for 2017.

Beneficial Use Impairment 2 Status Report

Melissa Sjolund[1]
[1] *MN DNR*

February 14, 2017, 2:30 PM – 2:40 PM

The Stage I Remedial Action Plan developed in 1992 for the St. Louis River Area of Concern (AOC) determined that nine Beneficial Use Impairments (BUIs) exist within the AOC. BUI 2, Degraded Fish and Wildlife Populations, specifically targets habitat issues within the AOC. BUI2 was triggered by a concern for the status of threatened and endangered species. Removal of BUI 2 will be justified when it is shown that key native species of fish and wildlife are present and not limited by legacy issues associated with physical habitat, food sources, water quality, or contaminated sediments.

BUI 2 removal objectives include monitoring and assessment for birds, fish, and small aquatic mammals; and a habitat restoration project for Piping Plover. Currently, all required monitoring, assessment, and restoration have been completed. Data have been compiled, summarized, and compared against removal objectives. Removal objectives for Common Tern, Great Blue Heron, Bald Eagle, wetland bird species, Walleye, Muskellunge, semi-aquatic mammals, and invasives have been met. Populations of Piping Plover and Lake Sturgeon have fallen short of removal objectives and may require further investigation of data trends and the potential for additional metrics. This BUI is under review by the Technical Team who will make recommendations for action this year.

Fish Tumors and Other Deformities Beneficial Use Impairment: Results of Tumor Assessment and BUI Status

Matt Steiger[1]
[1] *WI DNR*

February 14, 2017, 3:00 PM – 3:10 PM

The Fish Tumors and Other Deformities Beneficial Use Impairment is listed as one of nine BUIs in the St. Louis River AOC. Adult white suckers were sampled in 2011, 2013 and 2015 and assessed for tumors. Results of this study concluded that incidence rates of contaminant-related internal and external tumors and deformities in resident benthic fish species do not exceed incidence rates from a reference population. The St. Louis River AOC program is applying these study results to meet the BUI removal target.

Tracking the Source of E. coli at Impaired Beaches in the St. Louis River Area of Concern

Heidi Sillard[1]
[1] *LSRI*

February 14, 2017, 3:10 PM – 3:30 PM

In recent years, six beaches located within the St. Louis River Area of Concern (AOC) were listed as impaired waters on the State of Minnesota and State of Wisconsin 303(d) List due to contamination by pathogens. Removing the Beneficial Use Impairment (BUI) requires that 1) sources of storm water and wastewater that discharge into the AOC have been identified, 2) measures to reduce risk of human exposure to disease-causing microorganisms have been implemented, and 3) no water bodies within the AOC are on the 303(d) list due to controllable sources of pathogens. Routine monitoring of beaches for pathogens provides data on the concentration of E. coli; it does not provide data on the source of E. coli. Controllable sources are defined in the AOC Remedial Action Plan as human sources, therefore, routine monitoring must be coupled with DNA analysis in order to provide the data needed to achieve the BUI removal target. The objective of this project is to provide E. coli concentration data at the six impaired beaches and possible pathogen sources surrounding the routine monitoring location, including tributaries, sand/sediment, and storm water runoff inputs. Those samples resulting in high E. coli concentrations were systematically selected for further DNA analysis in order to determine whether the E. coli was of human origin (i.e., controllable). During the 2015 and 2016 beach seasons, routine and rain event sampling was conducted at each beach. E. coli samples were collected at least twice per week from the routine monitoring location and each suspected pathogen source. Over 30% of the samples collected resulted in an E. coli concentration that was greater than the federal advisory criterion (>235 MPN E. coli per 100 mL). Nearly 40% of those exceedances were analyzed via quantitative polymerase chain reaction (qPCR) in order to determine the pathogen source. Results from 2015 and 2016 suggest human fecal contamination for a portion of the samples analyzed; 2015 having a greater proportion of human positive samples than 2016. A summary for each of the six impaired beaches in the project, including potential E. coli sources, will be presented.

Monitoring the St. Louis River Lake Sturgeon Population

Paul Piszczek[1]
[1] *WI DNR*

February 14, 2017, 3:30 PM – 3:40 PM

Lake Sturgeon has and continues to receive significant state and federal attention toward restoration, with stocking, spawning habitat modifications, population monitoring, and angling regulations as the primary management tools. The St. Louis River population is monitored annually by the Minnesota and Wisconsin Departments of Natural Resources, with assistance from the Fond du Lac Band of Lake Superior Chippewa. In May 2015 and May 2016, over 400 Lake Sturgeon were captured and released, with an average length of 46 inches. Nearly all fish were implanted with Passive Integrated Transponder (PIT) tags to uniquely identify each fish and determine growth rates. Some fish had curled fins, a trait sometimes indicative of hatchery production. In 2015, one fish was recaptured after initial tagging in Sleeping Bay, MI, nearly 150 miles east of the St. Louis River. In 2016, 45 fish received hydroacoustic transmitters to determine seasonal habitat use and movement patterns. At least 19 acoustically tagged fish entered Lake Superior within a few weeks of their respective tagging dates, however 14 fish never left the river. Annual surveys will continue in 2017 and 2018 in partnership with the University of Wisconsin – Stevens Point through a U.S. Fish and Wildlife Service Great Lakes Fish and Wildlife Restoration Act grant. Acoustic transmitters will again be implanted to determine seasonal habitat use and genetic samples collected to evaluate the population's genetic ancestry.

Removing Legacy Wood Waste

Molly MacGregor[1]
[1] *MN DNR*

February 14, 2017, 3:40 PM – 3:50 PM

Nearly three dozen sawmills cut more than 1 billion feet of lumber in the St Louis Bay and Estuary from 1855 to 1927. Sawmills were built on the water, which provided the dual convenience of waste depository and proximity to ship and rail transport. The mills have been gone for 90 years, but the waste remains. Legacy wood waste includes sawdust, bark, slab sides and even logs. Its presence has been noted as impairment in water quality investigations of the Estuary. The extent of legacy wood waste in the St Louis River Estuary is unique among Areas of Concern on the Great Lakes, and indeed, among shoreline areas and ports. Legacy wood waste impairs fish populations by contributing ammonia, biological oxygen demand and methane in anoxic conditions. MNDNR has identified the locations of legacy wood waste and proposes threshold criteria for removal of legacy material; Minnesota's recommendations are informed by guidance from States of Washington and Michigan.

Knowlton Creek Stream Restoration

Paige Bake[1]
[1] *Stantec*

February 14, 2017, 3:50 PM – 4:10 PM

One of Duluth's 16 trout streams is about to be one of the most ambitious single stream restoration projects in [Minnesota] history. – Duluth News Tribune, August 24, 2016
Knowlton Creek, is a cold-water trout stream that has been severely degraded by human activity within the watershed, which resulted in reduced habitat value and transportation of large amounts of sediment to the St. Louis River Estuary behind Tallas Island. Because of this, the Knowlton Creek Watershed Restoration Project was documented as necessary for the removal of Beneficial Use Impairments and delisting of the St. Louis River Area of Concern (AOC). Additionally, elimination of sediment transported to the estuary was considered critical to the resilience of a 2009 compensatory mitigation project that restored open water at the mouth of Knowlton Creek.

In 2010, a diverse team of professionals gathered at Spirit Mountain Recreation Area (SMRA) to integrate SMRA's proposed water infrastructure project with The Minnesota Department of Natural Resources (MNDNR) effort to restore the Knowlton Creek watershed. The entire watershed project was completed in December 2016, through cooperative actions between resource professionals from MNDNR, SMRA, Minnesota Pollution Control Agency, The City of Cloquet, and the US Army Corps of Engineers

The watershed project was guided with a system-based, data-driven, fluvial geomorphology assessment approach in order to understand changes that had occurred in this dynamic landscape. The goal was to reduce erosion and sediment transport and restore critical elements of aquatic habitat for brook trout and associated species. Although the team was challenged by dramatic weather events during the planning and design phase of the project, adherence to the guiding principles and adaptability during construction resulted in desirable outcomes for the AOC, MNDNR, SMRA, the City of Duluth and the community.

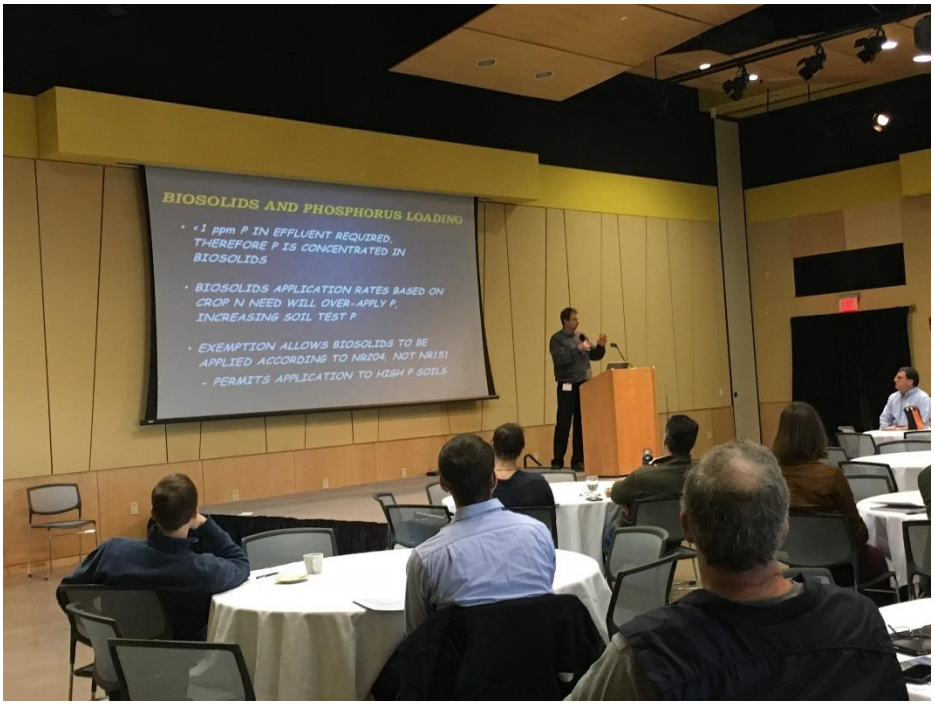
This presentation will describe how the watershed project was developed and implemented in a way that addressed the multiple goals of the partners. It will also highlight the stream restoration methodology that was used to design the project as well as adapt to conditions during the construction process.

Integrating Biosolids Land Application with the Crop Nutrient Needs on Farms in Northern Minnesota and Wisconsin

Richard Wolkowski[1]
[1] *UW – Madison/UW – Extension*

February 15, 2017, 8:40 AM – 9:00 AM

The land application of Field Green® biosolids represents an excellent example of a practice that offers a benefit to citizens of both cities and rural areas of northern Minnesota and Wisconsin. These biosolids are the result of the biological treatment of wastewater that utilize the current best technology to enhance water quality in the St. Louis River and produce a nutrient-rich organic soil amendment that is applied to crops in the region. Recycling nutrients such as N and P by land application is a preferred alternative to either incineration or landfilling. The production and use of biosolids are regulated according to guidelines developed by the US-EPA, the Minnesota PCA, and the Wisconsin DNR. Only sites that have an acceptable soil type, slope, distance to surface water, setbacks from human activity, soil pH and nutrient levels, and cropping practice are selected. Applications utilize GPS technology to monitor application rate and to provide adequate buffer from wetlands, waterways, and other surface water features. Our presentation will provide an overview of the best management practices that are used to produce and apply Field Green® biosolids, and how the program offers value and environmental benefits to the watershed by utilizing this by-product as a fertilizer and soil amendment.



Evaluation of the St. Louis River Walleye Fishery

Kirk Olson[1]
[1] *WI DNR*

February 15, 2017, 9:00 AM – 9:20 AM

The St. Louis River supports the largest self-sustaining Walleye population in Lake Superior, which also represents a genetically distinct stock of Walleye within the Great Lakes. Since 1981, the Wisconsin Department of Natural Resources, Minnesota Department of Natural Resources and Fond du Lac Band Resource Management have jointly monitored the Walleye fishery through a combination of population and harvest surveys. The most recent comprehensive evaluations of the fishery incorporating both population demographics and sport and commercial harvest were completed separately by the Wisconsin DNR and the Minnesota DNR in 1991 and 1992, respectively. In order to evaluate the current status of the St. Louis fishery, we analyzed Walleye population demographics and sport and commercial harvest of Walleye from 1981-2015. Similar to previous findings, a large portion of the St. Louis spawning population was migratory, utilizing shallower littoral habitats in Western Lake Superior. Sporadic population estimates conducted between 1981 and 2015 suggest that spawning Walleye abundances have declined in 2015. The cause of this decline appears to be, in part, the result of limited recruitment in recent years as natural mortality and growth rates have not changed systematically. Harvest was primarily driven by sport anglers in 2015 and our estimate of total yield by sport anglers was at our maximum sustainable threshold estimate, indicating that continued monitoring of the population is necessary.

Microhabitat Influence on Larval Fish Assemblages within Vegetated Beds: Implications for Restoration

Hannah Ramage[1]
[1] *UMD*

February 15, 2017, 9:20 AM – 9:40 AM

We examined larval and juvenile fish assemblage structure in relation to microhabitat variables within the St. Louis River Estuary, a drowned river mouth of Lake Superior. Fish were sampled in vegetated beds throughout the estuary, across a gradient of vegetation types and densities (including disturbed, preserved and post-restoration sites). Canonical correspondence analysis, relating species abundances to environmental variables revealed that plant species richness, turbidity and aquatic plant cover were most influential in structuring assemblages. Furthermore, plant species richness was positively correlated ($r=0.677$, $p<0.05$) with Tubenose Goby abundance, signifying evidence against the diversity - invasibility hypothesis. Results from this microhabitat analysis at this crucial life stage has potential to inform wetland restoration efforts within the St. Louis River Estuary and other Great Lake Coastal Wetlands.

Protecting Riparian Areas along the Pokegama River by Reducing the Impacts of Emerald Ash Borer through Underplanting

Shon Schooler[1]
[1] *Lake Superior Research Reserve*

February 15, 2017, 9:40 AM – 9:50 AM

Infestation by emerald ash borer (EAB) kills 99% of green and black ash trees within 5 years. We predict that ash tree death will decrease stream bank soil retention capability, particularly with the increasing frequency of intense storms, which will lead to increased stream bank erosion and sediment transport. This may be exacerbated by the intrinsically erodible clay soils along the Pokegama River. Planting tree seedlings in ash dominated riparian corridors in anticipation of EAB infestation will maintain the riparian corridor function and reduce the impacts of EAB on water resources. In this project we are testing three tree species (northern white cedar, red maple, and hackberry), three herbivore exclusion treatments (fence, spray, none), three planting techniques (artificial hummocks, scarification, none), within two zones (near the river (<5m) and away from the river (5-10m) in a replicated randomized experimental design in uninfested ash dominated riparian corridors of the Pokegama River in the Superior Municipal Forest in Superior, Wisconsin. Sites (72 total, 36 per zone) were selected in July 2015 and all trees (648 total, 216 per species) were planted in October 2015. We are measuring tree survival and growth (height and stem diameter), first every 6 months, then yearly, to assess what species and treatments provide the best survival and growth. Preliminary results found that 89% of the seedlings survived the first winter and 82% survived the first year. Survival rates were generally similar across treatments and zones after the first year (range = 77-86%). Species exhibited greater variability with fewer white cedar surviving after one year (63%) than hackberry (89%) and red maple (93%). Similarly, increases in height were similar across treatments and zones after the first year (range = 4.53â€“5.71cm) and mean height gain across tree species was more variable with red maple seedlings growing, on average, 11.36cm, hackberry 3.45cm, and white cedar (not) growing -2.41cm. Reduced height of white cedar was probably due to a combination of herbivory and stem dieback. By establishing proper planting practices we will improve the success of future restoration efforts in the St. Louis River Estuary.

10 Things We Learned from Your Vegetation Data

Nick Danz[1]
[1] *UW – Superior*

February 15, 2017, 9:50 AM – 10:10 AM

10 things we learned from your vegetation data

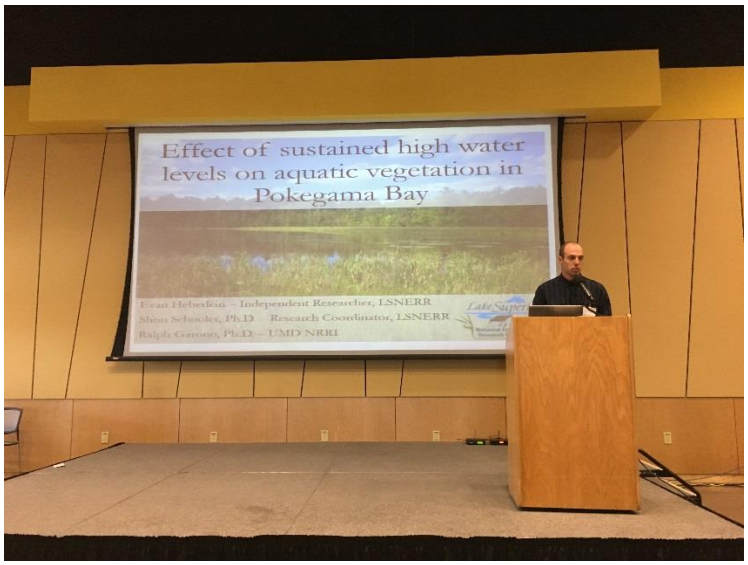
1. Depth is the predominant driver of plant community composition (substrate, hydrogeomorphic type doesn't matter as much) in the estuary
2. Turbidity / clay dominated sites don't have substantially different plant species composition than other sites
3. There are no true reference areas in the estuary, all sites have been impacted by human change
4. Floristic quality is moderately related to human watershed stress
5. Mean C is a robust measure of ecological conditions
6. Sites with Mean C above 5.0 are in good condition.
7. Vegetation cover decreased measurably post-flood
8. High likelihood of vegetation cover in areas <1.5 m water depth
9. Meander and plot-based methods give similar Mean C scores
10. Most areas in the estuary are in reasonably good ecological condition
11. Plant species have different water depth optima and tolerances

Effect of Sustained High Water Levels on Aquatic Vegetation in Pokegama Bay

Evan Heberlein[1, 2]
[1] *Lake Superior Research Reserve;* [2] *UW – Superior*

February 15, 2017, 10:10 AM – 10:30 AM

Water levels in Lake Superior have recently deviated from a near decadal cycle that was evident beginning before 1940. A result of this deviation was abnormally high water during the winters of 2014 and 2015 (level remained above 183.5 MSL). For this period the level of Lake Superior remained higher for longer than at any time in the water level record, dating back to 1885. In this project we examine the effect of this sustained high water event using permanent vegetation plots in five back bays in upper Pokegama Bay, an embayment of the St. Louis River Estuary whose water levels are directly linked with Lake Superior. We hypothesized a shift in vegetation type from wet meadow and emergent species to submerged and floating species with the increased duration of high water. An analysis of the plot data revealed a significant shift in aquatic vegetation types within Pokegama Bay during the study period. From summer 2014 to summer 2016, higher water levels were correlated with a decrease in emergent vegetation species (mean 89% to 18% cover) and an increase in submerged (mean 1% to 13% cover) and floating plant species (mean 2% to 4% cover) within the plots. These changes occurred within a brief time scale, signaling potentially dramatic impacts across trophic levels within this habitat. Future work should continue to examine the effect of water levels on vegetation to determine whether sustained water levels will continue to alter the aquatic vegetation or whether decreasing water levels will result in a return to previous vegetation or lead to an increasing abundance of invasive species.



Effectiveness of the Leaf Skeletonizing Beetle in the Control of Purple Loosestrife in Pokegama Bay

Adam Lein[1, 2]
[1] *Lake Superior Research Reserve;* [2] *UW – Superior*

February 15, 2017, 10:30 AM – 10:40 AM

Purple loosestrife, an invasive wetland plant species in the St. Louis River Estuary, creates dense monospecific stands that can reduce plant and herbivore diversity. In 2004 the leaf-skeletonizing biological control agent, Galerucella calmariensis, was introduced to Pokegama Bay. Due to the importance of quality habitat for the delisting of the St. Louis River Area of Concern we examined the effect of the beetle on purple loosestrife growth, reproduction, and abundance in order to determine if additional management actions need to be taken to reduce the effect of loosestrife on biological diversity. Effect of the beetle on loosestrife growth and reproduction was examined using a beetle exclusion design; setting up 18 plots in Pokegama Bay with three randomly assigned treatments: cage, open, and partial cages. Cages were constructed in 2015 before the beetles emerged from overwintering (early May) and taken down when flowering began (early August) to allow for pollination. Loosestrife plants were measured and destructively harvested at the end of the growing season in September. We found that loosestrife stem height, percent flowering stems, and seed number were all significantly reduced in the presence of the beetle. In particular the beetles had a large impact on seed production reducing the average number of seeds five-fold from approximately 400,000 to 80,000 per square meter. Effect of the beetles on loosestrife abundance was examined using surveys before and after the beetles were introduced. From 2004 to 2016 loosestrife abundance either remained at low abundance (less than 25%) or was reduced to less than 25% cover at the five sites surveyed. Prior studies indicate that loosestrife has little impact on plant and herbivore diversity at abundances less than 30% cover. This study indicate that the beetles have developed a self-sustaining population in Pokegama Bay, that the beetles reduce plant growth and reproduction, and this is leading to overall lower abundance of purple loosestrife. More work is need to examine the temporal variability in effect and whether this result will be sustained with changing water levels or a changing climate.

Small Plastic Particles with Huge Environmental Impacts in Our Freshwater Systems

Lorena Rios Mendoza[1]
[1] *UW – Superior*

February 15, 2017, 11:00 AM – 11:10 AM

Microplastics are becoming one of the most cited emergent contaminants in the last decade. These tiny synthetic polymers are associated with human activity. Microplastics have been increasingly documented, raising significant international alarms. The inadequate disposal of plastics has made this material a ubiquitous pollutant on beaches, rivers, lakes, and oceans around of the world. The longevity of most plastics in the environment ranges from hundreds to thousands of years and studies in ocean environment indicate that plastic materials simply photodegrade and break into smaller pieces. Microplastic particles are a new type of pollution reported in the Great Lakes with unknown impacts in the ecosystem and human health. Little information is currently available on the composition, distribution, or fate of microplastic debris in the western end of Lake Superior and St. Louis River Estuary. The aims of this research are to identify possible sources, abundance, and the potential of microplastics to be ingested by fish. In this study we collected a total of 35 samples during summer, 2016. There were 17 samples from surface waters using a manta trawl, 4 samples from effluent water from four wastewater treatment plants, and 7 beaches (samples from 100 m and 1 m2). To determine the type of synthetic polymer we are using a FTIR Micro Spectrophotometer. The microplastics were classified by color, size, pellets, fibers, and fragments. The first results from the analysis of 12 manta samples showed in average 18 fibers, 25 fragments, and 4 microbeads (from cosmetic products) per sample.

Tributary Influence on the Biogeochemistry and Metabolism of Nearshore Lake Superior

Josh Delvaux[1]
[1] *UW – Milwaukee*

February 15, 2017, 11:10 AM – 11:30 AM

Nearshore areas of the Great Lakes often have relatively high biodiversity, and as the interface between the terrestrial landscape and the open lake they play an important role in modulating whole-lake response to inputs of nutrients and energy from the watershed. These inputs occur primarily via tributary loading, and so it is critical to understand the dynamics of river plumes and the fate of organic carbon and nutrients delivered in the plumes. To assess the influence of river plumes on the biogeochemistry and metabolism of the Lake Superior nearshore zone, the spatial and temporal distribution of turbidity, nutrients, phytoplankton, dissolved oxygen, and dissolved carbon dioxide were measured in the western arm of Lake Superior and select tributaries from June 2016 through October 2016. This presentation will focus on the lake response to a large storm even in July, showing how the nearshore zone transitioned from a highly turbid, low productivity system immediately following the storm to high phytoplankton productivity after a one-month lag. A decrease in surface pCO2 during this period suggests that river nutrient loads have a greater effect than organic carbon loads on nearshore community metabolism.

Common Terns in the Great Lakes Region: Tracking Movement for Conservation Planning

Annie Bracey[1]
[1] *NRRI*

February 15, 2017, 11:30 AM – 11:50 AM

The Common Tern (Sterna hirundo) is declining globally, and in the North American Great Lakes declines have been significant. Loss and modification of habitat and predation are significant issues during the breeding season. However, lack of information on seasonal movement patterns and non-breeding habitat requirements limits the ability of managers to determine why populations are declining. Using geospatial tracking devices will help identify local movement within the breeding grounds and large-scale movement during the non-breeding season, which will help determine the degree of migratory connectivity and the extent of segregation of regional populations. We used light-level geolocation to track individuals breeding in lakes Superior, Huron, Winnipeg, and Oneida. In 2013-2015, 106 geolocators were deployed on birds nesting on Interstate Island (n=25) in the Duluth-Superior Harbor, Chequamegon Bay (n=11), Ashland, WI, Elm Island (n=30) in the North Channel of Lake Huron, McLeod and Egg Islands (n=30) in Lake Winnipeg, Manitoba, and Little Island (n=10) in Onieda Lake, NY. In 2016, we deployed 20 global positioning system tags on birds breeding in Lake Superior, five of which were used for year-round monitoring. Results from geolocators (n=49) reveal birds wintered in Central America and along the west coast of South America, with >50% of individuals wintering in coastal Peru, suggesting low recruitment between regional populations. On Interstate Island, individuals traveled up to 35km from the breeding colony, primarily along coastal Lake Superior and in Chequamegon Bay, movement up to 15km from the breeding colony was observed, primarily within the bay. I will present preliminary results from these tracking technologies, provide information on local movement by Common Terns in Lake Superior, and describe migratory routes and overwintering locations for individuals breeding in the Western Great Lakes region.

Update on Great Lakes Data Integration Visualization, Exploration and Reporting (GL DIVER) System: Future of Great Lakes Data Management

Emily Punke[1] , Kirk Wythers[2] , Annie (Johns) Gibbs[3]
[1] WI DNR; [2]MPCA; [3] NOAA

February 15, 2017, 11:50 AM – 12:00 PM

In the next three years, St. Louis River (SLR) Area of Concern (AOC) staff plans to remove four Beneficial Use Impairments (BUIs). Ready access to data and the ability to visualize and analyze this data is critical to the AOC coordinators and the scientists who will evaluate the scientific basis for the justification of BUI removal.

After the passage of Great Lakes Legacy Act in 2010, the chemical and biological investigations accelerated creating large volume of data. The SLR AOC community saw the need for a web-based and GIS enabled data system and long-term curator for the data. In 2014, NOAA stepped up, using its Great Lakes Data Integration, Visualization, Exploration and Reporting (GLDIVER) application. NOAA's GLDIVER database, query, and mapping tools provide customized data exploration and visualization to support decisions. It's designed to manage and integrate large amounts of data collected by different sources. Data are organized into a consistent and standardized structure, which improves communication and data delivery and facilitates interpretation, mapping, and analysis through query/visualization tools. GLDIVER is based on NOAA's existing Query Manager database and has the additional benefit of the ability to incorporate a large variety of biological data types. In addition to GLDIVER's powerful data management visualization capabilities, further analytical statistical and visualization capabilities are being developed with the Tableau and Tableau Server applications with near real time data connections to the Query Manager database. When fully deployed, GLDIVER and Tableau will be the primary data management tools used by SLR AOC staff, scientists and researchers who support AOC work.

The presentation will include updates on GLDIVER, which was presented in 2015 and again in 2016 during the key note time slot (after a last minute switch) and generated a great deal of interest. Many things have evolved in the last year including the official release of GLDIVER and the addition of an extensive amount of data from the St. Louis River Estuary. To complement the update and provide further details and opportunities to ask questions, a live demonstration of GLDIVER and Tableau during a lunchtime breakout session would be arranged.

Focus Group to Discuss Symbology, Labeling and Other Facets of the Proposed St. Louis River Estuary Guidebook

Martina McPherson[1]
[1] *ERG (NOAA OCM)*

February 15, 2017, 12:00 PM – 12:10 PM

The St. Louis River Estuary is one of two NOAA Habitat Blueprint focus areas in the Great Lakes Region and the focus study area for OCM's ongoing work on the Regional and National Inventory of Coastal Recreation and Tourism Data project. The past two decades represent an era of phenomenal growth and success in local tourism in the area and previous stakeholder engagements by NOAA have demonstrated a need for identification and documentation of recreational amenities and public access points. In addition to documenting the many recreational amenities of the estuary, NOAA OCM hopes to highlight the rich cultural heritage of the area by including sites of historical and cultural value to the Fond du Lac Chippewa. The final product will be a Guidebook with maps highlighting the various recreational and cultural amenities. NOAA OCM would like to solicit feedback from Summit attendees on a variety of guidebook-related formatting and content issues.

What is New with NOAA's Coastal Change Analysis Program (C-CAP)

Brandon Krumwiede[1]
[1] *NOAA Office of Coastal Management*

February 15, 2017, 1:30 PM – 1:50 PM

Land use and land cover play a significant role as drivers of environmental change, and information on what is changing and where greatly improves our understanding of past management practices and how to respond effectively to these environmental and human-induced changes. Through its Coastal Change Analysis Program (C-CAP), the National Oceanic and Atmospheric Administration's Office for Coastal Management produces nationally standardized land cover and change information for the coastal regions of the U.S. These products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands (using documented, repeatable procedures) with the goal of monitoring these habitats every five years.

This presentation will summarize some of the major changes and trends observed in the Great Lakes, as well as recent and upcoming improvements to C-CAP data including the development of high resolution C-CAP land cover for the lower portion of the St. Louis River and Nemadji River watersheds. The presentation will discuss the various ways that users can access existing data and ways that the data might be used to help in setting conservation and restoration priorities. In particular, the presentation will highlight the utilization of C-CAP data as part of NOAA's joint GLRI project with the Bureau of Indian Affairs and tribal communities focused on wild rice monitoring and restoration in the Lake Superior Basin.

Effects of Tributary Inflows on Water, Sediment, and Nutrient Budgets in the St. Louis River Estuary

Richard Kiesling[1]
[1] *USGS*

February 15, 2017, 1:50 PM – 2:00 PM

Flows, sediment, and nutrient fluxes in the St. Louis River Estuary (SLRE) are affected by inflows from multiple tributaries as well as by water exchanges with Lake Superior through two connecting ship entries. Five index-velocity gages were installed in 2015 to continuously monitor water levels, flows and velocity profiles in the SLRE. Sediment and nutrient concentration data also were collected at gages to support calculation of nutrient and sediment loads. Water budget calculations for 2016 indicate significant contributions to the water balance from the St. Louis, Nemadji and Pokegama Rivers as well as from the SLRE tributaries in the vicinity of Duluth, MN. High flow events from tributaries in 2016 produced brief synchronous discharge peaks out of the two connecting channels into Lake Superior. However, the patterns of outgoing flow from the estuary to the nearshore quickly changed to a mixture of inflows of lake water through the Duluth Entry and combined river outflows through the Superior Entry. These initial observations of changing flow directions during storm events illustrate the critical need for monitoring constituent concentrations and velocities in both entries in order to adequately calculate the net flux of water, sediment, and nutrients from the SLRE to the nearshore of Lake Superior.

Annual Mercury Bioaccumulation in the SLR Reservoir System: A Multi-year Study of Water Chemistry and Young-of-year Perch

Nancy Schuldt[1]
[1] *Fond du Lac Band of Lake Superior Chippewa*

February 15, 2017, 2:00 PM – 2:20 PM

The high concentration of mercury in fish in the St. Louis River system has been a focus of ongoing research since the early 1990â€™s, with one of the factors of concern being the potential for reservoir operations (water level fluctuations) to impact mercury methylation and the availability of mercury to the aquatic food web. A memorandum of agreement between the Fond du Lac Band, Minnesota Power, and the Minnesota Pollution Control Agency led to a cooperative study to address the question: Do water level fluctuations caused by the SLRP hydropower operation increase the production or mobilization of methylmercury relative to natural water level fluctuations? This study, Minnesota Power St. Louis River Hydroelectric Sediment Mercury Research Project (B.A. Branfireun, D. Fowle, D. Krabbenhoft), yielded some informative insights into those processes, but not sufficiently clear as to suggest effective mitigation measures or changes to reservoir operations to reduce methylmercury production and mobilization from adjacent wetland sediments. Subsequently, the three parties agreed to collect baseline water chemistry data on the reservoirs (Whiteface, Island, Fish, Boulder, Wild Rice and Thomson Reservoirs), and several uncontrolled reference lakes (Alden and West Two Lakes), along with young-of-year perch (Perca flavescens) to be analyzed for mercury. Water chemistry data included nutrients, chlorophyll a, DOC, TOC, TSS, sulfate, secchi depth, and total and dissolved mercury. Our assumption, based upon earlier investigations by John Sorensen in the Rainy River watershed, was that age-0 or YOY perch mercury concentrations represent a single growth season of mercury bioaccumulation. Monitoring this parameter can, over time, provide greater understanding of both spatial and temporal variability in mercury bioavailability and bioaccumulation rates, and potentially identify relationships between water level management and mercury bioaccumulation in fish. Data collection was conducted from 2010 through 2015, with water chemistry sampling events in spring, mid-summer and late fall, and perch collected in September of each year. This presentation will provide a summary of the baseline data collection and preliminary interpretations of those results.

Modelling Future Improvements in the St. Louis River Fishery from Sediment Remediation and Aquatic Habitat Restoration

Joel Hoffman[1]
[1] *US EPA – MED*

February 15, 2017, 2:20 PM – 2:40 PM

The presence of fish consumption advisories has a negative impact on fishing. In the St. Louis River, an important natural resource management goal is to reduce or eliminate fish consumption advisories by remediating contaminant sediments and improving aquatic habitat. However, we currently lack sufficient understanding to estimate the cumulative effects of these habitat improvements on fish contaminant burdens. To address this gap, our study had two main research objectives: first, to determine the relationship between game fish habitat use and polychlorinated biphenyls (PCBs) concentrations in the lower St. Louis River, and two, to calibrate and validate a habitat-based Biota-Sediment Accumulation Factor (BSAF) model that estimates fish PCBs concentration as a function of both sediment and habitat quality. We sampled two resident fishes, Yellow Perch (Perca flavescens) and Black Crappie (Pomoxis nigromaculatus), and two migratory fishes, Northern Pike (Esox lucius) and Walleye (Sander vitreus) of varying size and from locations spread across the St. Louis River estuary, the largest coastal wetland complex in Lake Superior. We found differences in contaminant concentration that were related to habitat usage, though results varied by species. For migratory fishes, increasing diet from Lake Superior was associated with decreasing PCBs concentration in tissue. For resident fishes, PCBs concentration was highest in the industrial portion of the river. Model calibration demonstrated that existing data sources can be used to accurately estimate fish contaminant burden except in the uppermost reaches of the river. Validation results will be used to improve small-spatial scale estimates. We conclude this approach has strong potential to be used for both initial project screening and to estimate a project's potential impact to improve the quality of the fishery.

Mercury Concentrations in Burrowing Mayfly Nymphs (Hexagenia limbata) in the St. Louis River Estuary

Craig Roesler[1]
[1] *WI DNR*

February 15, 2017, 3:10 PM – 3:30 PM

The St. Louis River Estuary (SLRE) is located at the lower end of the St. Louis River between Wisconsin and Minnesota. Past industrial and shipping activity significantly contributed to the contamination of the estuary. Burrowing mayfly nymphs (Hexagenia limbata) were sampled at 80 sites to determine density, total mercury (TotHg) tissue concentration and methyl mercury (MeHg) tissue concentration. Samples were collected at three categories of sites: random sites, sites with previous sediment samples with > 0.8 mg/kg TotHg concentrations in sediment, and sites previously sampled for dragonfly (Odonata) nymphs that had high mercury concentrations. Isopods (Caecidotea sp.) were sampled at some sites where Hexagenia was not present. Hexagenia density at random sites was 2.7 times higher than the mean density found in 1995, indicating improved conditions in the estuary. Hexagenia density was lower at sites with high TotHg concentrations in sediment than at random sites suggesting that mercury and/or other co-contaminants are restricting Hexagenia populations in these areas. Hexagenia tissue TotHg and MeHg concentrations were lower at sites with high sediment mercury concentrations than at random sites suggesting contributions to Hexagenia mercury concentrations by industrial legacy deposits of mercury is minimal. Small Hexagenia had higher TotHg and MeHg concentrations than large Hexagenia. Differences in feeding habits may explain this. Small Hexagenia probably have shallower burrows and may feed more on recently settled detritus and phytoplankton at the sediment surface. These materials have been found to have higher mercury concentrations than sediment in other studies. Large Hexagenia probably have deeper burrows and may feed more on bulk sediment. Isopods generally had slightly higher TotHg and MeHg concentrations than Hexagenia. This may also be due to feeding more at the sediment surface where food sources tend to have higher mercury concentrations.

Development of a Mercury Remediation Target for the St. Louis River AOC

Joel Hoffman[1]
[1] *US EPA – MED*

February 15, 2017, 3:30 PM – 3:40 PM

A collaboration of State-Tribal-Federal-Academic scientists will conduct a mercury bioaccumulation study on the St. Louis River AOC and lower Bad River. The study has three primary goals. First, we will determine differences and similarities in geochemical character, ecosystem types, and food web structure between the St. Louis River AOC and Bad River (reference) to account for baseline differences in mercury bioaccumulation between the AOC and the reference site (Bad River). Second, we will assess age- and size-specific mercury residues (based on scale-off, skin-on fillets) in selected fish species in both the St. Louis River AOC and Bad River (reference). Third, we will develop a mercury remediation and restoration target for the St. Louis River AOC that includes a long-term (post-remedy) anticipated change in fish mercury residues based on the differences in mercury bioaccumulation between the St. Louis River AOC and Bad River. Field sampling will begin in the summer of 2017. The project will have an ecosystem-based approach to studying mercury sources and fates. Highlights of the study include the use of a suite of isotopic tracers to identify mercury pathways and sources, inclusion of geochemistry studies to address factors influencing methylation, and comprehensive sampling of the food web.

A Tiered Framework for Evaluating Sediment Contamination including Bioavailability: Implications for Restoration and Remediation in the St. Louis River Estuary

Nathan Johnson[1]
[1] *UMD*

February 15, 2017, 3:40 PM – 4:00 PM

A tiered decision framework is presented to illustrate how derived Cfree measurements derived from passive sampling can be incorporated into risk management decisions in moderately or heavily contaminated sites. The framework builds upon tiered assessment approaches recommended by EPA that incorporate measures of bioavailability when the potential for toxicity due to sediment contamination is uncertain. Results of a probabilistic analysis illuminate large variability in the effective bioavailability of PAHs in the St Louis River Estuary (SLRE), and demonstrate that screening values or toxic unit predictions contain an implicit factor of safety. The proposed decision framework provides a flexible statistical guidance for moving through a tiered assessment approach that makes use of 1) screening level values based on literature or standard procedures, 2) passive-sampling-derived Cfree estimates of bioavailability and likely toxicity and 3) actual biological (toxicity or bioaccumulation) testing. The decision framework was developed and applied in the context of data collected from priority habitat restoration areas in the SLRE and a pilot project utilizing navigational dredged materials for habitat restoration. Results suggest that areas of moderate contamination stand to gain the most from direct measures of Cfree in a tiered assessment approach.

Vegetation Metrics for Evaluation of Management and Restoration Efforts

Carol Reschke[1]
[1] *NRRI – UMD*

February 15, 2017, 4:00 PM – 4:20 PM

In support of efforts to restore fish and wildlife habitats in the St. Louis River estuary we have sampled aquatic vegetation in both disturbed restoration sites and relatively undisturbed reference sites in the estuary since 2010. Aquatic vegetation data are being used by managers of the St. Louis River Area of Concern (AOC) to plan restoration of disturbed habitats. One challenge of these efforts is how to evaluate the success of the restoration; managers need to know when they have accomplished an adequate restoration of aquatic vegetation as part of restoring fish and wildlife habitats. Managers use metrics derived from quantitative vegetation data to evaluate and rank restoration and reference sites; these metrics are also used to determine threshold values to set as criteria for evaluating success of restoration efforts. Currently managers are relying on floristic quality assessment metrics which utilize Coefficient of Conservatism (Cc) values that are assigned to plant species based on fidelity of plant species to certain habitats, and their tolerance of either natural or anthropogenic disturbance. I've found that metrics based solely on Cc values (e.g. mean Cc and weighted Cc) are not working well to distinguish reference sites from restoration sites in the estuary. AOC managers suggested that a metric be refined that addresses diversity and lack of vegetation. I propose an alternative vegetation metric that I developed, called vegetation quality index (VQI), which can be used to evaluate habitat quality and identify threshold values for assessing when a habitat or site is adequately restored. This new VQI metric uses Cc values in combination with taxa richness and proportion of samples vegetated to indicate vegetation quality within a mapped polygon. Maps and tables will be presented comparing metrics such as mean Cc and weighted Cc to VQI in the estuary. An effective vegetation quality metric is needed to standardize the process of evaluating restoration success in the estuary, which is an important part of restoring fish and wildlife habitats, and therefore one step towards the goal of delisting the St. Louis River as a Great Lakes Area of Concern.

State of the Estuary – Developing a Long Term Monitoring, Assessment and Reporting Framework for the Lower St. Louis River

Tom Hollenhorst[1]
[1] *US EPA – MED*

February 15, 2017, 4:20 PM – 4:30 PM

As the lower Saint Louis River moves closer and closer to delisting as an Area of Concern, it is incumbent that we measure, assess and report on our success. Going forward, it's equally important that we continue monitoring to protect and sustain the healthy ecosystems we've worked so hard to attain. We propose here the development of a long term systematic monitoring, assessment and reporting framework to help highlight and publicize the successful recovery of the lower Saint Louis River. Such a framework should outline methods for regularly measuring, monitoring and assessing the current health of the river and its ecosystems into the future followed with a periodic reporting of the State of the Estuary. This framework should be developed by the stakeholder community over a series of meetings, leading to a collaborative, partner-driven approach. To the extent possible, existing sampling and monitoring programs should be incorporated, along with additional metrics needed to tell the complete story on the State of the Estuary. These additional metrics might include economic, social science and human health indicators, contaminants of emerging concern, long term restoration effectiveness and other monitoring needs not yet recognized. Examples of other State of the Ecosystem efforts will be discussed as possible models to follow.

Poster Presentation Abstracts

Moving towards AOC delisting, paleolimnology reveals the history of nutrients in the SLRE

Elizabeth Alexson[1]
[1] *NRRI – UMD*

Since the St. Louis River Estuary (SLRE) was listed as an Area of Concern (AOC) in 1987, actions have continued to restore water quality in hopes to eventually remove beneficial use impairments. Although some monitoring data exist, a lack of system-wide historical data prevents a full understanding of remediation. A paleolimnological study of the SLRE was initiated to close the knowledge gap. Various sedimentary indicators including diatom assemblages were analyzed from cores taken throughout the estuary and in Lake Superior. The paleorecord tells a complex, spatially variable story for the last century, but there is evidence that management to remediate the estuary has reduced the flux and concentrations of nutrients in the estuary. However in some areas nutrient levels persist above delisting thresholds possibly due to stressors that were not well understood at the time of the AOC listing. These stressors may include internal phosphorus loading and climate change. The diatom assemblages, integrated with other biological, chemical and physical indicators from the sediments, will aid agencies in determining where to target resources and delisting efforts.

Crowd-sourcing relative preferences for ecosystem services in the St. Louis River AOC

Ted Angradi[1]
[1] *US EPA*

Analysis of ecosystem service tradeoffs among project scenarios is more reliable when valuation data are available. Empirical valuation data are expensive and difficult to collect. As a possible alternative or supplement to empirical data, we downloaded and classified images from social media sites (SMS) Panoramio (n= 639), Instagram (n=2086), and Flickr (n=6644) for the AOC and 100 m buffer. We classified each image from the perspective of the beneficiary (photographer) according to US EPA's Final Ecosystem Goods and Services (FEGS) classification system. After removing images not in the AOC or with bad links, 58 (10%), 361 (24%), and 1035 (16%) of the images from Panoramio, Instagram, and Flickr, respectively, depicted an ecosystem service. The most frequently occurring non ecosystem services depicted were bridges, ships, indoor scenes, and people. Across SMS with repeat images removed, AOC services were percentage ranked as follows: recreational scene viewers, 28%; boaters, 24%, flora and fauna viewers, 20%; other recreation experiencers (e.g., dog walkers, beach goers, bikers, trail and greenspace users), 15%; angling, 7%; learners, 1%, inspirational/sacred experiencers, 1%. Across SMS, recreational services were ranked as follows: scene viewing, 28%; boating, 24%, birding, 16%; fauna and flora viewing, 8%; trail and greenspace use, 7%; angling 7%; dog walking, 3%; swimming, beach and ice use, 3%; biking, 1%; excursion rail, 1%. Potential biases include SMS user profile, user gender, user age, and user type (local or visitor).

Plans and progress for building a Great Lakes fauna DNA barcode reference library

Jonathan Barge[1]
[1] *US EPA*

DNA reference libraries provide researchers with an important tool for assessing regional biodiversity by allowing unknown genetic sequences to be assigned identities, while also providing a means for taxonomists to validate identifications. Expanding the representation of Great Lakes species in such reference libraries is an explicit component of research at EPA's Mid-Continent Ecology Division. Our DNA reference library building efforts began in 2012 with the goal of providing barcodes for at least 5 specimens of each native and nonindigenous fish and aquatic invertebrate species currently present in the Great Lakes. The approach is to pull taxonomically validated specimen for sequencing from EPA led sampling efforts of adult/juvenile fish, larval fish, benthic macroinvertebrates, and zooplankton; while also soliciting aid from state and federal agencies for tissue from shopping list organisms. The barcodes we generate are made available through the publicly accessible BOLD (Barcode of Life) database, and help inform a planned Great Lakes biodiversity inventory. To date, our submissions to BOLD are limited to fishes; of the 88 fish species listed as being present within Lake Superior, roughly half were successfully barcoded, while only 22 species met the desired quota of 5 barcoded specimens per species. As we continue to generate genomic information from our collections and the taxonomic representations become more complete, we will continue to make this information publicly available to improve the scientific understanding of Great Lakes invertebrates and fish species.

Assessment of aquatic macroinvertebrate communities in Munger Wetlands, SLRE: Lingering effects of legacy inputs?

Valerie Brady[1]
[1] *NRRI – UMD*

The Munger Landing Wetlands are about 10 river miles upstream from the Duluth/Lake Superior entry and just upstream of Munger Landing on the Minnesota side of the estuary. The wetlands are separated from the St. Louis River by a railroad track and levee, but there is a substantial surface water connection via a low bridge between each small wetland and the river. The wetlands have been impacted by historic urban development and still contain many submerged logs left over from logging operations. In August 2016, we collected macroinvertebrates using sediment cores and dip nets at 14 points within these wetlands where sediment samples were collected and characterized by the US Fish and Wildlife Service (May 2016) for potential contaminant chemicals. We also measured water quality variables and noted vegetation and sediment types at each macroinvertebrate sampling point. Here we compare macroinvertebrate assemblages amongst the 14 sampled points within Munger Wetlands, and to other samples within the SLRE that represent less disturbed wetland sites with similar vegetation and habitat types present. We also compare macroinvertebrate metrics to sediment chemistry results within Munger Wetlands. These results may help managers prioritize restoration of aquatic habitat in this area.

Designing and Implementing the 21st Ave W Aquatic Habitat Restoration

Dan Breneman[1]
[1] MPCA

Environmental metrics were used in a surface-area weighted averaging approach for the 21st Avenue West restoration project to assess existing site condition and inform design decisions. Sediment quality targets, benthic macroinvertebrates, and aquatic macrophyte metric scores were compared to estuary-wide restoration targets. Statistically comparing area-weighted means with restoration targets identified areas within the site that represent the highest probability of success. Great Lakes Restoration Initiative and Harbor Maintenance Trust Funds ($12.7M) were used to access 800K cubic yards of navigational dredge material for constructing habitat features over five seasons starting in 2013. A total of 187 restored acres within the 21st Avenue West project site are predicted to increase the overall biological score by 12%.

Atmospheric Mercury Loading in the St. Louis River Watershed and Potential Correlation with Dragonfly Bioaccumulation

Heather Buttgen[1]
[1] *Fond Du Lac Tribal and Community College*

The purpose of our project is to identify possible sources of high mercury levels in Northeastern Minnesota. We hope to accomplish this by measuring atmospheric deposition on land as well as estimating mercury levels using odonates, a common watershed predator species. We sampled 4 different locations in order to collect leaf litter and odonates. Areas of study; Whiteface River, West Two River, Cloquet River, and Otter Creek, all sites are within the St Louis River Watershed

This project is a continuation of an EPA EcoAmbassador project started in 2014. Continuous data sets are beneficial for developing a baseline understanding of many environmental parameters. Our project was designed in conjunction with the efforts of tribal resource managers to protect natural resources vital to tribal members. This and other projects may be used to provide guidance in protecting members by enhancing tools such as fish advisories. Partnerships with UMD have allowed us to build a bridge between FDLTCC and local university science departments. Mercury contamination hasn't always been a concern, but it is now commonly accepted that humans should consume fewer larger fish and less fish overall. Odonates are a common organism found throughout the region and their analysis is much more economical than traditional methods of measuring mercury in fish. Understanding how mercury flows through this ecosystem is important because high levels of mercury can have negative effects on our health such as tremors, vision loss, fertility, and delayed brain development. These potential problems for the Indigenous Community are particularly important because fish is a large component of the traditional diet.

This project enables FDLTCC students to gain valuable experience in field and laboratory techniques as well as assisting the FDL Natural Resources Program with important data enabling a more complete understanding of mercury in the St. Louis River watershed.

Seiche Propagation in the St. Louis River Freshwater Estuary

Alicia Couch[1, 2]
[1] *LSNERR* [2] *UW – Superior*

Water exchange in Laurentian Great Lakes estuaries is due to a phenomenon called the seiche. The seiche is the result of changes in wind velocity and atmospheric pressure on a large enclosed body of water, such as Lake Superior. It can be described as the sloshing back and forth of water, and can be viewed as waves or changes of water depth, and may even appear to be a tide, such as seen in the oceans. However, unlike tides the seiche has no regular periodicity, duration, or intensity. In this study we examined the effect of the seiche on upriver water velocity and water level using ADCPs and pressure transducers. We found that water velocity is greater through the Duluth entry than the Superior entry and Oliver Bridge. This is probably due to the Duluth entry being narrower than the Superior entry and closer to the lake than Oliver Bridge. Water flow can switch direction quickly and often over the course of 24 hours. Upriver flow was seen at Oliver (17 km upriver) and tends to lag behind the entries by approximately 2 hours. Inflows at Duluth entry appear to be correlated with higher water levels in Pokegama Bay.

A Method for Analyzing Volunteered Geographic Information to Visualize Community Valuation of Ecosystem Services

Jessy Carlson[1]
[1] *US EPA*

Volunteered geographic information (VGI) can be used to identify public valuation of ecosystem services in a defined geographic area using photos as a representation of lived experiences. This can help researchers better survey and report on the values and preferences of stakeholders involved in rehabilitation and revitalization projects. Current research utilizes VGI in the form of geotagged social media photos from three platforms: Flickr, Instagram, and Panoramio. Social media photos were obtained for the neighborhoods next to the St. Louis River in Duluth, Minnesota, and are being analyzed along several dimensions: the spatial distribution of each platform; the characteristics of the physical environment portrayed in the photos; and the ecosystem services depicted. In this poster, we focus on the photos from the Irving and Fairmount neighborhoods of Duluth, MN, to demonstrate the method at the neighborhood scale. This study demonstrates a method for translating the values expressed in social media photos into ecosystem services and spatially-explicit data to be used in multiple settings, including the City of Duluth's Comprehensive Planning and community revitalization efforts, habitat restoration in a Great Lakes Area of Concern, and the USEPA's Office of Research and Development.

2012 Flood Impacts on St. Louis River Plant Communities

Nathan Dahlberg[1, 2]
[1] LSRI [2]UW – Superior

On June 17, 2012, the Twin Ports area recorded one of its largest floods in history. This event created a massive disturbance in plant communities in the St. Louis River estuary. Initial literature reported significant changes in vegetation pre and post flood, however, little research has been reported in subsequent years. Using an estuary wide vegetation database compiled from multiple projects, we examined the impacts of this flood event on wetland and aquatic plant communities. By analyzing differences in Mean C, hydrogeomorphology, and vegetation occurrence, we discovered significant differences between pre-flood and post-flood vegetation surveys, especially in littoral zones. Our analysis suggests that the aquatic plant communities have not currently recovered to their pre-flood condition, indicating that the estuary has not yet recovered from the 2012 flood. This abstract is subject to change pending further analyses.

40th Ave W Aquatic Habitat Restoration

Diane Desotelle[1]
[1] *MPCA*

The poster will describe the purpose, analysis, and plans and specifications for the construction of aquatic habitat designed to improve the abundance and diversity of aquatic vegetation and macroinvertebrates at 40th Ave W just south of the Hibbard Power Plant.

Public-Private Partnerships for Cleaning Up Howards Bay

Joe Graham[1]
[1] *WI DNR*

Wisconsin Point Dune Restoration Project

Megan Grove[1]
[1] NOAA

The Wisconsin Point Dune Restoration project is specifically listed, as a priority project, in the St. Louis River Area of Concern 2013 Remedial Action Plan update as an "Action Still needed to Achieve Removal" of BUI 9: Loss of Fish and Wildlife Habitat. Completion of this project will make progress towards BUI 9 targets of rehabilitation and hydrologically connected habitats and treatment of invasive species. In order to achieve this, the project will eliminate approximately 14 of 20 parking turnouts and beach access points along the Lake Superior side of Wisconsin Point, which have led to dune deterioration. The remaining turnouts will be redesigned using low-impact development techniques, and improved to include elevated boardwalks for beach access over the dunes. A boat landing and canoe landing will also be enhanced for continued use by the public for recreational and hunting purposes. The eliminated parking and access points will be restored to native plant communities, which have been damaged by foot traffic and vehicle use. Additionally, shoreline erosion along Allouez Bay, resulting from steep slopes from past road construction, will be addressed by stabilizing the shoreline in vegetation and structure. The initial estimate for the area of native plant community and habitat restoration is as follows: approximately 45,600 sq. ft. of forested area, approximately 47,700 sq. ft. of dunes, and approximately 2,800 ft. of shoreline.

Flag River Estuary Restoration: Understanding Estuary Dynamics and Logistical Constraints

Jon Gumtow[1]
[1] *Stantec Consulting*

The Town of Port Wing and the Wisconsin Department of Natural Resources (WDNR) are partnering with Stantec Consulting to restore wetland hydrology and habitat in the Flag River estuary. The project area contains two existing settling ponds constructed in 1968 as part of the Town of Port Wing's wastewater treatment system. This facility was decommissioned in 2011 providing a unique opportunity utilizing Great Lakes Restoration Initiative (GLRI) funding to restore this high quality estuary habitat.

To understand the dynamic characteristics of the estuary, an analysis of historic records along with detailed physical, biological, and hydrologic studies were completed. This data was critical to developing a project design that restores a ecological gradient from open water to sedge meadow and scrub-shrub habitats that existed prior to 1968. Hydrologic studies helped understand the influence of seiche effects on the estuary's upper reaches. Plant inventories, soil borings, and topographic surveys played an important role in developing a restoration approach that considers the control of non-native invasive species, including reed canary grass (Phalaris arundinacea), and hybrid cattail (Typha, sp.).

Stakeholder collaboration during the early stages of this project was critical to understand and manage logistical constraints. Site access, construction techniques, recreational end-use, and beneficial reuse of surplus soil were considered early during the concept design phase to control costs and simplify the regulatory permitting obligations.

Using eDNA to estimate distribution of fish species in the St. Louis River

Chelsea Hatzenbuhler [1, 2, 3, 4]
[1] ORISE [2] USEPA, [3] NHEERL/ MED, [4] Duluth, MN

Environmental DNA (eDNA) analysis of extracellular material shed by aquatic organisms is a noninvasive genetic tool that can improve efficiency and reduce costs associated with species detection in aquatic systems. eDNA methods are widely used to assess presence/absence of a target species, and have also recently demonstrated potential for estimating biodiversity in controlled environments. Here we apply eDNA methods to estimate distribution of fish species in a larger and more complex system, the St. Louis River. The St. Louis River provides a suitable study area because fish diversity and species distribution in the St. Louis River is well documented, thanks to past and ongoing fishery assessment and invasive species early detection monitoring efforts by the U.S. EPA, U.S. FWS, and state and tribal agencies. For analysis of fish eDNA, water samples were collected from 240 randomly selected sites extending from the Duluth-Superior Harbor and Allouez Bay up to the Fond du Lac Dam; 120 sites were sampled in mid-June and another 120 in late October. At 30 sites, an additional water sample was collected for an inter-lab comparison of results obtained using identical processing methods at independent labs. Results from our study provide insight into the utility of eDNA methods for estimating fish distribution in large, complex aquatic systems and begin to inform us about how these methods can be operationalized for use by management agencies.

Minnesota Slip - Sediment Clean-Up

Heidi Bauman [1]
[1] *MPCA*

This poster describes the site design process to clean up contaminated sediments at the slip where the Irvin Ore Boat is located. This is part of the St. Louis River Area of Concern's Remedial Action Plan's work toward removal of the "Restrictions on Dredging" beneficial use impairment.

Assessment of the St. Louis River AOC Fish Tumors and Other Deformities Beneficial Use Impairment

Joel Hoffman[1]
[1] *US EPA*

The Fish Tumors and Other Deformities Beneficial Use Impairment (BUI) was listed as one of nine BUIs at the time the St. Louis River AOC was designated in 1987. At the time, no formal studies had been conducted to estimate the prevalence of either fish tumors or deformities. To assess the current status of fish tumors and deformities in the AOC, adult white suckers (Catostomus commersonii) were sampled during the spawning period in May during 2011, 2013 and 2015. We measured each fish, determined its sex and age (sagittal otolith), sampled dorsal muscle tissue for carbon and nitrogen stable isotope ratios to determine river versus lake residency, and conducted a necropsy-based assessment to document grossly visible abnormalities. Pieces of any observable abnormalities were preserved for subsequent histological analyses. A total of 622 white sucker were surveyed from 2011 through 2015. Of these, 27 (4.3%) white suckers had skin neoplasms, all of which were papillomas. A total of 29 (4.7%) of the white suckers had liver neoplasms. Sex and age were significantly associated with skin neoplasia incidence, whereas only age was significantly associated with liver neoplasia incidence. Neither neoplasia type was significantly associated with habitat use, indicating that neoplasia incidence did not change with increasing feeding in the AOC relative to Lake Superior. Further, there was not a significant difference in skin or liver neoplasia incidence between migratory white sucker captured below the dam and land-locked white sucker captured above Fond du Lac Dam. We conclude that incidence rates of contaminant-related internal and external tumors and deformities in resident benthic fish species do not exceed incidence rates from unimpaired areas elsewhere in the Great Lakes Basin.

The Saint Louis River Idea-Slam: Crowd Sourcing Good Ideas for the Saint Louis River

Tom Hollenhorst[1]
[1] *US EPA*

As part of the 2017 Saint Louis River Summit, we propose hosting an Idea-Slam using software originally developed by the U.S. Consumer Financial Protection Bureau. Idea-box is an open source online app/website used to collect and surface ideas from members of an organization, or the public in general. Using the app, users login, view a request or challenge for new ideas, can submit their own ideas and/or view, comment and vote on other previously submitted ideas. Initially we will start with three idea request or challenges as listed below. The first will be run prior to the Summit to help generate additional challenges that might be added for the summit depending on the results.

Initial Idea Challenges:

1. (Prior to summit) If you could ask a large group of Saint Louis River focused scientist, stakeholders, managers, politicians and the public a question about the SLR, what would you ask?

2. How might we better engage students and educators with the Saint Louis River?

3. How might we employ citizen science for the Saint Louis River?

The Idea-box app will be available for users two weeks before the Saint Louis Summit. We will e-mail previous summit participants and others an invitation to participate in the Saint Louis River Idea-Slam with clear instruction on how to proceed. During the morning of the first day at the Saint Louis Summit we will make a brief announcement about the Idea-Slam (< 2min.), and invite everyone to participate. This will be complimented with an Analog Idea-Slam using flip charts, colored markers and sticky dots (for voting) somewhere near the poster display area. Ideas collected on the flip charts way will also be added to the Idea-box app. On the second day of the conference we will briefly report on the results and provide the opportunity for participants to network and further discuss the most popular ideas as the summit schedule might allow. After the conference, ideas and comments collected during the Idea-Slam will be compiled, summarized and reported on.

Creating Regional Interdisciplinary Collaboration with Open Spaces at the People & Places Forum

Sakib Mahmud[1]
[1] *UW – Superior*

Facilitating the integration of natural and social sciences in resource management presents a wide range of questions, including where to find collaborators and what knowledge collaborators can contribute. In order to begin to document answers to these questions, the Twin Ports-based People and Places Work Group coordinated a special gathering to bring together researchers and scholars from diverse fields to discuss environment-human research and collaboration opportunities. Hosted by the Lake Superior National Estuarine Research Reserve and the US EPA, the group invited over 150 individuals and participants from eight regional universities. The goals were to collect and document ongoing regional research and teaching activities, as well as research interests and expertise. The work group includes members from the University of Wisconsin-Superior, Minnesota Sea Grant, the Lake Superior Reserve and the US EPA. Utilizing Open Space meeting designs, the work group invited participants to brainstorm about potential collaborations, in general, and ecosystem services research, in particular. Our poster summarizes our process for building a regional-interdisciplinary network, documents our expertise, as well as outlines our initial outcomes and plans to continue to build momentum around the growing interest in collaboration.

Investigating phenology of larval fishes in St. Louis River estuary shallow water habitats

Greg Peterson[1]
[1] *US EPA*

As part of the development of an early detection monitoring strategy for non-native fishes, larval fish surveys have been conducted since 2012 in the St. Louis River estuary. Survey data demonstrates there is considerable variability in fish abundance and species assemblages across different habitats and at multiple temporal scales. To optimize early detection monitoring we need to understand temporal and spatial patterns of larval fishes related to their development and dispersion, as well as the environmental factors that influence them. In 2016 we designed an experiment to assess the phenological variability in larval fish abundance and assemblages amongst shallow water habitats. Specifically, we sought to contrast different thermal environments and turbidity levels, as well as assess the importance of vegetation in these habitats. To evaluate phenological differences we sampled larval fish bi-weekly at nine locations from mid-May to mid-July. Sampling locations were split between upper estuary and lower estuary to contrast river versus seiche influenced habitats. To assess differences in thermal environments, temperature was monitored every 15 minutes at each sampling location throughout the study, beginning in early April. Our design also included sampling at both vegetated (or pre-vegetated) and non-vegetated stations within each sampling location throughout the study to assess the importance of this habitat variable. Hydroacoustic surveys (Biosonics) were conducted in alternate weeks between larval fish sampling events, to quantify the progressive development of vegetation. Temperature data show that shallow upper estuary habitats warm faster than similar habitats in the lower estuary. Higher variability in warming rates was observed amongst lower estuary habitats. These and other habitat patterns will be compared to larval fish abundance and assemblage data to assess temporal and spatial relationships that could improve non-native fish early detection. [This abstract does not necessarily reflect U.S. EPA policy].

Mesocosm experiment: are contaminated sediments limiting growth of aquatic plants at 21st Avenue West?

Carol Reschke[1]
[1] *NRRI – UMD*

Within the St. Louis River estuary, the bay at 21st Avenue West has been identified as a restoration site due to high levels of sediment contaminants including polycyclic aromatic hydrocarbons (PAHs), mercury, polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzo-p-furans (PCDFs), as well as very sparse aquatic vegetation, depauperate macroinvertebrate communities, and therefore degraded fish and wildlife habitats. Local scientists and managers have suggested at least 5 hypotheses to explain the very sparse cover of aquatic vegetation (AV) at 21st Avenue West: 1) contaminated sediments are limiting growth of AV; 2) contaminated water is limiting growth of AV; 3) browsing by waterfowl or fish is limiting growth of AV; 4) lack of propagules is limiting growth of AV; and 5) excessive deposits of sediments from Miller Creek and Coffee Creek are limiting growth of AV. Since detailed and extensive studies of sediment contamination have been conducted in the estuary, evaluating the contaminated sediments hypothesis was a priority; this study of aquatic plant growth and possible limiting factors was designed to inform and support restoration efforts in the estuary, which is a Great Lakes Area of Concern. A mesocosm experiment was designed to determine if sediment conditions limit aquatic vegetation growth in the bay at the 21st Avenue West restoration site. The mesocosm experiment was run in summer 2014. Three species of aquatic plants (water celery, sago pondweed, and softstem bulrush) were grown in sediment cores collected from a vegetated reference site (Clough Island) and an unvegetated restoration site (21st Avenue West). The plants were grown in 50 gallon mesocosms filled with untreated water from Lake Superior, with continuous aeration from aquarium air pumps. Plants were grown for 12 weeks before harvest. We found that two of the three species (water celery and sago pondweed) grew well in sediments from 21st Avenue West when grown in mesocosms filled with untreated Lake Superior water. The third species (softstem bulrush) was difficult to grow and plants that survived lost biomass during the experiment. The results suggest that it's unlikely that sediment contamination alone is limiting growth of aquatic plants at 21st Avenue West restoration site.

Field experiment: is contaminated water limiting growth of aquatic plants at 21st Avenue West?

Carol Reschke[1]
[1] *NRRI – UMD*

Within the St. Louis River estuary, the bay at 21st Avenue West has been identified as a restoration site due to high levels of sediment contaminants including polycyclic aromatic hydrocarbons (PAHs), mercury, polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzo-p-furans (PCDFs), as well as very sparse aquatic vegetation, depauperate macroinvertebrate communities, and therefore degraded fish and wildlife habitats. Local scientists and managers have suggested at least 5 hypotheses to explain the very sparse cover of aquatic vegetation (AV) at 21st Avenue West: 1) contaminated sediments are limiting growth of AV; 2) contaminated water is limiting growth of AV; 3) browsing by waterfowl or fish is limiting growth of AV; 4) lack of propagules is limiting growth of AV; and 5) excessive deposits of sediments from Miller Creek and Coffee Creek are limiting growth of AV. A 2014 mesocosm experiment showed that it's unlikely that sediment contamination alone is limiting growth of aquatic plants at the 21st Avenue West restoration site. Subsequently a field experiment was designed to test whether contaminated water or the interaction of contaminated water and contaminated sediments at 21st Avenue West are limiting growth of aquatic plants in the bay. The field experiment was run in summer 2015. Two species of aquatic plants (water celery and sago pondweed) were grown in sediment cores collected from a vegetated reference site (Kingsbury Bay) and an unvegetated restoration site (21st Avenue West). The capped sediment core tubes were replaced in the sites in plastic buckets dug into the sediment; and experimental plants were surrounded by circular exclosures of wire fencing designed to prevent browsing by waterfowl or large fish. Plants were allowed to grow 10 weeks before harvest. We found that aquatic plants grew well in sediments and water within exclosures at 21st Avenue West. Consequently, it seems unlikely that water contamination alone is limiting short-term growth of aquatic plants at the 21st Avenue West restoration site. We found rusty crayfish hiding in sediments at the base of three plants when they were harvested, and plants at 21st Avenue West were covered with an oily residue, suggesting that further studies are needed.

Enhanced Microbial Sulfate Removal Through a Novel Electrode-Integrated Bioreactor

Daniel Takaki[1]
[1] *UMD*

In northeast Minnesota, there is a great concern of high sulfate levels in water systems due to its adverse impacts to wild rice ecosystems. There is additional concern due to the possible contributions on methylmercury production and eutrophication. Increased interest has emerged for developing new technologies to help treat the high levels of sulfate in the water. Biological sulfate reduction is a promising and economically viable plan for maintaining low levels of sulfate and sulfide, but its performance is highly variable. In this work, low electrical potential is applied to stimulate and sustain the process by continually supplying electron donor substrates to the sulfate reducing bacteria. Simultaneously, the sulfide formed via biological sulfate reduction can be removed in the form of iron sulfide. Sediment bioelectrochemical reactors were used to test the effect of low voltage on the efficacy of sulfate reduction and iron sulfide formation.

Stainless steel electrodes were inserted into reactors containing sediment collected from Second Creek near Hoyt Lakes where the level of sulfate is relatively high. Synthetic mine water with a sulfate concentration of 1000 ppm was treated within the reactors operated at 2 Volts along with open circuit reactors as the control. The sulfur chemistry in the pore water of the reactors was assessed to determine microbial activity; this resulted in demonstrating active sulfate reduction occurred. Microbial community structure and relative abundance of different species associated with sulfate reduction in the reactors will be examined. This study will result in a proof of concept application of electrical potential to provide electron donor and acceptor substrates to biological sulfate treatment in a controlled manner.

Mapping Wetland Areal Change in the St. Louis River Estuary Using GIS

Joseph Thoennes[1]
[1] *UW – Superior*

Wetlands are a crucial component of the environment in the St. Louis River estuary and it is important to track changes in wetland areas through time. Using the GIS program ArcMap, we delineated emergent wetlands in regions near Pokegama Bay and Allouez Bay for four different years: 1938, 1962, 1986, and 2016. We obtained historic aerial photos from Douglas County land records for these time periods, integrated the photos into ArcMap, and created personal geodatabases for each year. We then created two feature classes in each geodatabase, one for Pokegama and one for Allouez regions. Next, we used on-screen digitization to create polygons delineating emergent wetland boundaries at each site for each of the years. Using these polygons, we calculated the geometry of each emergent zone and from there determined the total change in wetland area over the decades. The results showed a significant negative trend in emergent wetland area, especially between 1962 and 1986 when total area dropped by about 150 ha, which was over 50% of the combined emergent vegetation area at these two sites. Between 1986 and 2016 total wetland area at these sites increased by 74 ha to 168 ha, but this was still 31% lower than in 1938, which was the year of the earliest available aerial photos. There are several reasons why the net long-term trend was negative for the amount of emergent vegetation at these sites, such as fluctuating water levels, or a reduction in cultural eutrophication with the introduction of the Western Lake Superior Sanitary District (WLSSD) in 1971.

Slowing the Flow: Setting Priorities and Defining Success in Lake Superior's South Shore Watersheds

Molly Wick[1]
[1] *Oak Ridge Institute for Science*

For over 60 years, watershed conservation efforts to improve water quality have largely focused on restoring and protecting hydrology under the mantra "slow the flow". This approach seeks to reduce peak flows with landscape scale watershed restoration approaches that increase in-channel roughness, upland roughness, upland retention and infiltration. As the frequency of high intensity storms increases, we are compelled to improve methods to prioritize slow the flow efforts and measure success in the Lake Superior basin in Wisconsin. Relying on an extensive literature review, we identified metrics and associated thresholds for impacts to stream hydrology, and compiled the best available datasets to evaluate those metrics. Storage is one of the most important parameters in predicting peak flows. The recently-updated Wisconsin Wetland Inventory along with the Wetland Functional Assessment, which describes wetland functions like surface water detention based on geomorphological characteristics, allow enhanced evaluation of subwatershed storage and opportunities to increase storage. In addition, a Potentially Restorable Wetlands layer, available across the basin, identifies probable historic wetlands based on soils and topography. Along with basin-wide data on soils, stream slope, precipitation, and snowmelt; we can calculate subwatershed peak discharges and compare them to the threshold where impacts start to be observed. The availability of detailed land use data (NASS Cropland Data Layer, WiscLands2, etc.) allow us to evaluate subwatershed open lands compared to peak flow impact thresholds. With land use overlaid with land ownership data, we can identify actionable opportunities for conservation as well as identify priority actions tailored to the existing land use interests (agriculture, forestry, municipal, etc.) at the subwatershed scale. The increasing availability of high-resolution, spatially resolved datasets allows us to advance strategic efforts rooted in sound science to better implement and evaluate slow the flow efforts in the Lake Superior basin.

The Lake Superior Regional Citizen Science Collaborative - Developing a Network for Community Collaboration

Emily Wilmoth[1]
[1] Lake Superior Regional Citizen Science Collaborative (LSRCSC)

The Lake Superior Regional Citizen Science Collaborative (LSRCSC) seeks to identify citizen science efforts and opportunities in the Lake Superior region in order to create an opportunity for communication and collaboration among people who want to participate in citizen science, researchers, and educators. Our group has coalesced from a much larger group of citizen science advocates and practitioners via a small seed grant from UM-Twin Cities. LSRCSC includes scientists and educators from University of Minnesota Duluth (NRRI and Sea Grant), Fond du Lac Tribal and Community College, Fond du Lac Band of Lake Superior Chippewa, and the US EPA Mid-Continent Ecology Laboratory. There is considerable interest from various agencies and organizations in applying citizen science to assessing ecosystem health of the St. Louis River Estuary and western Lake Superior, as well as engaging communities with scientific findings. In addition, there is a need to better understand how citizen science can best fit the needs of the Lake Superior region. LSRCSC is working toward; compiling a detailed list of existing citizen science programs, conducting a review of the citizen science literature relevant to the region, establishing a community network of users and creating a website (superiorcitsci.org) for networking and sharing of ideas and resources. This will culminate in a regional citizen science symposium for interested groups with the objective of developing a shared list of potential projects and outcomes to move citizen science forward.

Keynote Speaker

Peter David, GLIFWC
Learning in the Great Spirit's Garden: Stories from Manoomin (Wild Rice)

Peter David is a wildlife biologist with the Great Lakes Indian Fish and Wildlife Commission where he assists GLIFWC's member tribes in implementing their off-reservation treaty rights. He received his education (bachelor's and master's degrees in wildlife ecology) from the University of Wisconsin-Madison, and from the tribal elders and members for whom he has worked the last 30 years. He has had the opportunity to work with a variety of natural resources at GLIFWC, ranging from waterfowl to wolves, but most of his focus has been on manoomin or wild rice. He likes to spend his free time with his wife Lisa and 3 children in the great outdoors.

River Talks

RiverTalks: St. Louis River Science and Stories LIVE!

6:30-7:30PM

UWS Yellowjacket Union Great Room

Event Description:

A few years back, researchers interviewed a diverse group of folks who had spent years, decades even, working and playing on the St. Louis River. They used the stories to produce a website that connects human experiences to ongoing research on the River. Come hear those storytellers share their experiences and observations about the River over the course of their lives, LIVE!

Participants

Bob Cragin, (Phone calls only)
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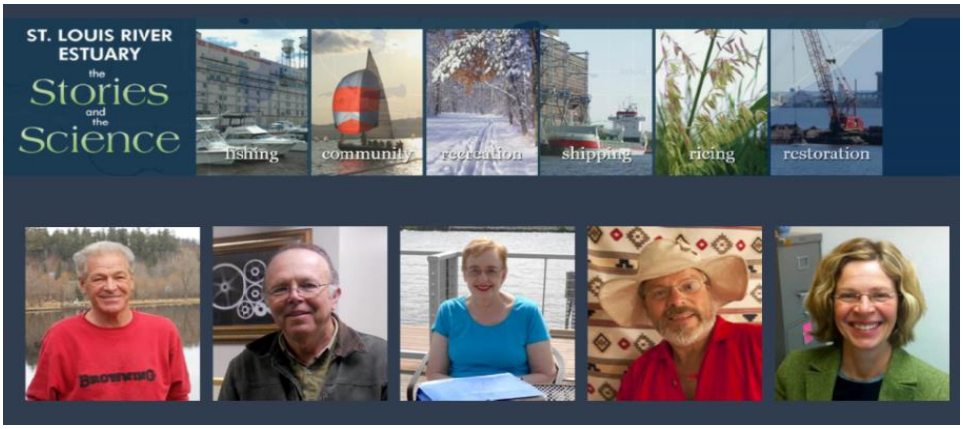

Program Agenda

Agenda DAY ONE: Tuesday, March 14

	Facilitator: Erika Washburn, Lake Superior National Estuarine Research Reserve (LS Reserve)	
8:30	**WELCOME** Erika Washburn, LS Reserve	
8:40	**OPENING REMARKS** Renee Wachter, Chancellor, UW-Superior Emily Larson, Mayor, Duluth Linda Cadotte, Director of Parks, Recreation and Forestry, Superior	
9:00	**KEYNOTE** **Learning in the Great Spirit's Garden: Stories from Manoomin (Wild Rice),** Peter David, GLIFWC	
9:50	**The Power of Connection: Sparking Creativity and Innovation by Re-Building our Relationship to the St. Louis River,** Kris Eilers, St. Louis River Alliance	
10:00	**A Community Runs Through It,** Molly MacGregor, MNDNR	
10:20	**BREAK** The Landing	**10:20 BREAKOUT: River Research Collaborations: Discussing Best Practices for Community & Academics, A University of Minnesota, Institute on the Environment Supported Listening Session,** Liz Hill - YU 203
10:50	**Designing Sediment Remediation Projects that Account for the Physical and Environmental Condition of Adjacent Structures in the St. Louis River Area of Concern,** Chad Scott, AMI Consulting Engineers	
11:10	**Are We Ready? Lower St. Louis River Basin Community Climate and Extreme Weather Perceptions and Preparedness: Mixed Methods Study Findings,** Vanessa Perry, UMN-Twin Cities	
11:30	**Working Together to Manage Duluth's Urban Watersheds,** Jesse Schomberg, MN Sea Grant	
11:50	**Update on NOAA Habitat Focus Area for the St. Louis River,** Liz Mountz, NOAA Office of Coastal Management	
12:00	**LUNCH, NETWORKING, AND POSTERS** The Landing	**12:30 BREAKOUT: Water Quality & Lab Tech Networking** YU 204
1:30	**Integrating Health and Fairness into Duluth's Comprehensive Plan,** David Bolgrien, USEPA-MED	
1:40	**Decoding Ecosystem Services in the Neighborhood through the Development and Utilization of a Framework,** Kathleen Williams, USEPA Office of Research and Development	
2:00	**St. Louis River AOC Water Quality Data Visualization Tools,** Rich Axler, NRRI-UMD	
2:10	**2016 AOC Progress and Updates,** Rick Gitar, Fond du Lac Band of Lake Superior Chippewa	
2:30	**Beneficial Use Impairment 2 Status Report,** Melissa Sjolund, MN DNR	
2:40	**BREAK** – The Landing	
3:00	**Fish Tumors and Other Deformities Beneficial Use Impairment: Results of Tumor Assessment and BUI Status** Matt Steiger, WDNR	
3:10	**Tracking the Source of E. coli at Impaired Beaches in the St. Louis River Area of Concern,** Heidi Saillard, LSRI	
3:30	**Monitoring the St. Louis River Lake Sturgeon Population,** Paul Piszczek, WDNR	
3:40	**Removing Legacy Wood Waste,** Molly MacGregor, MDNR	
3:50	**Knowlton Creek Stream Restoration,** Paige Baker, Stantec	**4:00-5:00 RIVER CAREERS: STUDENT NETWORKING EVENT** YU 204
4:10	**CLOSING REMARKS** Erika Washburn, LS Reserve	
4:30	**POSTER SESSION** – The Landing Featuring live music from Jim Hall	
6:30	**THE RIVER TALKS – St. Louis River Stories and Science LIVE! - Great Room**	
7:30	**ADJOURN**	

Agenda DAY TWO: Wednesday, March 15

	Facilitator: David Bolgrien, US EPA		
8:30	**WELCOME** David Bolgrien, US EPA		
8:40	**Integrating Biosolids Land Application with the Crop Nutrient Needs on Farms in Northern Minnesota and Wisconsin,** Richard Wolkowski, UW-Madison/UW-Extension		
9:00	**Evaluation of the St. Louis River Walleye Fishery,** Kirk Olson, WDNR		
9:20	**Microhabitat Influence on Larval Fish Assemblages within Vegetated Beds: Implications for Restoration,** H.N. Ramage, UMD		
9:40	**Protecting Riparian Areas Along the Pokegama River by Reducing the Impacts of Emerald Ash Borer through Underplanting,** Shon Schooler, LS Reserve		
9:50	**10 Things We Learned from Your Vegetation Data,** Nick Danz, UW-Superior		
10:10	**Effect of Sustained High Water Levels on Aquatic Vegetation in Pokegama Bay,** Evan Heberlein, LS Reserve, UW-Superior		
10:30	**Effectiveness of the Leaf Skeletonizing Beetle in the Control of Purple Loosestrife in Pokegama Bay,** Adam Lein, LS Reserve, UW-Superior		
10:40	**BREAK** – The Landing		
11:00	**Small Plastic Particles with Huge Environmental Impacts in Our Freshwater Systems,** Lorena Rios Mendoza, UW-Superior		
11:10	**Tributary Influence on the Biogeochemistry and Metabolism of Nearshore Lake Superior,** Josh Delvaux, UW-Milwaukee		
11:30	**Common Terns in the Great Lakes Region: Tracking Movement for Conservation Planning,** Annie Bracey, NRRI		
11:50	**Update on Great Lakes Data Integration Visualization, Exploration and Reporting (GL DIVER) System: Future of Great Lakes Data Management,** Emily Punke, WDNR; Kirk Wythers, MPCA; Annie (Johns) Gibbs, NOAA		
12:00	**Focus Group to Discuss Symbology, Labeling and Other Facets of the Proposed St. Louis River Estuary Guidebook,** Martina McPherson, ERG (NOAA OCM)		
12:10	**LUNCH, NETWORKING, AND POSTERS** – The Landing	**12:30: DIVER Database Details** YU 203, Emily Punke, WDNR	**12:30: St. Louis River Estuary Guidebook** YU 204, Martina McPherson, ERG
1:30	**What is New with NOAA's Coastal Change Analysis Program (C-CAP)** Brandon Krumwiede, NOAA Office of Coastal Management		
1:50	**Effects of Tributary Inflows on Water, Sediment, and Nutrient Budgets in the St. Louis River Estuary,** Richard Kiesling, USGS		
2:00	**Annual Mercury Bioaccumulation in the SLR Reservoir System: A Multi-year Study of Water Chemistry and Young-of-year Perch,** Nancy Schuldt, Fond du Lac Band of Lake Superior Chippewa		
2:20	**Modelling Future Improvements in the St. Louis River Fishery from Sediment Remediation and Aquatic Habitat Restoration,** Joel Hoffman, USEPA-MED		
2:40	**BREAK** – The Landing		
3:10	**Mercury Concentrations in Burrowing Mayfly Nymphs (Hexagenia limbata) in the St. Louis River Estuary,** Craig Roesler, WDNR		
3:30	**Development of a Mercury Remediation Target for the St. Louis River AOC,** Joel Hoffman, USEPA-MED		
3:40	**A Tiered Framework for Evaluating Sediment Contamination including Bioavailability: Implications for Restoration and Remediation in the St. Louis River Estuary,** Nathan Johnson, UMD		
4:00	**Vegetation Metrics for Evaluation of Management and Restoration Efforts,** Carol Reschke, NRRI-UMD		
4:20	**State of the Estuary – Developing a Long Term Monitoring, Assessment and Reporting Framework for the Lower St. Louis River,** Tom Hollenhorst, USEPA-MED		
4:30	**CLOSING REMARKS: The Road to Resilience,** David Bolgrien		
4:40	**ADJOURN**		

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