

Proceedings of the St. Louis River Estuary 2013 Summit



The 2013 St. Louis River Estuary Summit

February 26-27, 2013

University of Wisconsin - Superior

Yellowjacket Union

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Acknowledgments

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Introduction

The St. Louis River Estuary Summit was once again a great success. Over 180 people attended the summit this year, up from 150 last year and 140 in 2011. Although most participants were local, some travelled from as far away as Boulder Colorado, Green Bay, and Milwaukee to attend.

We had 23 talks and 10 posters that presented information on diverse subjects such as the Twin Ports harbor economy, science education, environmental research, mining, and Area of Concern restoration projects; all with relevance to the estuary. We also held group roundtable discussions this year, four each day, where interested individuals met around a predetermined subject during lunch. Discussion points were recorded and are added as an appendix to these proceedings. An exciting addition this year was the solicitation of summarizing remarks from attendees representing specific groups (research, port operations, public involvement, resource management, and education) at the closing of the Summit. It was great to hear what people had learned and how they expected to use this information, both personally and professionally. A common theme was that networking was a very important component of the conference; as people learned what others were doing they could then approach them and ask questions, develop ideas, and coordinate projects. A second repeated remark was that the amount of work being done in the estuary is incredible and that the Summit really helps to both deliver information and to remind us of the complexity of the environmental, economic, and social functions of freshwater estuaries.

We would like to thank all the presenters for bringing their exciting work to the summit. Without their donation of time and expertise there would be nothing to see (literally). Also, thanks to the sponsors for helping make this event free of charge for attendees. Without their support registration costs would likely reduce the ability for students and the public to attend this event; some of the people we want more involved. Also, special thanks to Marie Zhuikov who brought us into the 21st century by “tweeting” the meeting. This year Twitter, next year webinar?

Abstracts

Distribution of Submerged Aquatic Vegetation in the St. Louis River Estuary: Maps and Models

Ted Angradi, Mark Pearson, David Bolgrien, Brent Bellinger, and Mathew Starry
U. S. Environmental Protection Agency, National Health and Environmental Effects Laboratory,
Mid-Continent Ecology Division, Duluth, MN; SRA International Inc., a contractor to EPA.

In late summer of 2011 and 2012, we used echo-sounding gear to map the distribution of submerged aquatic vegetation (SAV) in the St. Louis River Estuary (SLRE). From this data, we produced maps of SAV distribution and we created logistic models to predict the probability of occurrence of SAV. Submerged Aquatic Vegetation predictor variables varied among areas of the SLRE, but generally included depth, fetch, fetch depth, and bed slope. Inclusion of digital echo data characterizing substrate hardness and clay content improved the model fit. About 40% of sites in less than three meters depth had SAV. Where SAV was present, SAV cover was 30-40%. The models can be used to estimate optimal design parameters for SLRE habitat restoration that includes modification of depth, slope, and fetch distance. The effects of the June flood on SAV could be detected using this methodology. *This abstract does not necessarily reflect U.S. EPA policy.*



Mark Pearson

A Survey of the St. Louis River Estuary with Emphasis On Non-Indigenous Species and Habitat Structure

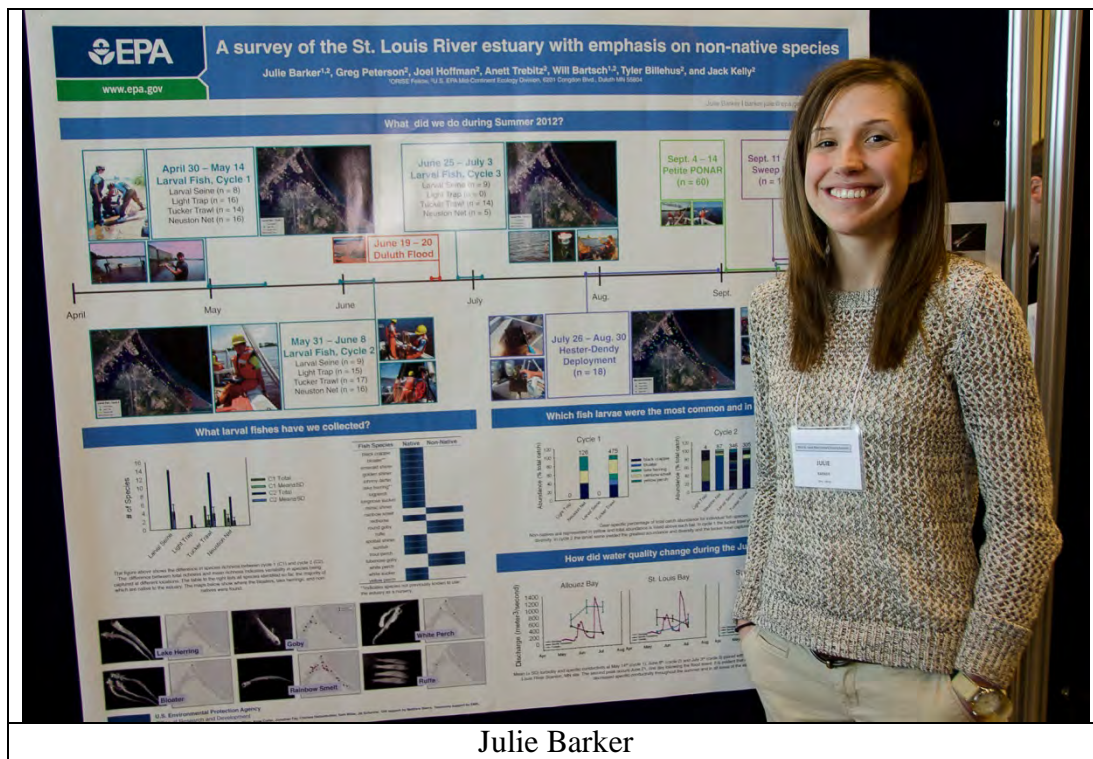
Julie Barker, Greg Peterson, Joel Hoffman, Anett Trebitz, Will Bartsch, Jack Kelly, Tyler Billehus

U.S. Environmental Protection Agency, ORISE

As part of a larger study to develop a monitoring network for aquatic non-indigenous species (NIS), a comprehensive multi-gear survey of larval fish, and macroinvertebrates in the St. Louis River estuary was conducted during summer 2012. A total of 139 larval fish samples and 118 benthic macroinvertebrate samples were collected in the lower estuary, randomly allocated throughout St. Louis, Superior, and Allouez bays.

Analysis of samples is not yet complete. To date, larval fish samples have yielded 18 different species, five of which were previously observed NIS. Among the four types of larval fish sampling equipment used (tucker trawl, beach seine, neuston net, and light trap) light traps collected the lowest abundance of larvae, while tucker trawl samples contained unique species (lake herring and bloater) compared to other gears.

Differences observed in species collected among gear and sample period indicate differences in species spawning patterns. Water quality data (temperature, pH, turbidity, conductivity, and dissolved oxygen) and habitat data (sediment type, vegetation type and cover) collected in conjunction with larval fish and macroinvertebrate collection offer insight on differences in habitat quality of the estuary both before and after the June flooding event.



Toward Delisting of the Water Quality Beneficial Use Impairment in the St. Louis River, MN: A Monitoring Approach

Brent Bellinger, David Bolgrien, Mark Pearson, Ted Angradi, Colleen Elonen from the U. S. Environmental Protection Agency, National Health and Environmental Effects Laboratory, Mid-Continent Ecology Division, Duluth, MN; and Matthew Starry from SRA International Inc., a contractor to EPA

Water quality in the St. Louis River Estuary (SLRE), a great lakes area of concern (AOC), is improving. A significant leap forward followed the opening of the Western Lake Superior Sanitary District in 1978. However, desire for continued improvement throughout the estuary was the impetus for including water quality as a beneficial use impairment (BUI) during AOC designation in 1992. Since then, many programs (e.g., best management practices, discharge permitting) have been directed toward increasing SLRE water quality, the objective being BUI removal and eventual AOC delisting. However, before final removal can occur, a defensible record is required, demonstrating that accepted thresholds have been met across the system. How temporally and spatially robust must the monitoring scheme be to demonstrate compliance remains a question. In the summer of 2012 we conducted monthly water quality sampling of the SLRE using an unequal-probability spatially balanced, stratified and randomized site selection design. Here we report on patterns and trends of those metrics essential for BUI delisting. Summaries include cumulative distribution factors and system-wide means further stratified by month, depth, or zone. For example, system-wide monthly TSS, TP, and Chl *a* concentrations were routinely below threshold concentrations, though exceptions were observed. While the final monitoring design and data needs rest with the AOC coordinators, our goal is to present results from an approach that has been used nationally to describe condition relative to specified thresholds, and identify potential hotspots of continued impairment. *This abstract does not necessarily reflect U.S. EPA policy.*



Novel Effects-Based Monitoring Approaches to Evaluate Chemicals of Emerging Concern in the St. Louis River Estuary (SLRE)

Jason Berninger, Gerald Ankley, Jenna Cavallin, Evan Eid, Elizabeth Durhan, Kathleen Jensen, Michael Kahl, Carlie Lalone, Elizabeth Makynen, Megan Severson, Kyle Stevens, Dan Villeneuve, Tim Collette, Drew Ekman, Ed Perkins, Natalia Garcia-Reyero
U.S. Environmental Protection Agency

As part of an on-going program of research in support of the Great Lakes Restoration Initiative, the US EPA MED laboratory has been developing effects-based biomonitoring tools to evaluate the occurrence and potential hazards associated with Chemicals of Emerging Concern (CECs). Over the 2010 (pilot), 2011, and 2012 field seasons, caged fathead minnows were deployed at multiple sites within the St. Louis River Estuary, including: a gradient of locations near the Western Lake Superior Sanitation District discharge, the Superior Municipal Treatment Plant discharge, Hog Island, Erie Pier, and Rice's point (adjacent to the Ship Canal). Grab and/or composite samples of surface water were collected concurrent with fish exposures and used for chemical analysis of target CECs as well as in vitro bioassays.

Following exposure in the field, fish were brought back to the lab, dissected, and tissues analyzed using targeted methods relevant to reproductive and endocrine functions as well as more open-ended methods including transcriptomics and metabolomics. Estrogenic activity was detected in a number of surface water samples collected in the SLRE. However, the egg yolk precursor protein vitellogenin, a widely used biomarker of estrogen exposure, was not significantly elevated in male fish exposed at the same locations. Nonetheless, some impacts on circulating concentrations of steroid hormones as well as expression of xenobiotic metabolizing enzymes in liver were detected. Collectively, the experiments to date have evaluated a range of exposure scenarios, multiple time courses, and different seasons. Ongoing efforts will focus on the impacts of temperature, food availability, and changes in municipal discharges over time on biological response profiles in caged fish.

A Color-Blind Pirate Asks, “Do RRR’s Make Gray and Green Turn Blue?”

David Bolgrien, Brent Bellinger, Ted Angradi from the U.S. Environmental Protection Agency, National Health and Environmental Effects Laboratory, Mid-Continent Ecology Division, Duluth, MN; and Matthew Starry from SRA International

Researchers and managers often do “R” projects when attempting to change conditions in natural and socioeconomic systems. Outputs from restoration, remediation, redevelopment, rehabilitation, reinvestment, and reuse, etc (hence, “R”) projects vary by application but have only a single outcome of improving human well-being (think “blue”). Classifying some R activities as “green” (i.e., habitat restoration) and others as “gray” (i.e., brownfield redevelopment) constrain our ability to account for all actual and potential environmental, social, and economic benefits. Mutually accepted metrics and indicators linking outputs of green and gray R outputs to human well-being can only come from collaborations between the diverse practitioners of natural and social sciences. We will use port operations, brownfield redevelopment, and delisting of the beneficial use impairments in the St. Louis River estuary to illustrate the challenges and potential benefits of incorporating a multi-R approach. *This abstract does not necessarily reflect U.S. EPA policy.*



David Bolgrien

Early Detection Monitoring for New Aquatic Invasive Species in Chequamegon Bay, Lake Superior

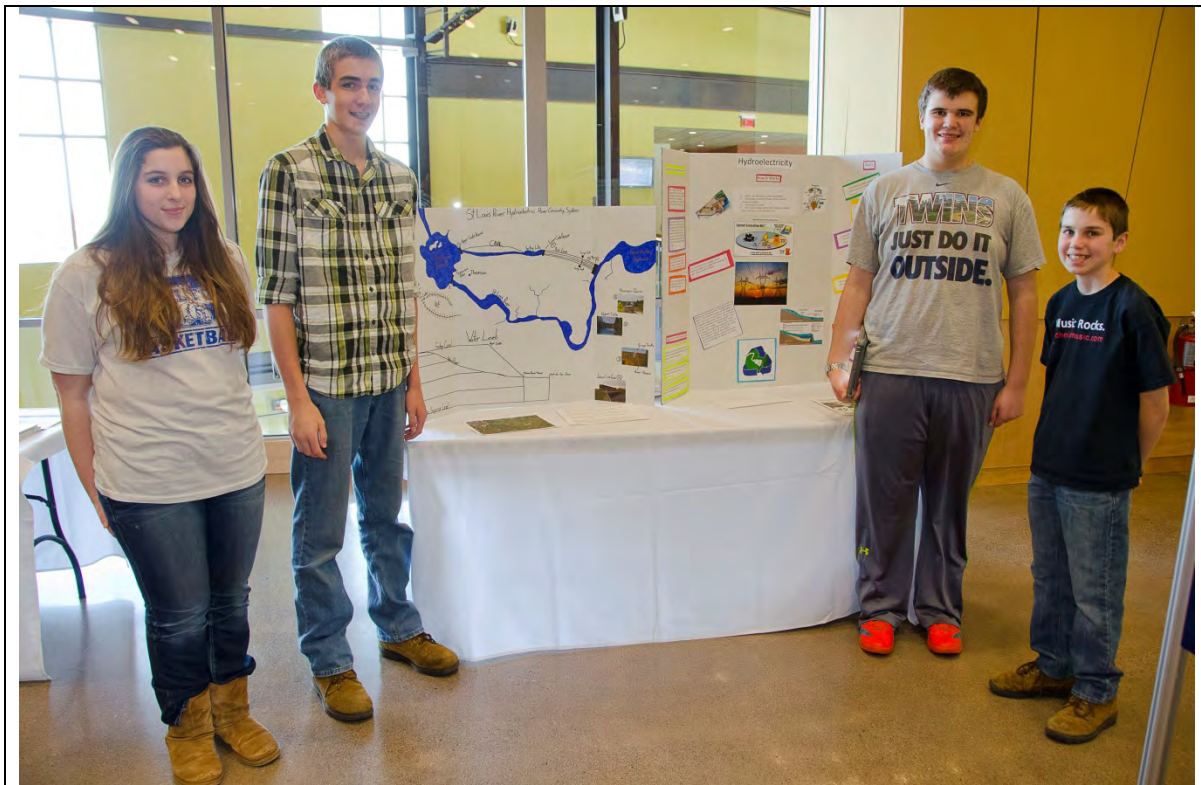
Gary Czipinski and Henry Quinlan
U.S. Fish and Wildlife Service

Chequamegon Bay, Wisconsin is a 39,520 acre embayment in southwestern Lake Superior. It is bordered on the north by the Apostle Islands National Lakeshore, and to the south by the city of Ashland, Wisconsin. The notoriety of the bay for recreational fishing, and the close proximity to a multi-island national park attract many boaters to the area every year. Since 2009, the U. S. Fish and Wildlife Service has conducted annual early detection monitoring for new invasive fish, aquatic plants, mussels, snails, and crayfish in Chequamegon Bay. In cooperation with the Wisconsin Department of Natural Resources and assisted by the Ashland County Land Conservation Department, this monitoring consists of 24 five-minute bottom trawl tows in sites considered to be high risk for introduction of invasive fish and aquatic plants. During this monitoring effort in 2011, curly-leaf pondweed (*Potamogeton crispus*) was discovered. In addition, we continue to collect previously detected invasive fish (4 species), one previously detected invasive aquatic plant, and native mussels, snails, and crayfish. No new aquatic invasive fish, mussels, snails, or crayfish have been detected.

St. Louis River Hydroelectric Dam

Day, Patrick; pday@carlton.k12.mn.us; Mark Matlock, Tim Jessen, Gabby Bremmer, Sam Macor from Carlton High School, Carlton, MN.

Our posters are about the Thompson hydroelectric dam. We have included history, facts, disadvantages to the river, and how it works. On one poster board we drew the whole system with labels and pictures. On the other poster board we have included many of the things that we have learned from our tour of the facility. We hope that people will be able to learn as much as we did from our tour.



Mark Matlock, Tim Jessen, Gabby Bremmer, and Sam Macor

St. Louis River Area of Concern: On the Road to Delisting

Diane Desotelle, MPCA AOC Coordinator; Cherie Hagen, WI DNR AOC Coordinator; John Lindgren, MDNR AOC Coordinator; and Rick Gitar, Fond du Lac Tribe AOC Coordinator

The St. Louis River AOC was designated in 1989 due to nine beneficial use impairments related to contaminated sediments, water quality degradation, fish and wildlife habitat impacts and issues related to aesthetics and beaches. The AOC is shared by Wisconsin and Minnesota and both are actively developing the Stage II Remedial Action Plan Update, also known as the Implementation Framework. The Framework, scheduled for completion in mid-2013, will provide a roadmap for removing BUIs and delisting the AOC. Some of the Framework's components include:

- AOC history;
- Stakeholder participation in the Framework's development and implementation;
- BUI designation, delisting targets, and goals;
- Decision-making guide for developing BUI removal objectives and implementing projects associated with BUI removal;
- Data System development, use, and goals for maintaining monitoring data for sediment, benthos, and vegetation; and,
- Goals for updating the Framework as projects are completed and more is learned of the success rate toward BUI removal.

The first progress report of the AOC has been completed. Project partners will continue to make progress reports available to continue our efforts to educate and inform the general public as the AOC progresses toward ultimate delisting.



Comparison of Wetland Fish Communities in the St Louis River Estuary and the Upper Great Lakes

John Dumke, Valerie Brady, Robert Hell, Ashley Moerke, Carl Ruetz, Don Uzarski, Joseph Gathman, and Jan Ciborowski

Natural Resources Research Institute-UMD

Great Lakes coastal wetlands provide valuable ecological functions, recreation opportunities, and aesthetic beauty. Even so, wetlands continue to disappear or degrade due to development, pollution, agricultural runoff, or from changes in Great Lakes water levels. The St. Louis River estuary (SLRE) contains many large wetland complexes. Seven sites were sampled within SLRE in 2011 and 2012 by the Natural Resources Research Institute as part of an EPA-funded Great Lakes Restoration Initiative project for Coastal Wetland Monitoring (CWM). The CWM project encompasses wetlands along the coasts of all the Great Lakes in both the United States and Canada, and offers a unique opportunity to compare SLRE wetland fish against those caught in wetlands across the northern Great Lakes. Fish were sampled at each wetland with fyke nets set overnight amongst discrete macrophyte beds. Fish data were standardized by sample effort (CPUE) per wetland. We are comparing data from 7 SLRE sites with 21 sites across Lake Superior, 13 in northern Lake Michigan, 10 in Green Bay, 26 near Sault Ste Marie, 16 in northern Lake Huron, and 12 in Georgian Bay. We expected that SLRE fish communities would be most similar to wetlands in the Lake Superior region, and least similar to wetlands of Lake Huron. This hypothesis is supported by sharing the most number of taxa and having the highest Proportional Similarity (36%) to Lake Superior fish communities. However, SLRE was similar to Green Bay in mean richness and all non-native comparisons, which is perhaps best explained by the similarities between the two regions (i.e. size, port areas, wetland connectivity). The SLRE is unique in that young-of-year bluegill/pumpkinseed are the dominant fish by relative abundance (34%), as well as having a high relative abundance of black crappie (21%). Interestingly, round goby were the dominant non-native species of coastal wetlands in all regions except Lake Superior, where three-spine stickleback were most abundant.



Valerie Brady and Patrick Collins

Influence of Drainage-Network Position and Geologic Setting on Channel Responses to Floods for Duluth-Area Streams

Faith Fitzpatrick, Karen Gran, Molly J. Wick, and Christiana R. Czuba
U.S. Geological Survey, University of Minnesota-Duluth

Geomorphic processes and sensitivity to disturbance for streams in the Duluth, MN area were summarized into a segment-scale classification based on drainage-network position, slope, geologic setting, and valley type. This classification helps explain the spatial distribution of varying channel-related damages associated with the record June 2012 flood. Geomorphic data collected by the U.S. Geological Survey in 2003-04 included drainage-network characteristics; segment slopes and valley types; and qualitative and quantitative measurements of channel, bank, and substrate conditions along 48 stream reaches spread over 20 watersheds.

Channel responses to large floods in the Duluth area, such as the June 2012 flood, vary depending on drainage-network position and whether the stream flows over bedrock. Erosion potential is highest where steep channels flow through confined or entrenched valleys with valley side walls consisting of unconsolidated glacial deposits. These reaches have a high potential for bed erosion, as well as lateral migration and widening, which can cause major landslides and mass wasting. These reaches contribute large amounts of coarse sediment and debris, which creates channel deposition problems downstream if there is a gently sloped reach before the channel empties into Lake Superior, or the St. Louis River Estuary. In contrast, bedrock channels will have less morphologic change from floods but have an expanded scour zone along channel margins. Bedrock channels also provide a relatively constant fixed base level for upstream reaches. River crossings, especially culverts, and floodplain constrictions have localized effects on these processes.

Recent post-June 2012 flood surveys by volunteers compiled by researchers at the University of Minnesota-Duluth indicate that channel responses largely fit the Duluth-area channel classification scheme. However, more documentation is needed to quantitatively compare the responses to baseline conditions. These results are critical for repairing infrastructure, long-term urban planning, and management of the riparian corridors.

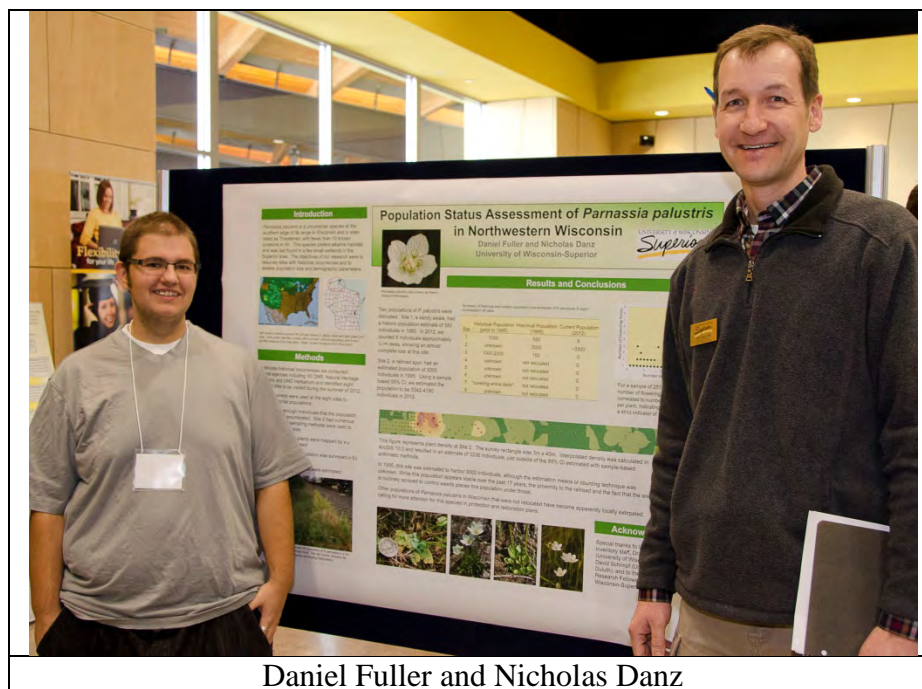


Faith Fitzpatrick

Population Status Assessment of Marsh Grass-of-Parnassus in Northwestern Wisconsin

Daniel Fuller and Nicholas Danz
UW-Superior

Marsh Grass-of-Parnassus, *Parnassia palustris*, is a Wisconsin State Threatened plant species, known only from a few scattered locations in northern Wisconsin. Our main objectives were to resurvey sites with historical occurrences of this species and assess population size and demographic parameters. We contacted local agencies to find locational information for historical plant occurrences. Using meander surveys during summer 2012, we revisited eight of these sites and found the species at only two sites. The first site was a coastal sandy swale harboring six plants, down from nearly 550 plants observed during the last survey of the site in 1995. The second site was a gravelly railroad shoulder estimated to have 3000 individuals in 1995. At this site, we mapped x-y locations of about 300 individual plants and used a systematic grid of 0.5-m² quadrats to survey the remainder of the population. Sample based 95% confidence interval estimates yielded of population size of 3342-4180 plants. We also used a kriging tool in ArcGIS to estimate and map the population, resulting in a slightly lower estimate of 3336 individuals. When compared to the 1995 estimate of 3000 individuals, these data suggest the population is holding steady. The data we collected can be used in the future to continue to monitor this population, to parameterize population demographic models, and to assess the ability of this species to survive in Wisconsin.



Daniel Fuller and Nicholas Danz

Parsing the Influence of Geography, Vegetation, and Bottom Water Dissolved Organic Carbon Fractionation on Sediment Total- and Methylmercury Concentrations in the St. Louis River Estuary

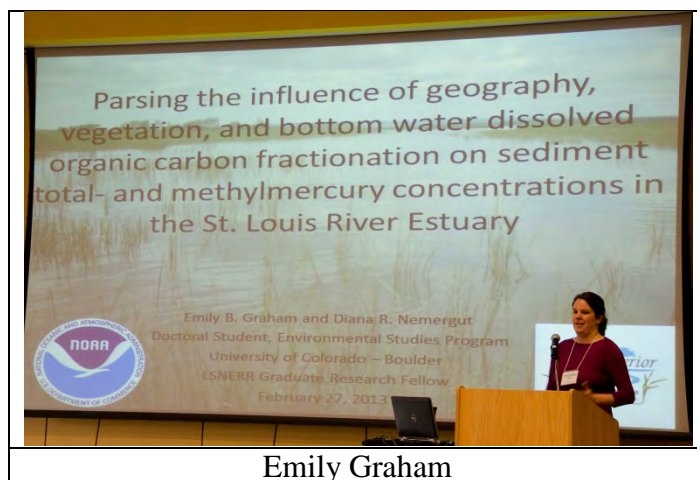
Emily Graham

LSNERR GRF, University of Colorado Environmental Studies Program, Institute of Arctic and Alpine Research

Mercury is a potent neurotoxin that bioaccumulates in animal tissue, causing human health and economic issues, and is deposited into environments as its elemental or ionic species. Mercury methylation, regulated by complex abiotic and biotic factors, subsequently transforms mercury into a more bioavailable form. In particular, dissolved organic carbon (DOC) may either increase methylation by providing substrate for the microorganisms that catalyze methylation or prevent methylation by binding to inorganic mercury compounds. Moreover, the chemical composition of DOC may impact the effect of DOC on mercury methylation.

Here, we examined correlations between bottom water DOC fractions and total- and methylmercury sediment concentrations at vegetated and unvegetated sites spanning a geographical gradient from the Red River tributary to the mouth of the St. Louis River. Sediment total- and methylmercury (THg and MeHg) levels were determined at the USGS Mercury Lab, and bottom water DOC fractions were determined using fluorescence spectroscopy and PARAFAC analysis. Data were analyzed with ANOVA, t-tests, and linear regressions, as appropriate. Results demonstrated a strong geographical influence on DOC fractions and sediment MeHg, THg, and MeHg, THg, with a secondary influence of vegetation. In general, sediment MeHg, THg, and MeHg, THg, were positively correlated with concentrations of microbially-derived DOC and DOC freshness and negatively correlated with humic matter concentration, however, there was no relationship between DOC fractions and mercury concentration at the Pokegama Bay site. Stronger relationships were observed in vegetated sediment than in unvegetated sediment.

The observed geographical differences in DOC-Hg relationships suggest underlying factors such as runoff and hydrology may be important considerations in managing mercury levels. This study also demonstrates that DOC fractionation, rather than total DOC concentrations, may be an important factor regulating mercury concentration and species. These results may aid local managers to mitigate mercury toxicity and sustain healthy fisheries.



Slow the Flow: Impacts of Land Use on Water Quantity and Water Quality

Carmen Hardin

Wisconsin Department of Natural Resources – Division of Forestry

The impacts of impervious surfaces in urban areas on water quantity and quality are becoming better understood every day; however, the impacts of agriculture and forest management common in rural areas are not as well understood. This talk will give a brief introduction to landscape scale impacts and considerations of traditional land management activities commonly found in more rural settings.



Coastal Wetland Monitoring in the St. Louis River Estuary, Past and Future

Robert Hell, Josh Dumke, Valerie Brady, Gerald Niemi, Annie Bracey, Nicholas Danz, Jeremy Erickson, Lucinda Johnson, George Host, Carol Reschke, Paul Meysembourg, Terry Brown
Natural Resources Research Institute

Multiple agency, university, and private organization personnel performed independent sampling within the St. Louis River estuary. While collaboration and information transfer occurs among some groups, sampling is often performed without prior knowledge about the work of others, particularly work planned in the future. Duplication of effort for results which could instead be shared creates redundancy of data, time, and cost, and can cause unnecessary stress to sensitive wetlands. The Natural Resources Research Institute (NRRI) and University of Wisconsin-Superior sampled seven sites in the St. Louis River estuary in 2011 and 2012 as part of a larger GLRI Coastal Wetland Monitoring (CWM) project. Methods for CWM included identifying major vegetation types and sampling the three most dominant for fish (by fyke net), aquatic macroinvertebrates (by D-frame dip net), and characterizing the habitat, water quality, and sediment influencing the fish and invertebrates. Wetlands are also sampled for birds and amphibians (three visits, listening surveys in the morning for birds and evening for frogs), and along transects for macrophyte vegetation (three transects perpendicular to shore, with parallel transects and points in each major vegetation zone: emergent, submergent, and floating-leaved). Our estuary map shows sites that have already been sampled (2011 and 2012), as well as sites slated for future sampling (2013-2015). Data are being archived in an NRRI database, CWM researchers are interested in data sharing opportunities with other researchers, and in providing data to agencies and non-profits for use in wetland protection and restoration.



Clinton Little and Jerry Niemi

Invasion by Stages in the St. Louis River Estuary

Joel Hoffman

U.S. Environmental Protection Agency

The St. Louis River estuary is recognized as an invasive species “hotspot” - the harbor ranks among the top locations in the Great Lakes reporting the first occurrence of new, aquatic non-native species. To date, 18 non-native benthic invertebrate, 4 non-native crustacean zooplankton, and 10 non-native fishes have successfully established populations in the system. Yet, the estuary is also a biodiversity hotspot, with over 200 native benthic invertebrate species, 36 native crustacean zooplankton species, and at least 40 native fishes. Only a few species that have invaded the estuary have become a nuisance. While some species such as ruffe, round goby, and zebra mussels have spread widely and obtained a relatively high and stable abundance, most non-native species remain obscure.

As the Great Lakes busiest shipping port, the Twin Ports are highly vulnerable to non-native species introduction. Once introduced, both environmental and biological factors control the establishment success of these species. Indeed, the idea that these species will spread over time is not well-supported by biological survey data. Rather, an “invasion stage framework” is a biologically useful concept to consider the establishment and spread of non-native species. This framework can help reveal factors either helping, or hindering, the success of an introduced species in the estuary. As such, this framework is an important tool for considering the potential ecological, social, and economic impacts of an introduced species.



Joel Hoffman

One-Hundred and Fifty Years of Change Comparing Pre-Development and Post-Development Wetland Distribution in the St. Louis River Estuary.

Tom Hollenhorst, Daryl Peterson, David Bolgrien, Ted Angradi, Mark Pearson, and Matthew Starry

U.S. Environmental Protection Agency

In 1841 Congress created the Lake Survey within the U.S. Army Topographic Engineers, which later became part of the U.S. Army Corps of Engineers. The Survey was charged with conducting hydrographical surveys and preparing and publishing nautical charts and other navigation aids. As part of this effort, the Saint Louis River was surveyed during the summer of 1861 with a detailed map published in 1863. This historic map was digitized, geo-referenced and classified into upland, flood plain, emergent, woody emergent and open-water habitat classes. This was then compared to contemporary maps of the same classes derived largely from recent aerial photography. Areas (acres) of each class were then summarized by six operational zones defined by the Minnesota Pollution Control Agency as part of the AOC delisting framework. History of the Survey for each aquatic habitat class, pre and post development within zones, will be discussed. We will also discuss how this information might inform the development of targets for habitat restoration as part of the BUI delisting process. *This abstract does not necessarily reflect U.S. EPA policy.*



Tom Hollenhorst

Denitrification Patterns of the Saint Louis River Estuary

Luke Loken, Jacques Finlay, Gaston Small, Emily Stanley, and Robert Sterner
University of Wisconsin – Center for Limnology, University of Minnesota

Nitrate concentrations in Lake Superior have increased fivefold in the past century, with minimal denitrification occurring in the open lake. We investigated how a shallow near-shore wetland of Lake Superior functions as it mixes with the world's largest lake. Receiving inputs from the St. Louis River, Lake Superior, and the cities of Duluth and Superior, the Saint Louis River Estuary is a potential hotspot for aquatic nutrient processing. We explored the spatial and temporal patterns of the estuary to remove bioavailable nitrogen. During the 2012 ice-free season, we performed seven longitudinal surveys of the estuary to determine physical and chemical characteristics of the estuary. This included nutrient concentrations and sediment denitrification rates using the acetylene block technique with nutrient amended site water, and varying input source waters to the estuary.

The greatest potential denitrification rates occurred in the lower estuary, and were 10-100 times greater than reported open-lake rates. Sediment denitrification responded to variation in source waters, and was correlated with nitrate concentrations in treatment water, suggesting nitrate control of denitrification rates. The estuary also showed increased denitrification rates as the season progressed; however, the Saint Louis River flooded in late June, and potential denitrification decreased to near early spring rates.

The 2013 field season will serve as a comparison to the high disturbance flood of 2012, and we hope to gain insights on the typical estuary processing rates. We predict that late season denitrification rates will be higher in 2013, due to decreased disturbance and increased water residence time. These data will be useful for managers to understand how an urbanized estuary processes aquatic nutrients as it mixes with Lake Superior.



Luke Loken

Superior SAMP: Balancing Conservation and Development

Darienne McNamara

City of Superior - Environmental Regulatory Coordinator

Approximately 85% of the undeveloped land in the City of Superior is wetland. Some of its 27,000 residents see this as an asset, others as an obstacle. City managers are faced with protecting wetland functional values while simultaneously promoting economic growth and development. To address this dichotomy, the City of Superior has developed a comprehensive program aimed at protecting our most valuable wetlands, while reducing the regulatory burden for projects that impact low-quality wetlands. The program, called the Special Area Management Plan (SAMP), began in 1996 and started its second phase, known as SAMP II, in 2006. To date, we have used a region-specific Routine Assessment Method to inventory and classify over 1,000 acres of wetlands in the City, developed an expedited permit process in partnership with state and federal agencies, and constructed our own compensatory wetland mitigation bank managed by City staff. Because of its investment in the SAMP program, the City is able to attract developers and promote growth despite the regulatory and environmental constraints stemming from an abundance of wetlands. The presentation will discuss how this unique SAMP program balances conservation and development in Superior, Wisconsin.

The Wisconsin Shore Land Restoration Project - Preliminary Findings 2007-2012

Michael Meyer, Dan Haskell, and Brick Fevold
Michael Meyer and Brick Fevold, WDNR-Rhineland
Dan Haskell, MTU-Houghton

Lake shore development for housing and recreation has resulted in substantial loss of habitat and wildlife diversity, and has increased the potential of input of surface water runoff sediments and nutrients to area lakes and streams. Partnerships between government agencies, academic institutions, and private landowners are working together in long-term research and monitoring projects investigating the ecological benefits of restoring impaired lake shore lands in Vilas and Ashland counties of northern Wisconsin. Research includes identification of restoration practices which maximize ecological benefits.

In Vilas County, we investigated the benefits of using down woody material (DWM) to increase the success of restoration projects on developed lakes in Vilas County. Specifically, we found that down woody material reduced variation in soil temperature, retained soil moisture, and improved plant survival and growth rates. In addition, we provide preliminary results on bird, and small mammal community diversity and abundance for lakes that have received restoration efforts and compare to paired reference lakes. We also tested several native tree and shrub species for survival and growth rates of “summer-planted” bare root stock and compared them to shrubs planted from nursery containers.

In Ashland County, we have partnered with local governments, organizations and community volunteers to: 1) restore approximately 10 acres and 4,100 feet of urban park shore land to a native plant community, 2) conduct long-term ecological monitoring including evaluating the effectiveness of green infrastructure to reduce storm-water, sediment and nutrient runoff into Chequamegon Bay, and 3) initiate public outreach to convey the value of restored shore land buffers in protecting ecological services while at the same time enhancing opportunity for local and regional tourism. The Ashland Chequamegon Bay Shoreland Restoration Project (www.ashlandshorerestore.org) is a partnership and community outreach restoration effort with funding support through the Great Lakes Restoration Initiative (GLRI). We share preliminary results from ecological and water quality surveys, and offer insights on the emerging natural history of a historically disturbed urban park shore land during the early stages of restoration. These studies are the first of their kind in the area and will continue to document the degree of change in subsequent years. The results will provide insight into which restoration practices are most effective in re-establishing native ecological communities that protect lake-shore land ecosystem function.

The Lake Superior National Estuarine Research Reserve: Facilitating Research to Inform Natural Resource Management Decisions, Now and for the Future

Mary Munn, Tracey Ledder, and Shon Schooler

Lake Superior National Estuarine Research Reserve (LSNERR)

The goal of the LSNERR is to facilitate research, education, outreach, and stewardship of Lake Superior aquatic ecosystems, particularly freshwater estuaries. The 16,697-acre LSNERR is located at the western tip of Lake Superior, and represents portions of the St. Louis River Freshwater Estuary. The St. Louis River is the largest US tributary to Lake Superior and the lower estuary is the largest US working harbor on the Great Lakes. Despite this human influence, the LSNERR lands and connecting waterways include numerous occurrences of rare species and community types. Rare species include Caspian tern, piping plover, dune thistle, fairy slipper, mystery vertigo, Franklin's squirrel, wood turtle and lake sturgeon. The combination of ecosystems within the lower river - estuarine wetlands and aquatic habitats, baymouth bar complex and surrounding upland forest – are unique within the Great Lakes region.

The LSNERR hopes to facilitate informed management decisions through high-quality monitoring and research. The LSNERR conducts water quality and meteorological monitoring through a mandated System-wide Monitoring Program. NERR-wide standard operating procedures ensure the data are comparable across Reserves. Water quality is taken at four permanent stations and required parameters include pH, temperature, conductivity, salinity, depth, turbidity, chlorophyll, dissolved oxygen, nitrogen (total, nitrate, nitrite, and ammonium) and phosphorus (total and SRP). There is one required meteorological station and weather parameters include air temperature, barometric pressure, wind speed and direction, precipitation, and light (PAR). These data are then put through a quality control process, archived in a central repository, and provided free of charge to anyone at request. The goal is to create a robust set of information to examine long term changes in the nation's estuarine environments. The data are also a resource the draws in researchers to conduct studies in the Reserves. The LSNERR was associated with more than ten external research projects in 2012 and we expect this number to grow as we serve as a nexus for current and future work.

Summary of Recent Amphibian and Bird Sampling in the St. Louis River Estuary

Gerald J. Niemi and Annie Bracey

University of Minnesota, Duluth; Natural Resources Research Institute and Department of Biology

Over the past 15 years we have gathered considerable data on amphibians and birds in the St. Louis River Estuary (SLRE). In 1999 The Nature Conservancy funded an inventory of the breeding birds of the SLRE to identify species of national concern that potentially nest within the Estuary. In 2002-2003 the Great Lakes Environmental Indicators (GLEI) project funded by the US Environmental Protection Agency (USEPA) counted amphibians and breeding birds in several wetlands to establish a baseline on current use of these wetlands. These data have also been incorporated into an improved understanding on the bird use of wetlands across the Great Lakes in relation to human disturbance. A continuation of that effort funded by USEPA is currently on-going (2011 to 2015) with many additional wetlands being sampled for amphibian and breeding bird populations as well as several benchmark sites that are scheduled for restoration. These data are being used to establish a sound monitoring program for these species across the Great Lakes region to determine changes in species composition and as indicators of the health of these animal communities and the wetlands where they occur. Coincident with the US EPA sampling, the US Fish and Wildlife Service and the Minnesota Pollution Control Agency have funded more detailed efforts to assess bird use and their associated habitat conditions at two sites identified as high priority for restoration: the 40th Avenue West Habitat Complex, and the 21st Avenue West Complex both in Minnesota. In these two areas, counts of bird use have been documented for spring and fall migration as well as the breeding season. These data and how they will be used to provide ecological assessments for ecosystem recovery of the SLRE will be summarized.

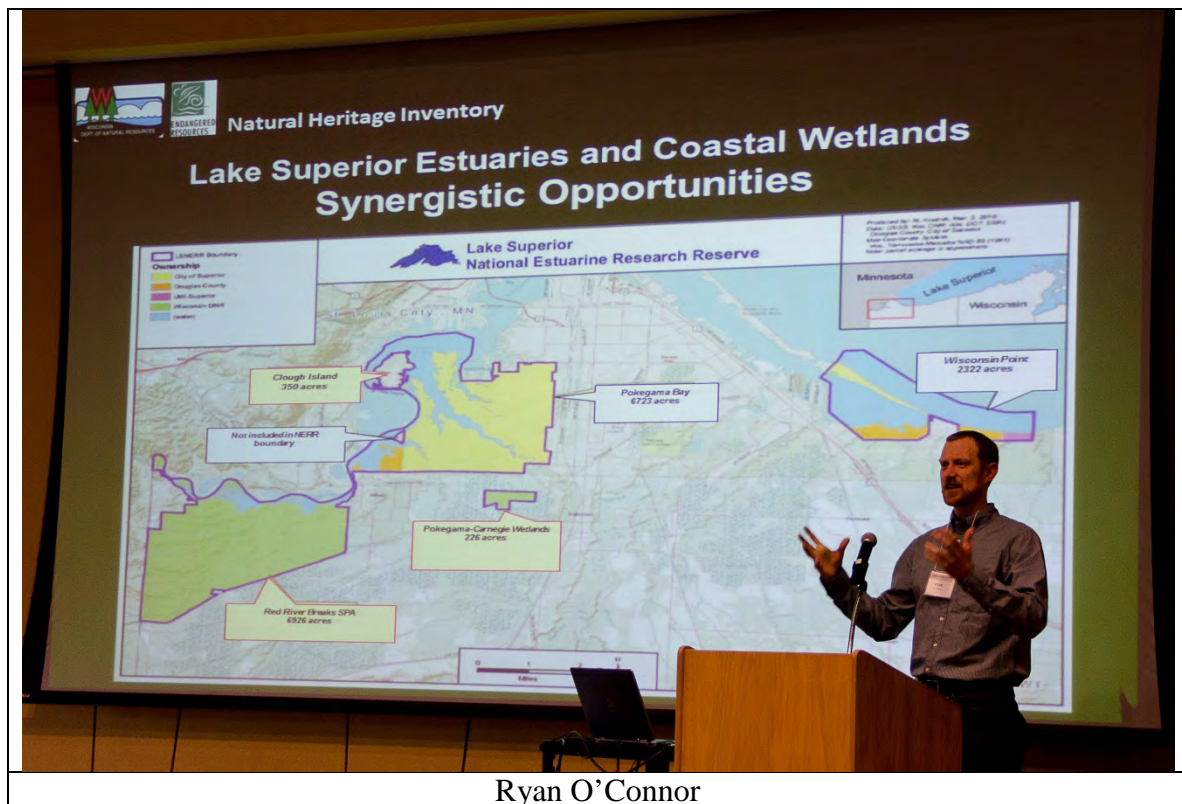


Jerry Niemi

New Prioritized Inventory Plan for Collecting New and Updated Data of Lake Superior Estuaries and Coastal Wetlands

Ryan O'Connor, Amy Staffen, and Kevin Doyle
Wisconsin DNR

The Wisconsin Natural Heritage Inventory (NHI) has developed a prioritized inventory plan for collecting new and updated data of Lake Superior estuaries and coastal wetlands. These data can then be used to inform understanding of estuarine characteristics and functions and guide future planning and management in the area. Based on a quantitative scoring index combining ecological significance, contribution to biodiversity (e.g., size, number of rare species or high quality natural communities etc.), data gaps, and time since last survey, the inventory plan outlines the biotic inventory needed to adequately assess the biodiversity composition, significance, and threats to coastal wetlands and associated rare species along Wisconsin's Lake Superior shoreline. Our hope and intent is that the inventory plan will guide future inventory work of both NHI and partner organizations, with efforts focused on the most critical sites, and facilitate targeted, coordinated, systematic monitoring of high-quality natural communities and associated rare species. We believe prioritizing and coordinating inventory and monitoring efforts in this way is an efficient use of funds and resources as well as an opportunity for experts across partner organizations to work together to achieve common goals.



Invasive vs. Native

Hayley Olson and Sarah Backlund
Superior Middle School (6th grade)

Invasive species are greatly affecting the St. Louis River Estuary's native species. How do they have so much power? What are they doing? And, how did they get here in the first place? That's what we're finding out! We are doing two experiments. The first experiment is with molding bread. We took bread and put a wet paper towel on it and put it in a dark area. This experiment shows how the mold (invasive) grows on the bread (native). The second project is with plants. We planted invasive and native. We are observing and comparing the growth and reproduction rates. We can't wait to see the results!



Hayley Olson, Sarah Backlund, and Stephanie Francis

Remediation-to-Restoration (“R2R”) at Hog Island, St. Louis River Area of Concern, Lake Superior – A Success Story and Model

Christine Ostern

Douglas County LWCD

The Hog Island site is located in Superior, WI, in the St. Louis River AOC at the western tip of Lake Superior. The site was one of the first to be remediated through the Great Lakes Legacy Act and is also one of the first R2R projects in the Great Lakes. Restoration activities have returned ecological function, structure, and diversity to this heavily contaminated portion of the harbor and at other sites in the Superior harbor; addressing several beneficial use impairments. A blueprint for restoration, the draft Hog Island Ecological Restoration Master Plan, was developed following remediation and used to apply for grant funding for habitat restoration. The year 2012 was the last of four years of grant funded restoration work. Restoration activities included: native plants restored to riparian buffers, coastal wetlands, and open water; unique habitat structures installed; wild rice seeded; and invasive species controlled. Restoration activities were conducted by Douglas County, WI through a regional partnership with NOAA and the Great Lakes Commission; in collaboration with the Lake Superior Research Institute and with the help from numerous private, public, and corporate landowners, several restoration companies, and state and federal agencies. The Hog Island R2R project serves as a model for other such projects in the Great Lakes.



Watershed Wide Wetland Assessment: Correlating Mapped Wetland Types to Functions at the Landscape Level

Andrew Robertson and Kevin Stark
St. Mary's University

Wetlands are typically delineated based on characteristics of hydrology, soils and vegetation. In general, wetlands must have a source of water for at least a portion of the growing season that (over time) leads to the development of hydric soils and/or hydrophytic vegetation. Wetlands can also be characterized on the basis of hydrogeomorphic attributes such as landscape position, landform, water flow path and waterbody type.

Mapped landscape metrics can be used in a watershed level wetland assessment process to correlate wetland type to wetland function. These metrics are based on the hydrogeomorphology of the wetland landscape and can be represented in classification systems such as Tiner's LLWW (NWI-plus) or Brinson's HGM Approach. Using a collaborative process based on wetland science and the best professional judgment of local and regional wetland experts, these metrics can also be used to link wetland types to the ecological goods and services that they provide to the watershed in which they are situated.

The presentation will review the application of a landscape level wetland functional assessment process to several subwatersheds in Northern Wisconsin. It will go on to discuss how such data can be used to focus decision making related to wetland restoration or rehabilitation.



Kevin Stark and Andrew Robertson

Social Science in Coastal Management

Patrick Robinson

University of Wisconsin – Extension

The goal of natural resource management is to maintain or promote the ability of ecosystems to sustain healthy biotic and physical resources within a framework that recognizes, integrates, and balances human needs. Effective coastal management involves thoughtful consideration and analysis of the ecological, economic, and social dimensions of management issues, while recognizing that the mix and relative weight of those dimensions may vary depending upon the issue being addressed. The need for cross-disciplinary scientific inquiries that facilitate improved coastal management outcomes through increased understanding of both the biophysical and human dimensions of management issues has been widely recognized. Despite this broad recognition, implementation of these approaches is still fraught with various challenges and barriers. Improving our understanding of these challenges and barriers will further enable our ability to address them, and, thereby, foster appropriate and effective utilization of cross-disciplinary approaches to solve coastal management challenges.

This presentation shares research from a case study analysis of the National Estuarine Research Reserve System (NERRS) related to improving our understanding of the critical factors that influence the incorporation of social science into coastal management. The case study research provides insights into potential strategies for encouraging and enabling cross-disciplinary approaches to coastal management. The results have potential implications for St. Louis River Freshwater Estuary management, including efforts to address anthropogenic sources of pollution and efforts to better understand ecosystem services for the system. Potential resources for examining social science questions related to the estuary will also be explored.



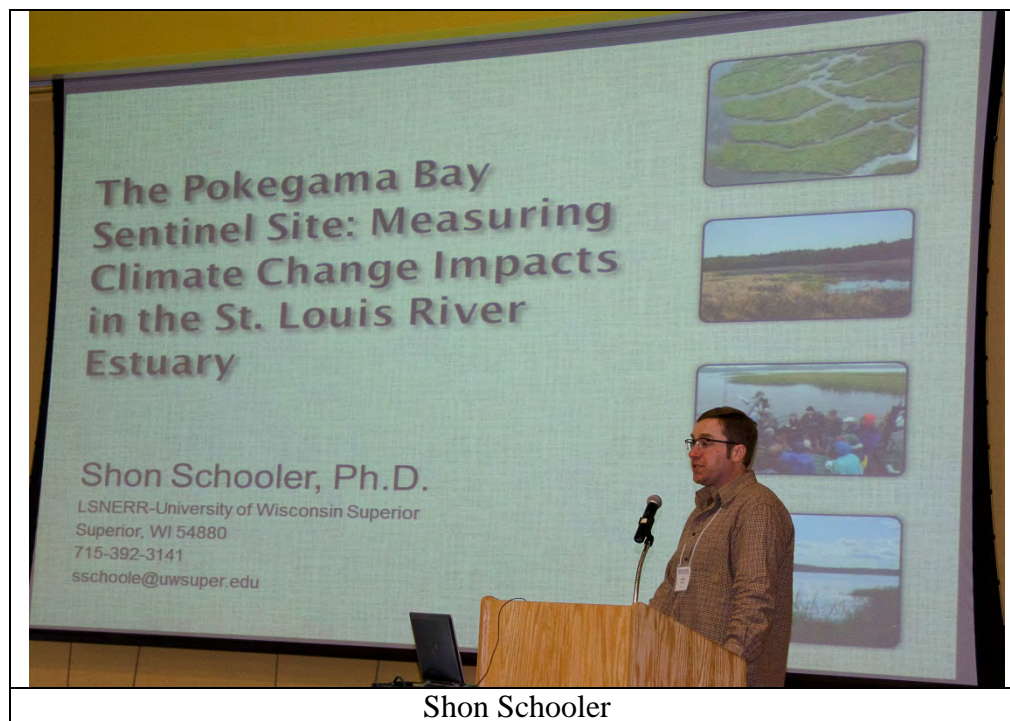
Patrick Robinson

The Pokegama Bay Sentinel Site: Measuring Climate Change Impacts in the St. Louis River Freshwater Estuary

Shon Schooler

Lake Superior National Estuarine Research Reserve (LSNERR), UWS

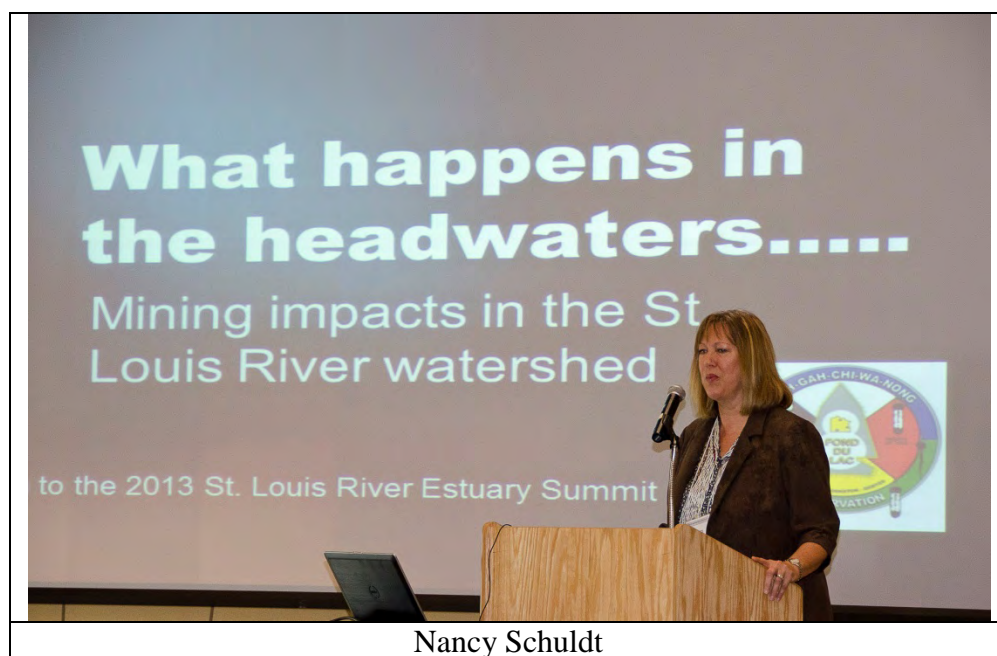
The mission of the Lake Superior National Estuarine Research Reserve is to improve the understanding of Lake Superior freshwater estuaries and coastal resources and address issues affecting them. One of the major issues affecting our natural environment is a changing climate. Understanding and predicting the effects of climate change will improve our ability to adapt to events before they cause major damage to our economy and quality of life. The NOAA Sentinel Site Program is designed to create a national network of long-term research sites that measure the effects of climate change on our estuaries. The Lake Superior NERR is currently setting up a Sentinel Site in Pokegama Bay. The infrastructure will include a weather station, a water quality station, surface elevation tables (to measure sediment accretion or subsidence), groundwater monitoring wells, and permanent vegetation transects. The goal will be to measure changes in climate and the associated effects on water quality, erosion, decomposition, marsh morphology, vegetation, and wildlife. This presentation will give details on the instrumentation and measurements, timeline for implementation, and research questions to be addressed.



What Happens in the Headwaters: Mining Impacts in the St. Louis River watershed

Nancy Schuldt, Fond du Lac Environmental Program

The Fond du Lac Band of Lake Superior Chippewa has been involved in environmental review of numerous hard rock (ferrous and sulfide) mining projects upstream of the reservation, within the St. Louis River watershed. For over a century, iron mining has significantly impacted thousands of acres of high quality wetlands and forested lands in the headwaters of the St. Louis River, and continues to adversely affect water quality in the river and many of its tributaries. This mining ‘footprint’ has permanently altered hydrology in streams, lakes and wetlands, fragmented upland habitat, transferred surface and ground water between major watershed divides, degraded air quality and visibility, and the industry is the largest source of mercury emissions within the Lake Superior Basin. The mining ‘fingerprint’, or typical water chemistry effects, include elevated conductivity and hardness, sulfate, and some metals, above water quality and drinking water standards. Proposed sulfide mining in the same region will increase these impacts, including more toxic water chemistry discharged to the environment. The elevated sulfate has contributed to diminishment of wild rice resources, increased mercury methylation, aquatic toxicity, biological community impairments, and eutrophication in some downstream waterbodies. Mitigation is insufficient, and typically has not been done within the watershed. Reclamation requirements do not result in restoration of the ecological and cultural resource services that this landscape provided for millennia. Decades of planning and assessment and many millions of dollars have been spent to restore the St. Louis River Area of Concern; how do we as research scientists and resource managers rationalize our efforts when the headwaters are being systematically altered and degraded?

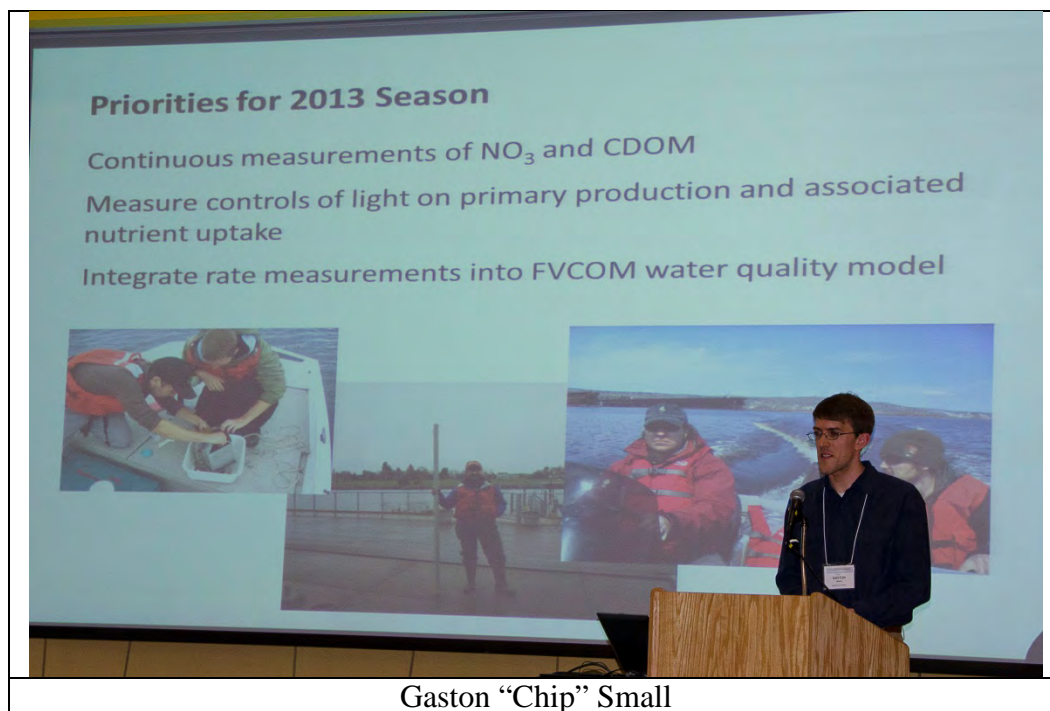


Nancy Schuldt

Seasonal and Spatial Patterns in Water Column Biogeochemistry in the St. Louis River Estuary

Gaston Small, Jacques Finlay, Luke Loken, Emily Stanley, and Robert Sterner
University of St. Thomas, University of Minnesota, University of Wisconsin

The St. Louis River Estuary may play an important role in processing urban-derived nutrients before these nutrients enter oligotrophic Lake Superior, but the efficiency of nutrient retention is likely to vary depending on physical conditions. During the summer months, warmer temperatures and longer hydraulic residence times should result in higher overall rates of biological uptake and processing of nitrogen, phosphorus, and organic carbon. We test this hypothesis using data from seven longitudinal surveys of the estuary from April-September 2012. We use a variety of conservative tracers to infer the contribution of various sources (e.g., St. Louis River, Lake Superior, WLSSD, urban runoff), and analyze concentrations of biologically available nutrients relative to these conservative tracers to quantify rates of nutrient processing. We also present preliminary results from direct measures of nitrification and primary production. We describe our planned sampling efforts measuring algal production and microbial processing rates in the SLRE for the 2013 season, and efforts to integrate these rate measurements with an existing hydrodynamic model of the estuary in order to gain a more complete picture of the physical and biological controls on this important ecosystem.

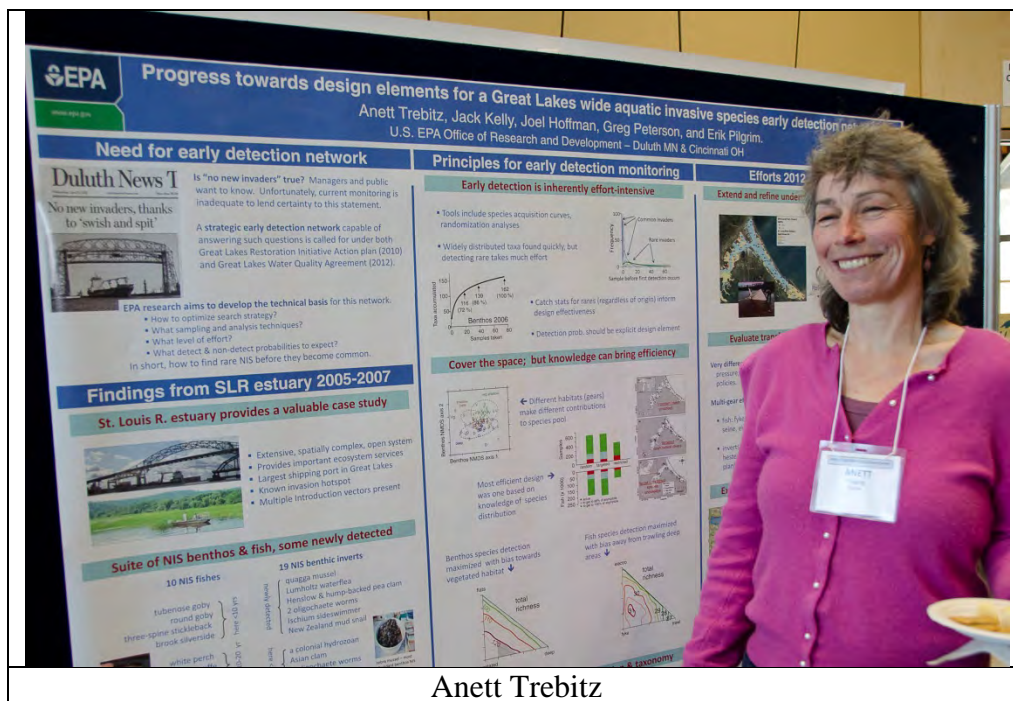


Gaston "Chip" Small

Progress Towards Design Elements for a Great Lakes Wide Aquatic Invasive Species Early Detection Network

Anett Trebitz, John Kelly, Joel Hoffman, Greg Peterson, and Erik Pilgrim
US Environmental Protection Agency

Great Lakes coastal systems are vulnerable to introduction of a wide variety of non-indigenous species (NIS), and the desire to effectively respond to future invaders is prompting efforts towards establishing a broad early-detection network. Such a network requires statistically-valid sampling designs to assess survey performance, detection probability, and effort required. We began our research into NIS detection strategies in 2005-2007, via a comprehensive multi-gear sampling effort of the St. Louis River estuary (SLRE). That work confirmed SLRE's status as an NIS hotspot (8 new benthic invertebrates detected), and elucidated elements of an early detection strategy such as overall effort required, prospects for optimizing sampling design, and applicable mathematical and statistical tools. Findings from this first phase of research informed the design for fish-NIS monitoring that the Fish and Wildlife Service has conducted in the SLRE since 2007 and now expanded to other coastal systems. In the summer of 2012, we initiated a second phase of NIS research with further sampling in the SLRE and a new sampling effort in Isle Royale coastal waters. Our goals include 1) explore the efficacy of larval fish as monitoring targets; 2) refine understanding of the role of gear combinations for efficient sampling of benthos; 3) evaluate transferability of SLRE findings to a system with very different physical setting, invasion pressure, and level of AIS concern; and 4) advance capability of DNA-based detection by expanding relevant signature libraries and comparing capabilities and challenges via paired traditional and DNA-based enumeration. Partners in this work include US-FWS-Ashland and MN-DNR (fish sampling), and US-NPS (Isle Royale work).



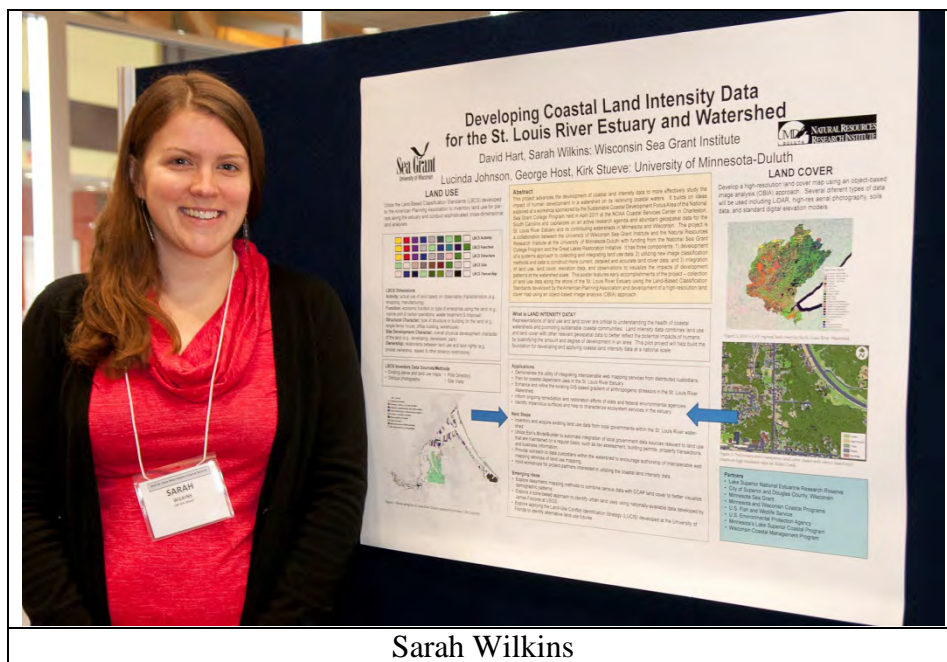
Anett Trebitz

Developing Coastal Land Intensity Data for the St. Louis River Estuary and Watershed for Minnesota and Wisconsin

Sara Wilkins, David Hart, Lucinda Johnson, and George Host
UW Sea Grant Institute, NRRI-UMD

Representations of land use and land cover are critical to understanding the health of coastal watersheds and promoting sustainable coastal communities. Land use and land cover are different, but related phenomena, and are often confused. Land use data maps reflect how people utilize the land, while land cover data measures characteristics of the physical material at the surface of the earth. Several problems exist for researchers who wish to utilize land use/land cover data for characterizing watershed characteristics including access barriers to data, inaccurate use of proxies, and outdated data. This project capitalizes on an active research agenda and abundant spatial data for the St. Louis River Estuary and contributing watershed in Minnesota and Wisconsin and the recent creation of the Lake Superior National Estuarine Research Reserve (LSNERR) to advance the development of coastal land intensity data.

The St. Louis River Estuary is also the focus of considerable planning activity as a Great Lakes Area of Concern (AOC) that could benefit greatly from more accurate and relevant landscape information. We utilize a land use classification model developed by the American Planning Association, known as the Land Based Classification Standards (LBCS), to provide a robust, in-depth understanding of land uses along parcels adjacent to the estuary. This data will be integrated with existing LiDAR data for the estuary and watershed to visualize the impacts of development at both scales. These combined pilot projects provide the foundation for building coastal land intensity data at a national scale.



Sarah Wilkins

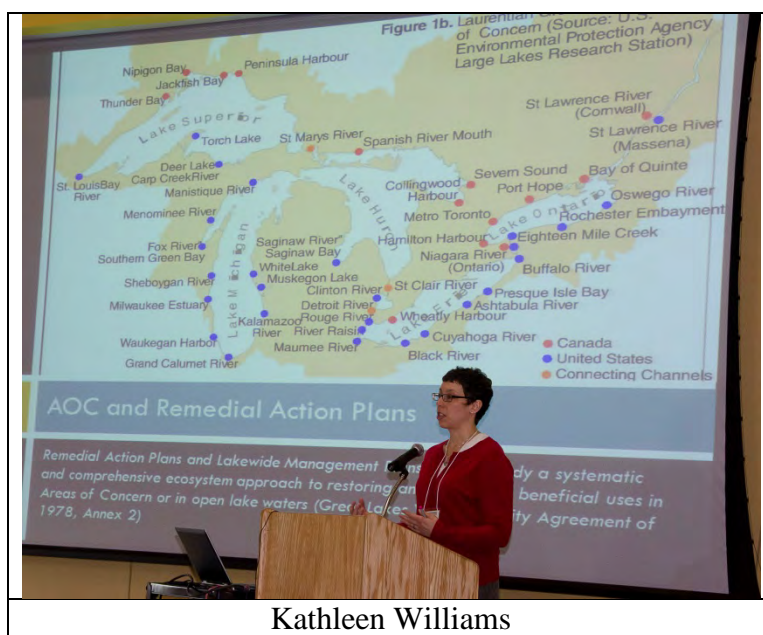
What Does Environmental Governance Look Like in US Areas of Concern?

Kathleen Williams

University of Wisconsin - Milwaukee

Forty-three Areas of Concern (AOC), or toxic “hotspots” were identified in the 1987 Protocol of Great Lakes Water Quality Agreement. In this Agreement, the International Joint Commission recommended an ecosystem approach as the most effective means of addressing the complex issues facing AOCs, but did not prescribe specific guidelines for implementing such an approach (Landre & Knuth, 1993; Hartig & Law, 1994; Mackenzkie, 1997; Beierle & Konisky, 2001.) The result has been forty-three different ways of creating and implementing Remedial Action Plans (RAP), with varying levels of success. The goal of this study is to identify and analyze contextual factors that contribute to successful RAP implementation in the twenty-nine US and Binational AOCs.

Using an institutional analysis approach, data for the US and Binational AOCs were collected, including the number and type of beneficial use impairments, size of the AOC, setting of the AOC (urban or rural), jurisdictional complexity, range of stakeholders, and coordinating agencies to determine the range of contextual variance within the AOCs. These data were analyzed alongside Great Lakes Restoration Initiative (GLRI) data on project funding for the initial round in order to test the assumption that some AOCs would have more institutional capacity, or be better positioned to articulate their goals and abilities. Thus, greater capacity would be reflected in more funding through GLRI in those AOCs. The initial results show that some AOCs did have both diverse stakeholder involvement and multiple funded projects. This is important for the St. Louis Estuary AOC because it is highly complex – it is the largest AOC, has multiple AOC Coordinators and is home to the largest port on the Great Lakes. Thus, it has a very unique context. This study will contribute to understanding the complexities of environmental governance and the role that institutional arrangements play in shaping the context.



Kathleen Williams

Critical Source Area and Priority Management Zone Determinations for the Deer Creek Watershed

Greg Wilson and Mike Strong
Barr Engineering

Modeling and terrain analysis refinements have been made possible by the recent release of high-resolution Light Detection and Ranging (LiDAR) topographic data and the geologic atlas mapping for Carlton County, Minnesota. The overall goal of this project is to supplement and refine the Deer Creek Watershed TMDL (Total Maximum Daily Load) Report and Implementation Plan project with detailed determinations of critical source areas and prioritization of the associated management practices. The TMDL implementation plan will describe turbidity impacts to aquatic life uses of Deer Creek, correlate turbidity to other pollutants (sediment, suspended solids, etc.), describe and quantify unique turbidity/sediment stressors which include groundwater influences, legacy impacts of the watershed and stream channel, significant in-stream and near-stream sources (slumps, bank erosion, etc.) and upland contributions. This presentation will discuss how we are combining GIS analysis and watershed monitoring and modeling results to identify and prioritize areas of the landscape that have a high propensity to deliver excess runoff and/or sediment load to surface waters, either by an overland flow path or by an increased risk for mass wasting.



The Port of Duluth-Superior: Mid-America's Gateway to the World; The Working Harbor Economic Engine for the Region

Adele Yorde

Duluth Seaway Port Authority

Millions of tons and billions of dollars move through the Port of Duluth-Superior each year. As the largest tonnage port on the Great Lake St. Lawrence Seaway, the vitality of this region depends on the strength of this Port...and the Port relies on the strength of the industries it serves.

The Port handles some 40 million short tons of cargo annually, including: iron ore, coal, limestone, grain, cement and salt, plus heavy-lift and project cargo en route to destinations across North America and around the world.

The Port is also an engine for job growth and economic sustainability, helping to support 11,500 jobs and commerce that generates \$1.5 billion in business revenues to bolster the region's economy.

The Port Authority drives industrial development. The Duluth Seaway Port Authority owns this port's only break bulk terminal which handles all types of general cargo from wind energy components, mining machinery, pallets and super sacks to structural steel and heavy-lift equipment for oil and gas production. The Port Authority is one of the region's largest owner/operators of industrial property, in addition to managing Erie Pier, the harbor's dredged material placement and reuse facility.

The Port Authority invests in infrastructure, develops sites, builds buildings and retrofits facilities to meet the needs of growth-oriented companies. In 2013, the Port Authority will embark on another exciting project along Duluth's waterfront – undertaking the first phase of an adaptive reuse and redevelopment project on Dock C&D to expand cargo handling capacity and eventually create a new Multimodal Transshipment Facility in the Port.



Adele Yorde

Appendices:

St. Louis River Estuary Summit Program: Talks

Tuesday February 26, 2013			
Time	Session	Presenter	Title
9:00	Welcome	Shon Schooler, LS NERR	Housekeeping
		Renee Wachter, University of Wisconsin-Superior	Opening Remarks
9:15	Integrating Social & Natural Sciences Chair: S. Schooler	David Bolgrien, US EPA	A Color-blind Pirate asks "Do RRR's Make Gray and Green Turn Blue?"
9:35		Patrick Robinson, UW-Extension	Social Science in Coastal Management
9:55		Adele Yorde, Duluth Seaway Port Authority	The Port of Duluth-Superior: Mid-America's Gateway to the World; The Working Harbor Economic Engine for the Region
10:15		Kathleen Williams, UW-Milwaukee	What Does Environmental Governance Look Like in US Areas of Concern?
10:35	Break	Break	Break
11:05	Impacts Chair: N. Danz	Nancy Schuldt, Fond du Lac Tribe	Mining Impacts in the St. Louis River Estuary
11:25		Josh Dumke, UM NRRI	A Comparison of Wetland Fish Communities in the St. Louis River Estuary and the Upper Great Lakes
11:45		Deanna Erickson, LS NERR	Water Quality Reports from K-12 students (2 schools)
12:05	Lunch & Roundtables Chair: J. Jereczek	Lunch & Roundtables	Vegetation Assessments Nick Danz
			Contaminated Sediments Tracey Ledder
			Ecosystem Services David Bolgrien
			Climate Change Shon Schooler
1:30	Assessments Chair: D. Bolgrien	Carmin Hardin, WI DNR	Slow the Flow: Impacts of Land Use on Water Quantity and Water Quality
1:50		Gerald Neimi, UM NRRI	A Summary of Recent Amphibian and Bird Sampling in the St. Louis River Estuary
2:10		Andrew Robertson, St. Mary's University	Watershed-wide Wetland Assessment: Correlating Mapped Wetland Types to Functions at the Landscape Level
2:30		Tom Hollenhorst, US EPA	150 Years of Change: Comparing the Distribution of Wetlands in Early and Post-development St. Louis River Estuary
2:50	Break	Break	Break
3:20	Biogeochemistry Chair: T. Ledder	Gaston Small, University of St. Thomas	Seasonal and Spatial Patterns in Water Column Biogeochemistry in the St. Louis River Estuary
3:40		Luke Loken, UW-Madison	Denitrification Patterns of the St. Louis River Estuary
3:50		Brent Bellinger, US EPA	Toward Delisting of the Water Quality Beneficial Use Impairment in the St. Louis River: A Monitoring Approach
4:10	Poster session	Posters	Posters
6:00	Adjourn	Adjourn	Adjourn

Wednesday February 27, 2013			
Time	Session	Presenter	Title
8:30	Welcome	Shon Schooler, LS NERR	Housekeeping
8:40	Assessments	Ryan O'Connor, WI DNR	New Prioritized Inventory Plan for Collecting New and Updated Data of Lake Superior Estuaries and Coastal Wetlands
9:00	St. Louis River Estuary Area of Concern Chair: N. French	AOC Coordinators	On the Road to Delisting: Updates on BUI Blueprints and Delisting Packages
10:00	Break	Break	Break
10:30	Slow the Flow and Invasions Chair: M. Hudson	Greg Wilson, Barr Engineering	Critical Source Area and Priority Management Zone Determinations for the Deer Creek Watershed
10:50		Faith Fitzpatrick, USGS	Influence of Drainage-Network Position and Geologic Setting on Channel Responses to Floods for Duluth-Area Streams, Geomorphic Processes and Sensitivity to Disturbance for Streams in Duluth, MN
11:10		Joel Hoffman, US EPA	Invasion by stages in the St. Louis River Estuary
11:30	Lunch & Roundtables Chair: J. Jereczek	Lunch & Roundtables	Environmental Education Deanna Erickson
			Wetland Assessments Cherie Hagen & Rick Gitar
			Slow the Flow Matt Hudson
			AOC Progress John Jereczek
1:00	Assessments and Biogeochemistry Chair: D. Erickson	Michael Meyer, WI DNR	The Wisconsin Shoreland Restoration Project: Preliminary Findings 2007-2012
1:20		Shon Schooler, LS NERR	The Pokegama Bay Sentinel Site: Measuring Climate Change Impacts in the St. Louis River Estuary
1:40		Christine Ostern, Douglas County	Hog Island Remediation-to-Restoration
2:00		Emily Graham, University of Colorado	Parsing the influence of geography, vegetation, and bottom water dissolved organic carbon fractionation on sediment total- and methylmercury concentrations in the St. Louis River Estuary
2:20	Wrap-up Chair: D. Erickson		Research, Port Operations, Public Involvement, Resource Management, Education
2:45	Adjourn	Adjourn	Adjourn

St. Louis River Estuary Summit Program: Posters

Poster	Presenter
Population Status Assessment of Marsh Grass-of-Parnassus in Northwestern Wisconsin	Dan Fuller and Nick Danz
Distribution of submerged aquatic vegetation in the St. Louis River Estuary: Maps and models	Ted Angradi, Mark Pearson, David Bolgrien, Brent Bellinger, and Mathew Starry
A Survey of the St. Louis River Estuary with Emphasis On Non-Indigenous Species and Habitat Structure	Julie Barker
Coastal Wetland Monitoring in the St. Louis River Estuary, Past and Future	Bob Hell, Josh Dumke, Val Brady, Gerald Niemi, Annie Bracey, Nick Danz, Jeremy Erickson, Lucinda Johnson, George Host, Carol Reschke, Paul Meysembourg, Terry Brown
Superior SAMP: Balancing Conservation and Development	Darienne McNamara
Design Elements for a Great Lakes Wide Aquatic Invasive Species Early Detection Network	Anett Trebitz
Early Detection Monitoring for New Aquatic Invasive Species in Chequamegon Bay, Lake Superior	Henry Quinlan and Gary Czypinski
Novel Effects-based Monitoring Approaches to Evaluate Chemicals of Emerging Concern in the St. Louis River Estuary	Jason Berninger, Gerald Ankley, Jenna Cavallin, Evan Eid, Elizabeth Durhan, Kathleen Jensen, Michael Kahl, Carlie Lalone, Elizabeth Makynen, Megan Severson, Kyle Stevens, Dan Villeneuve, Tim Collette, Drew Ekman, Ed Perkins, Natalia Garcia-Reyero,
Developing Coastal Land Intensity Data for the St. Louis River Estuary and Watershed for Minnesota and Wisconsin	David Hart, Sarah Wilkins, Lucinda Johnson, George Host
Invasive vs. Native	Hayley Olson and Sarah Backlund
Research and monitoring at the LS NERR	Mary Munn, Tracey Ledder, and Shon Schooler

Notes from Discussion Tables

Tuesday, February 26, 2013: Four Roundtable Discussions

Vegetation Assessments/Nick Danz

The group discussed existing and past vegetation projects in the estuary, including the different types and locations of the surveys. We discussed how these disparate datasets might be combined to give a more holistic picture of vegetation in the estuary. We discussed what future studies might concentrate on, including structural and functional values of vegetation (e.g. with respect to fish production, nutrient cycling, etc...). Also, could some special species, such as Wild Rice or others be used as indicators of environmental condition. We talked about how we might predict potential restoration scenarios using vegetation data in combination with recent work to characterize sediments throughout the estuary. Also, it would be good to separate upstream/downstream differences in vegetation from stressed/unstressed differences to see what the real effects of human activity are.

The roundtable was represented by folks from Fond du lac, US EPA, UWS, LSRI, WI DNR, LSNERR, USFS, and a few more.



The vegetation roundtable discussion

Contaminated Sediments/ Tracey Ledder

Big Question: How do we get all these sediment researchers communicating (what are the data needs and data use?)

On-going research and management work:

- Mercury Methylation over geographical gradients, carbon content influence on the biological availability of contaminants, microbial communities.
- Water samples, sediment samples, and biota samples looking at mercury and methyl-mercury in estuary for potential Hg TMDL project.
- Nutrient fluxes, river to lake gradient differences in nutrients, denitrification sediment to air.
- Remediation and Redevelopment WDNR (needs for more information for remediation decisions).
- Superfund sites: Remediation-to-Restoration projects, contaminants of emerging concern.

Problems:

- Fluctuating environment. We don't have much information on sediment movement, how does boat traffic affect sediment movement, differing ages of data sets – all of these issues make it hard to determine patterns as related to services.
- Analytical lists are different project to project, detection limits are often above effects concentrations for particular contaminants of concern (which makes management decisions difficult).
- Data Gap- sediment movement, sediment deposition rates.
- Documentation of quality control and detection limits needs to be more accessible.

Ecosystem Services/David Bolgrien

Notes on the Ecosystem Services Roundtable discussion at the SLRE Summit III (2/26/2013) – reported by David Bolgrien

- 1) There were about 12 people representing a range of groups, agencies, and interests. These included municipalities, private business, university researchers, resource managers, and educators. People did not simply represent the positions of their professions or agency. There was a passion for the subject.
- 2) People had genuine concern that as decision makers, they need more and better information on the biophysical condition of the estuary but also on the socioeconomic conditions of the users/beneficiaries of the estuary. People did not consider the source of the information to be as important as the ability to put the information to work on their problem. It did not matter whether the information was from a government agency, NGO, or old-timer's anecdote, what mattered was that the information was relevant and applicable to their needs.
- 3) The ability (or inability) to assemble, interpret, and use relevant information (especially "hard" data) became a central theme of the discussion. There was a nominal natural science / social science divide but it was not the key driver or concern. More important was the divide between data providers (often "scientists") and data users (often agencies/NGOs/educators/the public). Better connections between data sources and data users was a desired outcome of the group.
- 4) Despite the desire for data-driven decisions, many people/agencies depend on "best professional judgement" (BPJ) for decision making and messaging. As long as the message (and its assumptions) pass the "laugh test" then everyone (including funding agencies and the public) are satisfied. Everyone gets to move on. There is no "paralysis from analysis". Since most decisions or messages are incremental and multi-part, the sum of lots of little reasonable things is still pretty reasonable. The BPJ approach is relatively effective, cheap, and familiar.
- 5) The use of data (both quantitative and qualitative) for decision making and messaging is important but remains challenging for people/groups. People unfamiliar with methods used to generate the data (collection methods, statistics, study designs, interpreting results) are not comfortable using the data and, frankly, will avoid using the data. Using "hard" data incorrectly is deemed riskier than not using the data at all. When data are used, people select (cherry-pick) results that are relevant to their message and can be packaged and delivered. People know that this process could bias or cheat the results. People recognized the value of using hard data but only if the data can be assembled, interpreted, packaged, and delivered.
- 6) People acknowledged that monetary valuation was the key (only?) factor in decision making and messaging. Using dollars to make comparisons is (arguably) easy and effective. It was suggested that social science data is more likely used than natural science data (when available) because they come in dollar units. In fact, natural science data often need to be interpreted in the context of social science data before used by the public. In practice, this means recasting natural science data into dollars. The flood of 2012 is an example. Expressing flood damage and restoration needs in dollars communicated the scope and spatial extent of the problem. Similar to using BPJ, the credibility of dollar figures is infrequently questioned. People expect "officials" to estimate damage in dollars but few people follow-up and check whether the estimates are correct. In most situations, real costs are assessed much later – long after people have forgotten the sound-bit estimates. It concerned people that important decisions and messaging was so often done without hard data.
- 7) In this discussion and the education/outreach discussion the perceived information needs for the SLRE varied with a dichotomy of opinion about the visibility of the estuary. Some people believe that the SLRE enjoys a high profile in local and regional hearts and minds. Other people

believe the estuary is “out of sight and out of mind” of many locals and visitors/tourists. The former group cited public participation in outreach activities and increased funding for R2R projects and LSNERR. The latter group cited the low level of economic growth associated with (or driven by) the estuary, the stigma of “pollution”, and the lack of connection/access to the estuary. Both groups feel the estuary is greatly overshadowed by Lake Superior and the amenities of Canal Park/lakefront area.

- 8) People suggested that more socioeconomic data are needed to understand the problem and propose solutions. In particular, it is important that specific features of the estuary be linked to specific beneficiaries. For example, the proportion of all anglers and boaters that use the estuary is not known. There are different investments and expectations for fishing and boating in the estuary compared to Lake Superior or even inland lakes. Knowing who is willing to make what investment to use the estuary (and why) would help people/agencies make decisions about R2R investments and education/outreach messages. In general, if we understand how people perceive the estuary as a “brand”, we could optimize the appeal of that brand.
- 9) Analysis of beneficiaries would help people/agencies better understand the outcomes of their actions. What is good for one group might not be good for another. For example, restoring a wetland that impedes access to boats docks may create tension between nominal beneficiaries. With the exception of large scale projects by the ACOE or Superfund (for example), comprehensive analyses of the environmental, social, and economic winners and losers of management actions are usually beyond the capabilities of people/agencies. Tools for accounting for ecosystem services and benefits would be useful - but only if they can be made operational by users. A tool or data that no one can use hurts more than helps decision making.
- 10) There was concern that work being done in the estuary was not (maybe, could not) be integrated across boundaries of discipline and agency. The success of individual projects usually cannot be aggregated or applied use outside of the bounds of that original project. The BUI delisting process attempts to ameliorate this by accounting for cumulative impacts of R2R projects. Adapting an ecosystem services framework (or mentality) helps because it extends the focus of outcomes from, for example, the amount of wetlands restored to the amount of wetland functions restored. This has long been implicit by referring to “habitat” restoration (because habitat is a function of a wetland or other resource). The ecosystem services approach makes it more explicit.
- 11) On the practical side, people were interested in more funding to build capacity for using “real” data (natural/social science, cost/benefit valuations, collect their own data, etc). In particular, EPA (Region 5, AOCs, GLRI, GLNPO, maybe ORD) could fund more interdisciplinary projects. People identified a disconnect between regulators (at EPA, state agencies, or even county/city departments) and the public (or actual or potential users of the estuary). People appreciate the flow of GLRI dollars into the SLRE but question how priorities were established and funding decisions were made. Again, an ecosystem framework that connects changes in the field to changes in environmental and socioeconomic well-being might be useful. Many projects try to have visual impact for the public (i.e., boots on the ground moving dirt). Those might be great projects but not necessarily greater than a project with less visual impacts. Using data as part of the messaging of project outcomes is advantageous.
- 12) Capacity building could also be done informally (but still effectively) if coupled with on-going SLRE stakeholder meetings. For example, it may be possible to leverage the diversity of people/agencies at HTAC to spread the gospel of ecosystem services and increase the sharing of useful data. Again, “useful” data means data that are relevant to a problem AND can be packaged and delivered in response to that problem. The diversity of interests gathered through

HTAC might create opportunities to connect environment and socioeconomic problems with common solutions.

- 13) It might be useful to develop (or find) a primer or other means for documenting the goals, assumptions, and method of various disciplines and how they use data. Such information might lead us commonalities that can be exploited for mutual benefit. Lack of understanding or miscommunications between people/agencies can project uncertainty or inefficiency to the public. For example, agencies charged with habitat restoration, Superfund remediation, public health, and economic redevelopment operate in very different procedural and funding environments even though they have the same mission of improving community well-being. Becoming more familiar with how each entity operated, including their constraints, would help us recognize opportunities for synergy.



Climate Change/Shon Schooler

Issue: Perceptions of Effect on Quality of Life

- Solstice storm
- Ice fishing/Snow melting/ skiing
- Growing Seasons
 - on-ground
- Atmospheric event driven
- Response
 - Adaptation? v.s. mitigation?
 - Effect on future management
- Will not be the same
- Resiliency
- Fragmentation and movement

- Land-use change agriculture
- Water Transport
 - Beneficial aspects
 - Habitat restoration implications
 - Cold water resources loss
 - ELOHA
 - Public Narrative
 - Baseline Social
 - Cultural



Craig Roesler, Peter David, and Fred Strand

Wednesday, February 27, 2013: Four Roundtable Discussions

Environmental Education/Deanna Erickson

What do you wish people in the St. Louis River Watershed understood about the estuary? What is crucial knowledge for public decision making?

Stronger understanding of nexus between human activity and what the impacts are- runoff, for example.

Broader understandings of the watershed context- people don't understand the limitations of political boundaries to the watershed as a whole. Seeing the watershed beyond the political entities within it. People need to wrap their heads around the St. Louis River Watershed and the Lake Superior Watershed. Understand collaborative solutions; get away from putting a band aid on one place at a time.

I wish we were doing a better job in the science community of doing a better job of listening to people who have lived and worked here forever.- it's important for researchers to understand what's valuable to people, we need to social science construct.

People don't understand the global and regional significance of the region. People don't know what the AOC is- don't know if the river is polluted or clean, contaminated sediments.

People need to understand the limits of beach advisories and other warnings- media messages need to be sculpted to contain solid science in an understandable way.

What the estuary does for people that they're unaware of. It's a fish nursery- there are many other things in terms of ecological services, educational opportunities, esthetics, and recreation. How unique it is! Special! To understand the value of aquatic plants, and other things that aren't understood very well.

What's the message from Joel's conclusion that there hasn't been an invasion in the last 10 years? Is that a useful public message or perception? What do we want the public to lock in on invasive species?

- understand the difference between Lake Superior and the inland lakes.

- Negative stories/impacts can be disempowering. Scientists need to bridge that gap in a way that's attractive to people.

- Create a social norm from the success of invasives. "The people of the St. Louis River watershed do not transport invasive species." People also need to understand that their own actions make a difference- washing boats.

One perception is that problems were fixed after WLSSD came online. But the protection of the estuary is ongoing- everyone plays a role. That needs to be the drumbeat, no matter who you are. You can't just point to WLSSD and say things are fixed.

Help people understand how our streams have changed and why it matters what we do in riparian zones. Connect this to how we treat our roads, our riparian vegetation, and flashiness in floods.

Young children are the most impressionable and need to have direct experiences. The whole idea of scale in this- exposing them to aerial views, finding where they are, understanding the significance. Including parents in presentations is a really powerful way to educate adults and draw them into experiences in the region.

The need to connect is both for youth and the public. There's nothing wrong also, with talking to the people who already have an interest- they can be our information carrier to the public. Kids who already have a connection are a big advantage- they can really help in the future. We need to establish opportunities for physical connection with the estuary.

Finding ways to offer help as a means of teaching. People already know so much. Scientists need to recognize the richness of direct experience. More publicly available experiences!

What research, restoration, service or education needs do you have- or know of- that could be met by students or volunteers?

Opportunities for stream bank restoration and riparian plantings: fun, active. Older groups can take initiative to monitor sites before and after restoration.

Pre- and Post- photos. Teachers can get photos for photo monitoring. Deer creek for example. Adam Fulton from MN DNR has needs in this area.

Trash is always high on the list as being a problem. Plastics.

Public programs where people rake the storm drains, adopt a drain.

There has been a movement in Duluth to get all the leaves/woody debris out of streams.

College students: baseline bird surveys, frog surveys. Gerald Niemi. There are high school groups that are doing high level.

Getting people to volunteer, one comment is that when people help with a project, it gives them ownership. They must incorporate WHY they're doing it.

History teachers collect oral history on the river. Would be useful on Stories and Science website. Western portion of the river in Duluth has changed a lot. Oral history could really keep this story as part of public memory. Collect good memories, things people used to do. Courtney K. has been doing this.

Anne Timm (USFS) likes every opportunity available to mentor young scientists. Need someone to help her set trap nets, collect plant samples. Undergrads/volunteers.

Teaching students about scientists, how they're not accessible. This perception needs to be changed through direct experience of scientists.

There is a heavy focus on "meet the scientists" and stuff, but we also need to extent to history, politics social sciences.

Having kids get to the water, so that they know how to get there. Help their families get there too, so they can go again.

Other comments:

Giving people ownership is a really important component. For example, have the older kids give tours to the younger ones.

Students do come to WLSSD via the city bus system!

Wetland Assessments/Cherie Hagan & Rick Gitar

No written notes.

Slow the Flow/Matt Hudson**Issues of concern:**

- Private land ownership – difficult to manage large landscapes.
- Zoning affecting how private land owners manage their land. Pushes people to do things that may not benefit the resources.
- Flash flooding: What's lag time to peak flow recovery?
- Targeted approach: Find field of highest sediment areas with biggest index of flow production and focus recreation there.
- Roads: How can we alleviate water running off roads?
- Sediment traps at base of where ditch meets stream.
- Target BMP's.
- Ecosystem service basins: What climate can be provided that can make a decision a no-brainer for land owners?
- What would drive people's sense of belonging?
- Targeting areas of high turbidity contributions.
- Work on stream and upland at the same time.
- What's the "unimpacted" situation on the day plain? Is turbidity standard the right metric?
- Sediment yield for reaches of the stream – what is least affected? What is the gradient?
- Climate change and increase in storm events as a focus for slow the flow. Look at what happened in Duluth and Chequamegon Bay last summer – teaching tool.

AOC Progress/John Jereczek:

No written notes.

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