Proceedings of the St Louis River Estuary 2012 Science Summit

St. Louis River Estuary Science Summit 2012

March 8 & 9

University of Wisconsin - Superior

Yellowjacket Union

ST. LOUIS RIVER ESTUARY
Area of Concern to Area of Recovery
2012 Summit

Acknowledgments

Thanks are owed to many people and organizations for support of this very grass-roots event.

Special thanks to the following organizations who provided funding and in-kind contributions:

Lake Superior National Estuarine Research Reserve
University of Wisconsin Extension
University of Wisconsin – Superior
Short Elliott Hendrickson, Inc.
Barr Engineering Company
US Environmental Protection Agency – Mid-Continent Ecology Division
Enbridge Engineering
Minnesota's Lake Superior Coastal Program
Wisconsin Coastal Management Program
Wisconsin Sea Grant
West Wisconsin Land Trust
Limnotech
Minnesota Sea Grant

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Published by The Lake Superior National Estuarine Research Reserve, Superior, WI

LSNERR Document number: 2012-R-1002

Cover photo by Sue OHalloran

Interior Photos by Michel Anderson (www.singingcanoe.smugmug.com)

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Introduction

The 2012 St Louis River Estuary Science Summit was a great success. Over 150 people attended the summit this year, up from 140 last year. Although most participants were local, some travelled from Milwaukee, Madison, Wausau, Minneapolis, and Ashland to attend. We had 33 talks and 14 posters that presented information on research and restoration projects of relevance to the estuary. We also held a panel discussion "Building the Bridge Between Research and Management" where six researchers and managers discussed the challenges involved with promoting applied environmental research to address key management needs. We would like to thank all the presenters for bringing their exciting work to the summit, and the sponsors for helping make this event possible.

Results from the Exit Survey

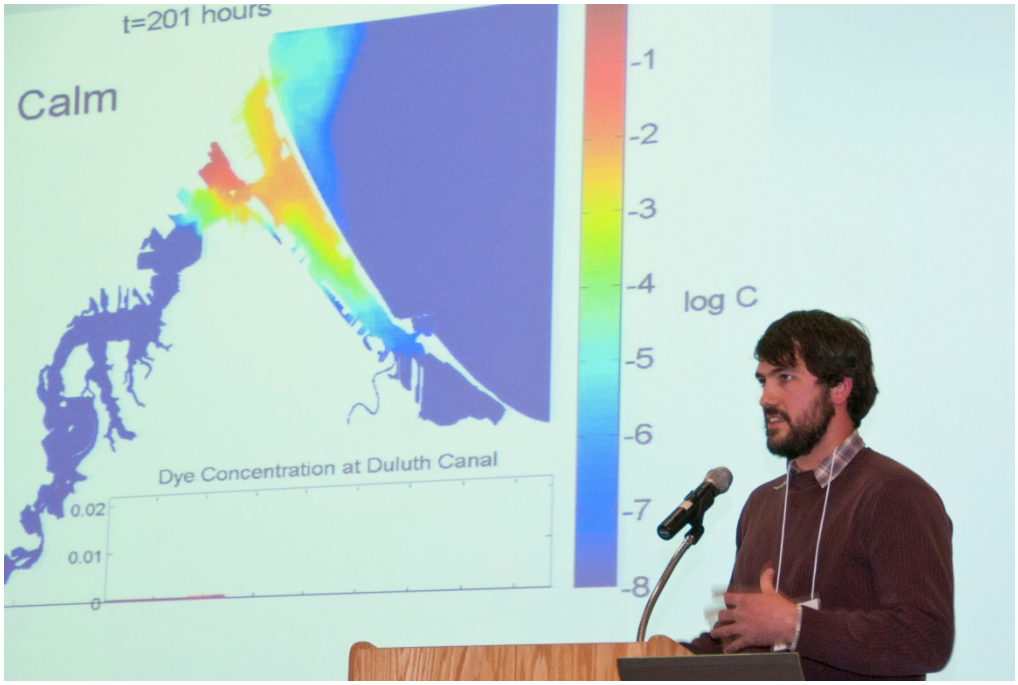
We conducted an exit survey after the event. The link to the web-based survey was sent to everyone on the registration list who gave email contact details, which totaled 153 people. Thirty-eight people (25%) responded to the survey. All respondents agreed that it was worth their time to attend the summit (100%). Almost all (97%) said they would attend next year, depending on availability. All agreed that the presentations were either good (50%) or great (50%). Most respondents thought the balance between research and management/restoration talks was good (80%). Everyone learned something new; most agreed that they gained some new information (65%) or a lot of new information (35%). For example one said "I walked away with 30 questions or action items that will help inform and direct my future work in the estuary." Everyone also agreed that they gained new useful contacts (2-8, average 5) as a result of the summit. The results from the survey indicate that we met our goals of disseminating information about projects in the estuary and provided an opportunity for participants to meet and form new associations.

Abstracts for Oral Presentations

Development of a model to examine the effect of barrier islands on local water currents near a treated sewage outfall

Matt James and Jay Austin
University of Minnesota-Duluth, Large Lakes Observatory

We present results from an improved St Louis Estuary model based on the Finite Volume Coastal Ocean Model (FVCOM), a three-dimensional primitive equation ocean circulation model. This current model has dramatically improved resolution throughout the estuary and harbor over previous versions. The harbor/estuary grid is coupled to a fully-resolved (though lower resolution) model of the whole of Lake Superior, including high-resolution regions around the Apostle Islands and in the Portage Canal for use in future research. We are beginning to use the model to examine the flushing and exchange characteristics of the harbor/estuary system under a range of idealized meteorological scenarios. Estuary currents, temperatures, water levels and the dispersal of a virtual dye under realistic meteorological and fluvial forcings were examined both with and without the inclusion of proposed dredge-spoil islands.

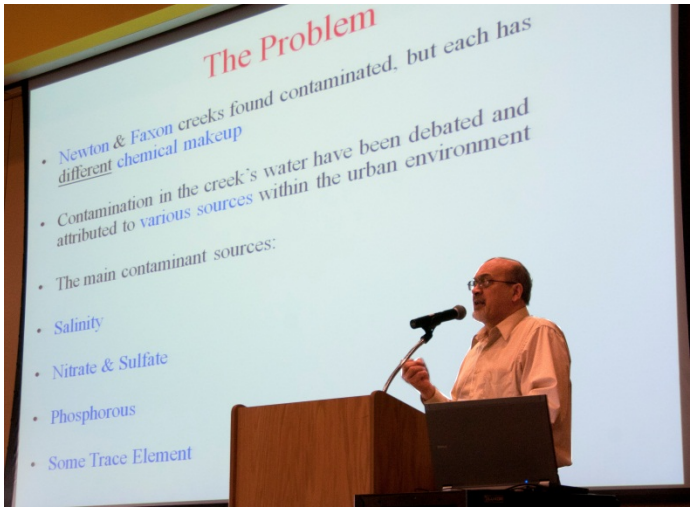


Matt James

Study the Water Quality of Two Urban Streams Newton and Faxon Creeks in Superior, WI

William Bajjali
Department of Natural Sciences, University of Wisconsin – Superior

A study of water quality was conducted for the Newton Creek that running in urban area in the city of Superior, and discharge into Hog Island Inlet (HII). Water quality data collected from 5 locations located along the creek flow from its head to its mouth. Throughout the year there is a wide range in measured properties of the temperature, dissolved oxygen, electro conductivity, and Ph. These ranges show there are numerous factors affecting these properties of the creek and the impact from Murphy Oil is the greatest. Some of the recorded salinity was observed to be much greater than the acute criteria. The high salinity of the creek water is attributed to the chloride and sodium concentrations with relatively elevated concentrations of sulfate and nitrate. A geochemical model reveals that the water chemical composition of HII is the result of a mixing ratio of about 90 % of Lake Superior water and 10 % of Newton Creek water. Faxon Creek, which was monitored for comparison purposes, recorded salinity concentrations much higher than the salinity of Newton Creek. Both Newton and Faxon creeks revealed different chemical makeup. Faxon Creek reveals that all major cations and anions concentrations in its water are higher than in Newton Creek water with exception the sulfate and nitrate. Nitrate and phosphorous concentration in Newton Creek is much higher than in Faxon Creek and exceeds the recommended concentration value set by EPA. The chemical makeup and the variation of the major ions in both creeks show that the source of water contaminations in Newton Creek originates mainly from the discharge of the treated wastewater treatment of Murphy Oil with minimum contribution from surface runoff. The source of contamination and mainly the elevated salinity and chloride concentration in Faxon Creek water is mainly from urban surface runoff from the city of Superior.



William Bajjali

Relationship between water quality and anthropogenic stressors in the St. Louis River Estuary

Will Bartsch , Richard Axler , George Host , and Jerry Henneck

Natural Resources Research Institute, Universiy of Minnesota - Duluth

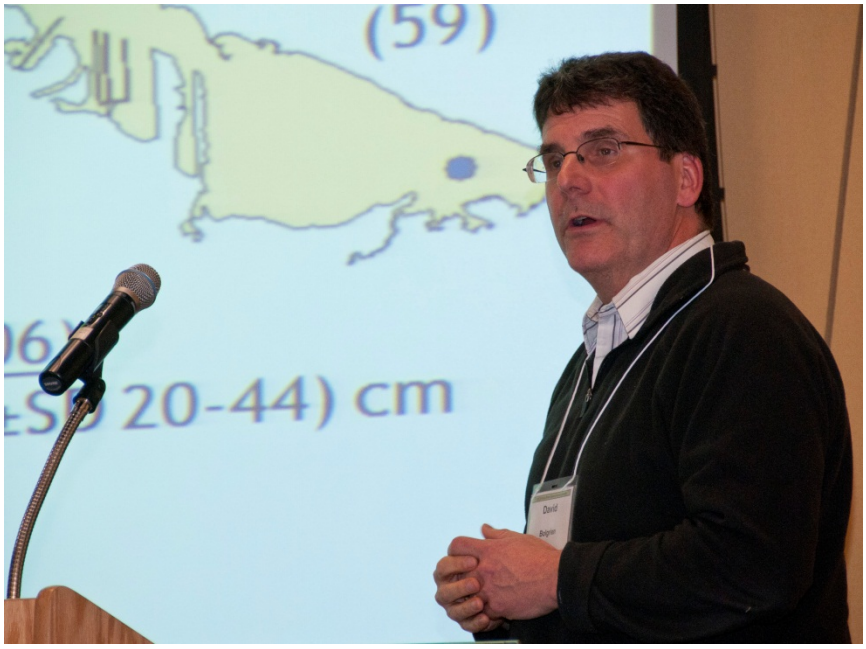
The St. Louis River drains an area of 9,412 km² (3,634 mi²) and empties into the western tip of Lake Superior. Shortly beyond the Fond du Lac Reservoir, the river opens up into a 4856 ha (12,000 acre) freshwater estuary that separates Minnesota and Wisconsin. To characterize the anthropogenic stressors within the watershed, a GIS-based anthropogenic stressor gradient has been developed. The components of the stressor gradient are: road density, point-source pollution permit density, population density, percent agricultural land and percent developed land. To assess the relationship between the stressor gradient and water quality within the St. Louis River Estuary, extensive water quality sampling was conducted during different flow regimes. Twenty six locations, selected to be evenly distributed across the stressor gradient, were sampled during base flow in 2010 and 2011 and the end of spring runoff in 2011. Near shore and tributary samples were taken at each site. Additionally, the tributaries of 17 of those sites were sampled during five storm events (≥ 0.5 inches/day) during summer 2011. The samples were analyzed for dissolved oxygen, pH, conductivity, turbidity, temperature, clarity, color, nutrients, chlorophyll-a, phaeophytin, chloride and sulfate. Chloride was significantly correlated ($p \leq 0.1$) with the stressor gradient for all flow regimes in both the tributaries and near shore environment. Other parameters were also significantly correlated with the stressor gradient. In tributaries they included: total nitrogen and conductivity during base flow; total nitrogen, ammonium-N, nitrite/nitrate-N and chlorophyll-a during spring runoff; and ammonium-N and nitrite/nitrate-N during storm events. In the near shore environment they included: ammonium-N, nitrite/nitrate-N and orthophosphate during base flow; and nitrite/nitrate-N and phaeophytin during spring runoff. As a tool to aid in remediation projects throughout the estuary, the stressor gradient could be used to identify both reference areas and watershed issues of concern.

Will Bartsch

Time series analysis of water level and temperature in the St Louis River Estuary

David Bolgrien, Brent Bellinger, Ted Angradi, and Mark Pearson
US EPA ORD MED

HOBO sensor recorded pressure and temperature data every 15 minutes in the St Louis River estuary between 6/23 – 10/31 2011. Sites included Allouez Bay, Superior Bay, Hearding Island, WLSSD Bay, railroad bridge, Clough Island, Spirit Lake, Oliver Bridge, and Nekuk Island. Results were compared to historical data of Mortimer and contemporary data from gages at the Duluth canal and outer harbor. Metrological data were taken from Sky Harbor airport. There was no seasonal trend in water elevation in the estuary. Consistent with Mortimer, we found tidal oscillations at 23.97 h and 12.39 h and major seiche oscillations at 7.96 h, 4.96 h, 3.82 h, 3.39 h, and 3.04 h. Oscillations at Oliver Bridge were out of phase and lacked coherency with other sites. Water elevations at sites downstream of Clough Island varied in-phase with high coherency for the 8 hour seiche. Elevations in Spirit Lake and the river varied in-phase with high coherency. The largest change in hourly elevation was 0.23 m in Allouez Bay and 0.44 m change in the canal. In the estuary, in-phase diurnal water temperature oscillations were observed at all sites except Clough Island and Oliver Bridge. Temperatures upstream of the railroad bridge were generally warmer than downstream. Temperatures in the Duluth canal were generally lower than in the estuary. Seasonal temperature maxima (>20^{o} C) were reached in late July/early August. Estuary temperatures decreased (<12^{o} C) and became more uniform by the end of October. Some transient changes in water elevation, temperature, and conductivity (measured at the USGS gage) could be associated with changes in wind direction and current flow though the Duluth Canal.



David Bolgrien

Habitat Restoration in the St. Louis River Estuary: Past and Present

Patrick Collins
U.S. Fish & Wildlife Service

Habitat restoration projects in the St. Louis River Area of Concern (AOC) have made significant progress toward removing some Beneficial Use Impairments (BUIs). Recent successes and on-going efforts build on a history of past projects that can be traced to the early days of the St. Louis River Remedial Action Plan and, in some cases, significantly earlier. We will survey the history of habitat restoration efforts in the St. Louis River AOC and examine the context linking individual projects into a broader, estuary-wide restoration effort targeted at removing BUIs and delisting the AOC.

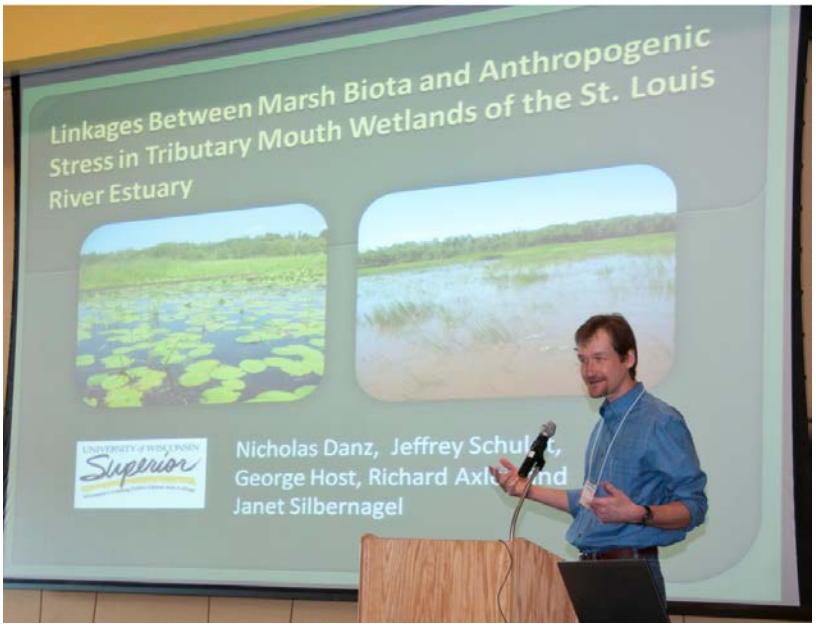
Patrick Collins

Linkages between marsh biota and anthropogenic stress in tributary mouth wetlands of the St. Louis River Estuary

Nicholas Danz [1], Jeffrey Schuldt [1], George Host [2], Richard Axler [2], and Janet Silbernagel [3]

[1] Department of Natural Sciences, University of Wisconsin - Superior
[2] Natural Resources Research Institute, University of Minnesota – Duluth
[3]Department of Landscape Architecture, University of Wisconsin - Madison

The St. Louis River Estuary (SLRE) is bounded by natural habitat and highly industrialized areas in the cities of Duluth and Superior. Marshes of the estuary play a critical role in protecting water quality and supporting rare flora and fauna. Our aim here was to evaluate the potential influence of human disturbance on marsh vegetation and macroinvertebrate communities in the SLRE. Disturbance was quantified for contributing watersheds with an index that integrated multiple types of human activity. In 2010-2011, we surveyed 28 marshes positioned at the mouth of tributaries to the SLRE – biota in these wetlands should be subject directly to stresses delivered down the drainage network of the tributary watersheds. Percent cover of plants in emergent/submergent zones was recorded in 15 1-m2 quadrats in each marsh. Macroinvertebrates were sampled in emergent and submergent vegetation using D-frame sweep nets in each marsh. Following taxonomic identification, several relative abundance, richness, and diversity metrics were used to describe the macroinvertebrate community present in each marsh. Water depth and physiographic setting were the primary controls on plant community composition, whereas anthropogenic stress was a less important control. Indicators of marsh plant condition including Coefficient of Conservatism and Floristic Quality Index (FQI) were negatively related to human disturbance, while some nutrient- and sediment-tolerant species had greater abundance in sites with greater stress. Several relative macroinvertebrate metrics were significantly correlated with anthropogenic stress. Future work in marshes of the SLRE will attempt to disentangle the types of stress important to wetland biota.



Nicholas Danz

Wild rice soup: A mix of the ecology, history and management of manoomin.

Peter David
Great Lakes Indian Fish & Wildlife Commission

Northern Wisconsin and Minnesota is fortunate to be part of the "Wild Rice Bowl": that relatively small part of the world where this incredible wetland plant naturally grows in relative abundance. Primarily because of its great nutrient content, wild rice has been a mainstay resource for both humans and wildlife species in this region for thousands of years, and it has left its mark not only on our landscape, but in our history books and oral traditions as well. Unfortunately, rice is a resource that has declined in abundance in many areas, including the St. Louis estuary. This presentation will provide an overview of the ecological and cultural significance of wild rice – especially to the Ojibwe - and review its interesting role in the history of our region. It will also provide an overview of the management efforts that are underway in the region, discuss some of the threats that rice is facing today, and highlight some of the research areas that could benefit this unique plant.

Peter David

Sharing our Estuary: Unveiling the Lake Superior NERR Education Program

Deanna Erickson
Lake Superior National Estuarine Research Reserve

In Fall 2012, the Lake Superior NERR conducted interviews, surveys, and focus groups with the public, tribal resource management and K-12 educators in order to build a responsive and engaging new education program. From this input and current research in teacher professional development, community programming and science education, strategies and program recommendations have been developed that will shape LSNERR programming into the future. LSNERR Education Coordinator Deanna Erickson will present the Education Program Strategic Plan as well as an overview of public and K-12 programs in development for 2012-2013.

Deanna Erickson

Using Stories to Teach Estuary Science

Cynthia Hagley[1], Janet Silbernagel[2], George Host[3], Mark Wagler[2], James Matthews[2], Annette Drewes[4], Roseanne Fortner[2], Matthew Axler[3], Richard Axler[3], and David Hart[5]

[1] Minnesota Sea Grant, University of Minnesota-Duluth
[2] Department of Landscape Architecture, University of Wisconsin - Madison
[3] Natural Resources Research Institute, University of Minnesota – Duluth
[4] Save Our Rice Alliance
[5] Wisconsin Sea Grant, University of Wisconsin - Madison

As part of a joint Minnesota and Wisconsin Sea Grant-funded project, we are developing geoquests and geocache tours to support place-based learning in the St. Louis River estuary. At a recent pilot workshop for middle and high school teachers and students, participants used mobile devices to explore environmental and cultural aspects of the estuary using GPS and ARIS (Augmented Reality for Interactive Storytelling), an application that allows users to create and share their own location-based quests, tours, and stories. The final product will be targeted to youth, teachers, local citizens, local decision-makers, and Lake Superior enthusiasts. Our goals are to increase awareness, collaborative learning, stewardship, and the ability to focus monitoring and management on the most critical resource issues in the St. Louis River estuary.

Cynthia Hagley

Spatial Modeling for Ecological Design of Remediation-to-Restoration sites in the St. Louis River Estuary

George Host, Valerie Brady, Carol Reschke, Dan Breneman, Gerald Niemi, and Lucinda Johnson
Natural Resources Research Institute, University of Minnesota - Duluth

Two habitat complexes within the St. Louis River Estuary have been the focus of an "Ecological Design" process, in which biological variables collected in the field were integrated with geospatial data in order to develop a predictive model of aquatic vegetation. We sampled vegetation, sediment types, benthic macroinvertebrates, and bird usage at the 21st Avenue West and 40th Avenue West habitat complex areas, along with reference locations at other sites. These data were integrated with existing aquatic vegetation data, bathymetry, wind fetch and other environmental variables. Classification and Regression Tree (CART) and logistic regression approaches were used to develop predictive models for dominant aquatic vegetation communities based on environmental factors. These relationships were incorporated into a GIS modeling framework to map the predicted distribution of aquatic vegetation across these restoration sites. This approach allows the assessment of ecological design scenarios, in which alternative restoration approaches can be evaluated. Scenarios include alterations to substrate or bathymetry to provide more suitable habitat for emergent, floating-leaf or submerged aquatic vegetation beds, along with the creation of islands or breakwalls to disrupt wind fetch and dissipate wave energy. Stakeholders in the restoration process have the ability to submit alternative approaches and designs, alone and in various combinations. Environmental endpoints are assessed in terms of the type and areas of different aquatic vegetation beds established, along with the consequent improvement for macroinvertebrate fish, and avian habitat. This ecological design tool will provide additional information to inform restoration activities within the estuary and ultimately further the removal of Beneficial Use Impairments from this Area of Concern.

Restoration conversion of boreal forest in Pokegama Carnegie Wetlands natural area, Wisconsin

Nicole Staskowski and Jens Jensen
Cardno JFNew

Cardno JFNew is beginning the fifth year of a 120-acre restoration project at the Pokegama Carnegie Wetlands state natural area in Superior, Wisconsin. The project is compensation for forested wetland conversion impacts along a new transmission line in northwestern Wisconsin. The restoration goals are intended to progress the goals of the Wisconsin DNR Wildlife Action Plan by restoring an assemblage of conifer dominated wetland mosaic communities to this northern region of the state. This will also advance the loss of fish and wildlife habitat beneficial use for which the watershed is impaired. The restoration project activities are three-fold: removal of aggressive woody species, planting of boreal forest tree species, and monitoring to assess the success of conversion. The first two activities, the removal of aggressive woody species and planting of appropriate boreal forest species, have taken place over the first four years of the restoration. Woody vegetation targeted for control as part of this phase included *Populus tremuloides*, *Alnus incana*, and various *Salix* species. Woody removal activities included cut stump treatment, forestry mowing and targeted, aquatic-approved herbicide treatment. Native boreal forest species were planted across the site. In the wetland areas these include *Picea mariana*, *Larix laricina*, and *Thuja occidentalis*; in the upland islands these include *Picea glauca*, *Pinus strobus*, *Abies balsamea*, and *Thuja occidentalis*. Restoration work and monitoring began in 2008. Thus far, data suggests the site is headed toward an assemblage of boreal forest dominated species. This is largely measured by survival of trees and reduction of invasive species across the site. In addition to the boreal forest conversion monitoring, state listed plant monitoring is also required. Populations of the State Threatened *Petasites sagittatus* and *Salix planifolia* were identified and are being protected on the site.

Marshall 6th Grade Students Monitor Brewery Creek

Jack Burt, Jessica Jahn, Lily Braafladt, and Dave Johnson
Marshall School, Duluth, MN

Marshall School 6th grade students have been conducting an intensive monitoring project of their on campus creek, Brewery Creek. The students will share the the whys, whats, hows of their project along with trends that they have seen in their results.

Jack Burt, Jessica Jahn, and Lily Braafladt

Chemicals of Emerging Concern Within the St. Louis River and Their Effects on Wildlife

Zachary Jorgenson[1] and Vicki Blazer[2]
[1]US-FWS
[2]USGS

Multiple studies have documented the presence of chemicals of emerging concern (CEC) in aquatic systems across the United States at varying concentrations from both known and unknown sources. While most studies use suspected point sources to select sample locations, few have sampled across a location in an effort to elucidate possible sources of contamination. Even fewer studies have looked at how these areas may be affecting native fish differently. The U.S. Fish and Wildlife Service, Environmental Contaminants Program, initiated a collaborative study with the U.S. Geological Survey and Environmental Protection Agency under the Great lakes Restoration Initiative to explore the current concentrations of select CECs within the St. Louis River (SLR) as a part of a larger Great Lakes wide sampling effort, as well as examining potential impacts to select fish populations. Water,sediment and fish samples were collected at four locations along the SLR in both 2010 and 2011. Water and sediment samples are being analyzed for select pharmaceuticals, hormones, and other inorganic and organic wastewater indicators. Fish were weighed, measured, bled and necropsied in the field. A suite of bioindicators are being assessed to evaluate general and reproductive fish health. Select fish samples are also being subjected to stable isotope analyses for their history of movement within the SLR. Results will be interpreted based on a variety of factors, including: geographic differences in CEC concentrations and effects in fish, the relationship between the combination of CEC concentrations and effects in fish, and possible sources of contamination. Results will contribute to understanding how different reaches along the SLR influence the varying concentrations of CECs along with how exposure to these compounds may adversely affect wildlife.

Zachary Jorgenson

Nutrient limitation of attached algae production in the St. Louis River Estuary

Richard Kiesling and Sarah Elliott
U.S. Geological Survey

We investigated the linkages between in-channel nutrient gradients and periphyton production in two bay sites and two main-channel sites in the lower St. Louis River during the summer of 2011. Ambient nutrient gradients were sampled every four to six weeks at four main river sites from early May until mid-September. Sites were located above the Oliver Bridge, near the mouth of Pokegama Bay at buoy marker 20, above the railroad bridge in the upper channel, and above the Blatnik Bridge in St. Louis Bay. Periphyton production was measured in early September at two main-channel sites upstream of the Oliver Bridge and two near-shore bay sites in the Kimballs Bay area. Instream experiments, using liquid-media nutrient-diffusing periphytometers, provided estimates of ambient periphyton productivity as well as tests of P and N-limitation. Periphyton production rates varied among the sites, with maximum values observed at the two main-channel sites above the Oliver Bridge. Main-channel production rates were three times higher than the rates measured in the near-shore, upper-bay sites. In addition to higher production rates, one of the two main-channel sites above the Oliver Bridge was N-limited when compared to controls. In contrast, one of the two upper-bay sites was P-limited when compared to controls. Pair-wise comparisons of ambient production rates at the four sites did not identify any additional significant differences in production rates. Our results illustrate the importance of understanding local N and P trophic dynamics when characterizing complex systems like the lower St. Louis River.

Richard Kiesling

The St.Louis River - River Watch Program: Working with Youth on Water Quality Issues

Courtney Kowalczak
Fond du Lac Tribal & Community College

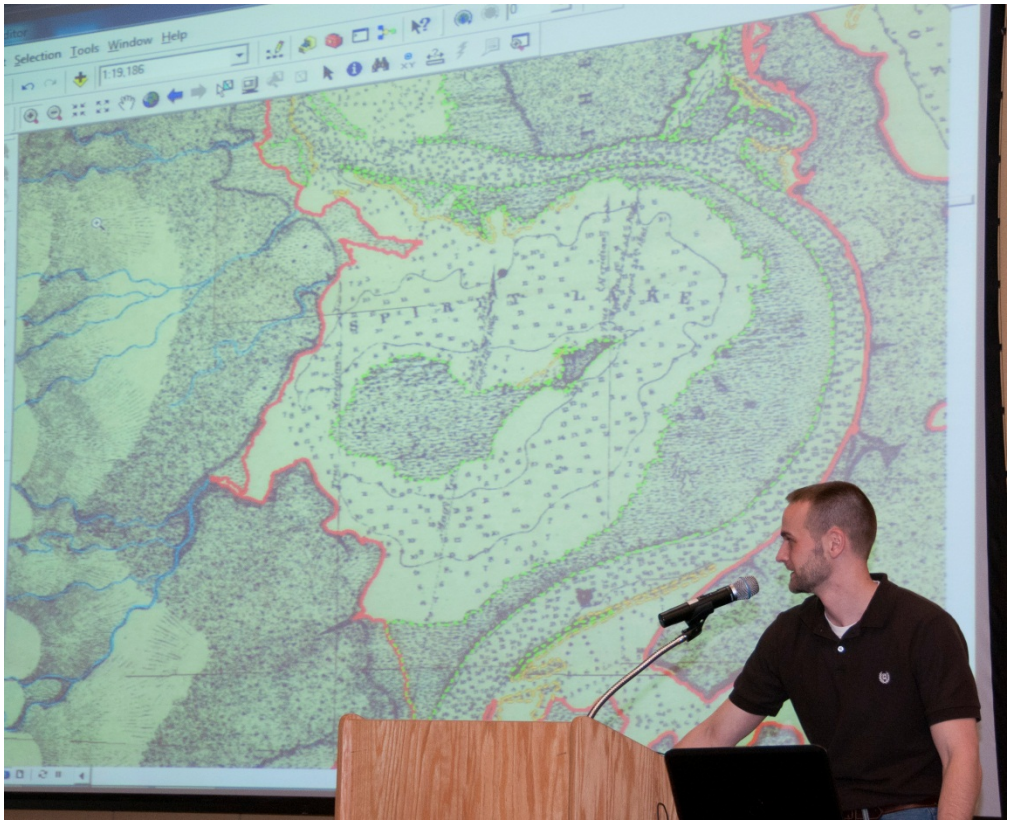
As the largest U.S. tributary to Lake Superior, the St. Louis River in northeastern Minnesota is a significant region-wide water resource. The vastness and rural nature of this 3634 square mile watershed makes gathering water quality data a challenge Community involvement is key to identifying water quality conditions from year to year and raising the awareness of important water quality issues. Fond du Lac Tribal and Community College (FDLTCC) has played an important role in monitoring this resource since 1997 by coordinating the St. Louis River – River Watch Program. Unfortunately in 2007 the River Watch program was put on hiatus due to lack of funding. This year the St. Louis River- River Watch Program is again funded and will re-engage students from over 20 area secondary school and their communities. These students gather biological, chemical, and physical data throughout the St. Louis River watershed and western Lake Superior basin. As a result of their participation, students have a practical opportunity to apply their classroom knowledge in an important scientific data collection effort. They develop valuable scientific and social skills while following detailed protocols, solving scientific problems, and cooperating with their peers. They are given opportunities to share not only their data but also the water quality issues that face their community. The data that they gather provides a basis for evaluating the water quality and ecological health of the St. Louis River system. This data is shared not only through community presentations but also through the Fond du Lac Tribal and Community College St. Louis River Watch internet accessible water quality database. Successful locally led river conservation efforts engage all concerned citizens, and River Watch activities help make the voices of youth and their community heard in natural resources management and conservation efforts.

Courtney Kowalczak

Rectification & Digitization of 1861 Hearding Chart for the St. Louis River

John Kubiak
Community GIS Services, Inc.

Our project used the existing high resolution image of the 1861 William Hearding Duluth-Superior Harbor Chart and recompiled the existing map to an orthogonal base with a projection. From this recompiled image we digitized the shoreline, wetland boundaries, other related features, and depth soundings. Finally, we created a bathymetric elevation model from the digitized depth soundings and created contours. The final product is in ESRI geodatabase format with corresponding metadata.

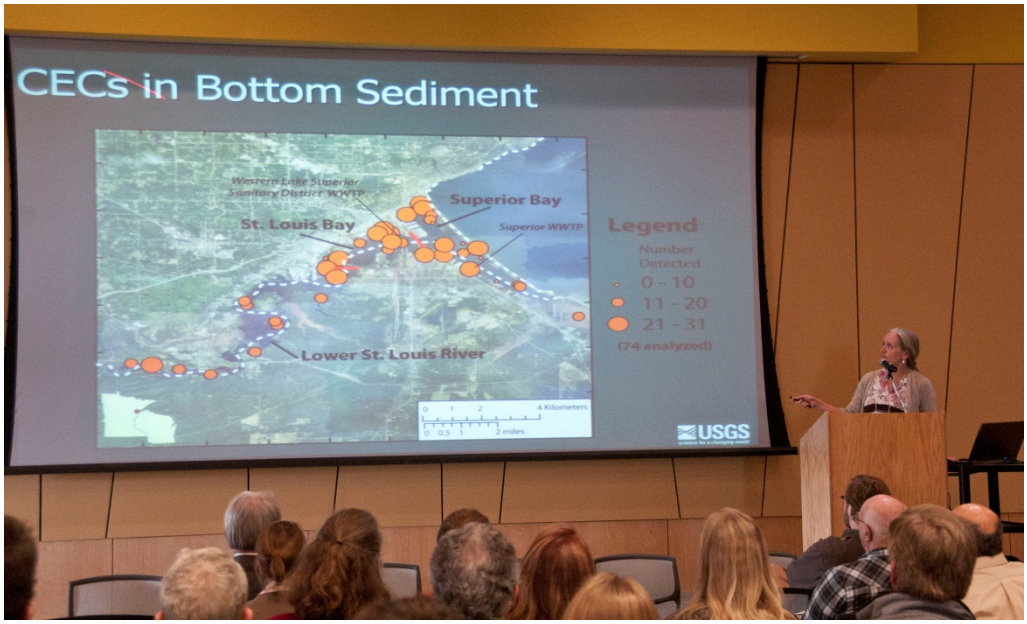


John Kubiak

Presence of Selected Endocrine Active Chemicals and Pharmaceuticals in Water and Sediment from the St. Louis River, St. Louis Bay, and Superior Bay, Minnesota and Wisconsin, 2010

Victoria G. Christensen, Kathy E. Lee, Richard L. Kiesling, Kristen A. Kieta, and Jesse Anderson
U.S. Geological Survey

In 1987, the International Joint Commission designated the St. Louis Bay portion of the lower St. Louis River as one of the Great Lakes Areas of Concern (AOC) because of accumulation of polycyclic aromatic hydrocarbons, mercury and other metals, and polychlorinated biphenyls in sediments over time. Concerns arose about the potential ecological and human health effects of contaminants of emerging concern (CECs). Although numerous studies have investigated the presence and effects of CECs, little is known about the presence of a subset of CECs known as endocrine active chemicals (EACs). The U.S Geological Survey cooperated with the Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources to collect water and sediment from 40 sites in the St. Louis River, St. Louis Bay, and Superior Bay from August through October 2010 to define the presence and partitioning of 170 CECs including EACs and pharmaceuticals. The number of detections ranged from 0 to12 EACs in individual water samples and 0 to 11 in individual bottom sediment samples. Estrone (a steroid hormone) and Hexahydrohexamethyl cyclopentabenzopyran (a synthetic fragrance) were the most commonly detected EACs in water samples; beta-sitosterol (plant sterol), estrone, and 4-tert-octylphenol (alkylphenol) were the most commonly detected EACs in bottom sediment samples. EACs were detected in 58 percent of the water samples and 90 percent of bottom sediment samples. The greater detection rate of EACs in bottom sediment compared to the detection rate of EACs in water samples indicates that bottom sediment is an important sink for EACs.



Kathy E. Lee

Restoring Fish populations and the Habitat they need to Survive

John Lindgren
Minnesota Department of Natural Resources

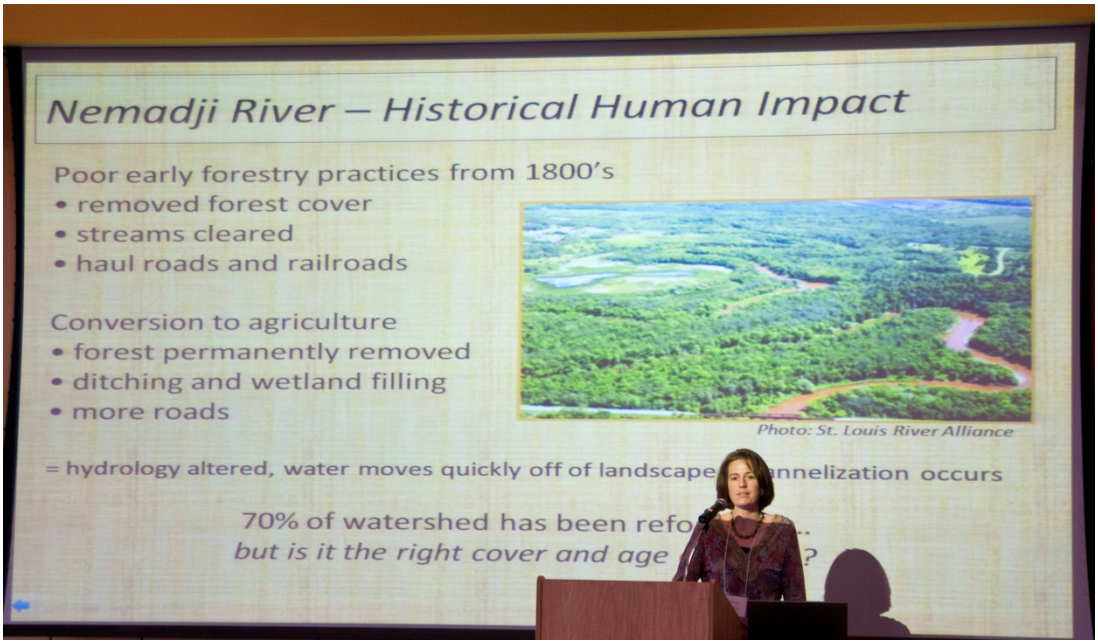
Water quality within the St. Louis River estuary improved dramatically after the Clean Water Act allowed for the construction of the Western Lake Superior Sanitary District in 1979. The Minnesota and Wisconsin Departments of Natural Resources took advantage of this opportunity to implement long-term programs to restore populations of keystone fish species that had been extirpated from the system. The lake sturgeon rehabilitation program began in 1983. Fourteen year-classes were established by stocking 143,000 fingerlings, 762,000 fry and 500 yearling lake sturgeon from 1983 through 2000. Lake sturgeon have been marked with Northwest Technologies coded wire tags, external floy tags and PIT tags. The rehabilitated population has a spatial distribution primarily from the estuary to the Apostle Islands, with limited movement up the North Shore of Lake Superior. Habitat enhancement within the populations traditional spawning grounds was accomplished by MDNR in 2009. Since then, returning adults have been monitored annually and the first naturally reproduced sturgeon fry was documented by Fond du Lac Resource Management in 2011, just below the recently completed habitat project. The Lower St. Louis River Habitat Plan identifies restoration of functional wetland habitat within "shallow sheltered bays" as a critical objective to move the St. Louis River AOC towards recovery and delisting. Several projects have been described in the Habitat Plan that will accomplish this objective. The Radio Tower Bay Sheltered Bay Restoration Project was funded by the National Oceanic and Atmospheric Administration in 2010. The project is a two phased effort to remove historical marine debris (railroad pilings, radio towers and saw mill waste), establish optimum bathymetry and establish recreational access to this 75 acre wetland complex. Phase I of the project, which includes removal of railroad pilings and radio towers is being completed beginning in February of 2012. It is anticipated that Phase II of the project will be completed in 2013. Funding for the second phase of the project will most probably come from a proposed allocation of funds from Minnesota Dedicated funding by the Lessard-Sams Outdoor Heritage Council, with Federal assistance being pursued through the Great Lakes Restoration Initiative.

John Lindgren

Management Considerations for Red Clay Soils in the Nemadji River Basin

Christine Ostern[1] and Jane Anklam[2]
[1]Douglas County LWCD
[2]Western Wisconsin Land Trust

The Nemadji River joins the St. Louis River as one of its largest tributaries in the Superior harbor near the Superior entry to Lake Superior. The watershed of the Nemadji River is located in Douglas County, Wisconsin and Carlton, St. Louis, and Pine Counties, Minnesota. Flooding and sedimentation are common problems for many southern Lake Superior tributaries; and rivers like the Nemadji are known to be major contributors of sediment to Lake Superior. The sedimentation loading issues in the Nemadji River Basin are well documented by the 1998 Natural Resources Conservation Service (NRCS) report titled "Erosion and Sedimentation in the Nemadji River Basin." That report estimates the annual sediment yield from the Nemadji River is 132,000 tons per year. The report further estimates that 74% of that sediment reaches Lake Superior each year; the highest average annual suspended sediment load per square mile drainage area among all rivers in Minnesota and Wisconsin for which the U.S. Geological Survey collects data. Nearly 90% of the sediment from the Nemadji River Basin comes from bank and bluff erosion. Controlling sheet and rill erosion is a component of reducing sediment loads, however, large scale hydrologic modification are required to address the channel shaping flows responsible for the estimated 117,000 tons of sediment coming from the banks and bluff annually. Additionally, approximately one third of the basin is comprised of glacial till and glacial lake-lain clay soils. These soils are commonly referred to as "red clay" and are considered highly erodible and prone to extensive mass wasting along streams and tributaries. Resource managers have been working towards implementing the recommendations from the multi-stakeholder collaboration that produced the 1998 report and continue to submit new proposals for further implementation of watershed best-management-practices to address management on the red clay soils of the Nemadji River basin.



Christine Ostern

Douglas County Aquatic Invasive Species Program

Carrie Sanda
UW-Superior, LSRI

Like many counties across Wisconsin, Douglas County must deal with existing AIS populations and the threat of new infestations from outside the County. Unique to Douglas, however, is its direct connection to the largest shipping port in the Great Lakes basin. Transport of AIS from Lake Superior to inland waters is of particular concern because fisherman routinely alternate between Lake Superior and inland lakes on a daily basis depending on weather. In addition to AIS in Lake Superior, most County lakes are within five miles of another inland waterway that contains AIS. Preventing the spread of AIS between inland lakes is also of particular concern, due to their close proximity and direct connections through streams. With help from state AIS programs, Douglas County waterway groups have been working independently to prevent AIS from spreading. The County has begun directly participating in these efforts through its AIS program. In 2009, the County AIS Strategic Plan was developed and four main goals were identified: Goal 1: AIS infestations already existing in the County are controlled or eradicated and prevented from spreading; new AIS infestations are prevented. Goal 2: Communication between lake and river residents, watershed groups, visitors, and other waterway organizations is improved and education is provided for all users. Goal 3: The County and municipalities participate in the protection of water resources and understand how critical the resource is to the county, municipalities, northern Wisconsin and the region. Goal 4: Sustainable funding for AIS research, monitoring, planning, restoration and education activities are adequately provided by private, local, county, state, federal, and tribal sources. Through a Wisconsin DNR grant, these goals are being addressed through education and outreach projects, lake monitoring, and boat landing inspections.

Carrie Sanda

Early Detection of Non-Native Fishes in the St. Louis River Estuary

Joshua Schloesser, Gary Czypinski, and Henry Quinlan
U.S. Fish and Wildlife Service

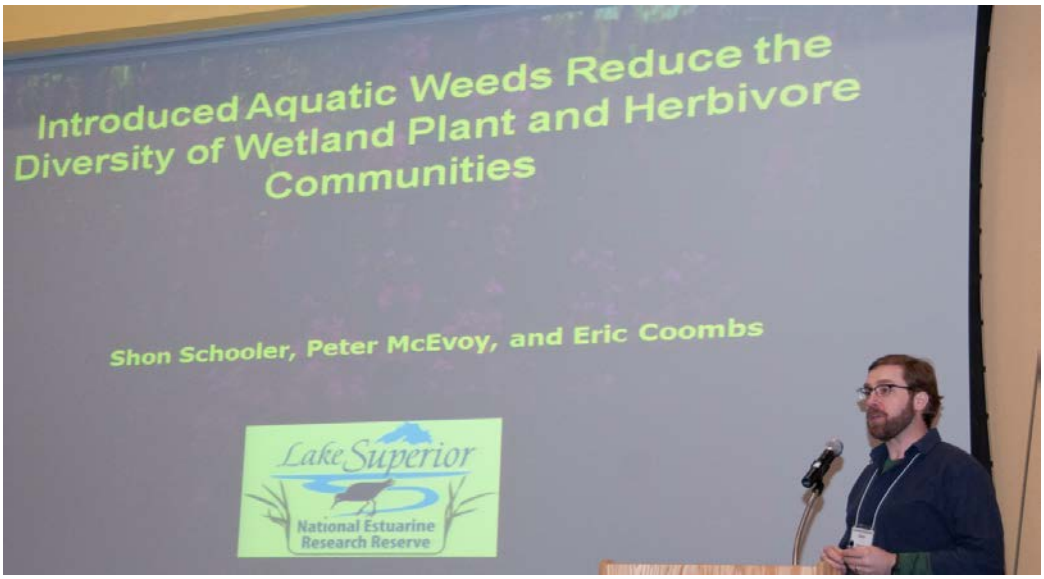
Invasive species pose a serious threat to the ecological stability of the Great Lakes warranting continual monitoring for the arrival of new species. The St. Louis River Estuary (SLRE) has a "high risk" potential for new introductions and establishment of invasive species in Lake Superior. The SLRE was sampled from 2008-2011 each August and September by boat electrofishing, fyke nets, and bottom trawling. Sample locations were randomly selected according to depth strata; fyke nets in 0-1 m, electrofishing in 1-2 m, and bottom trawling in >2 m water depths. Annual sampling at the SLRE consisted of 20 sites each for fyke nets and electrofishing, and 10 for bottom trawls. From 2008 to 2011, an average of 35 fish species and 13,161 fish were captured each year. A total of 6 invasive fishes, all previously detected, have been captured each year during this monitoring. No new fish introductions have been detected. Evaluation of the sampling program through rarefaction curves indicated that a total of 50 (current effort level) samples at the St. Louis River would detect 94% of the known species in the study area. A gear mixture of 40% fyke nets, 40% electrofishing, and 20% trawls maximizes the number of species detected in the SLRE. Invasive fish monitoring will continue in the SLRE through standard fish collection techniques. In 2012, the U.S. Fish and Wildlife Service will initiate an environmental DNA (e-DNA) component to our early detection efforts.

Joshua Schloesser

Effects of purple loosestrife and reed canary grass on the diversity of wetland plant and moth communities

Shon Schooler[1], Peter McEvoy[2], and Eric Coombs[3]
[1]Lake Superior NERR
[2]Oregon State University
[3]Oregon Department of Agriculture

Invasive plants have the potential to reduce the biotic diversity of plant and animal communities. We examined the negative effect of two invasive wetland plants, purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*), on the species richness and diversity of plant and moth communities within 24 wetland study sites. We hypothesized that as the cover of the invasive species increased, the diversity of the local plant and moth community would decrease. Increasing cover of purple loosestrife and reed canary grass was associated with reduction in the diversity of wetland plant communities irrespective of the diversity measure examined. Moth species richness was positively correlated with plant species richness and decreased as percent cover of the invasive plant species increased. Wetland hydrology, soil characteristics, and topography were measured to control for potentially covarying and confounding influences on plant diversity. Temperature, ambient light, and surrounding land-use were measured to control for potentially covarying and confounding influences on moth sampling and diversity. None of these variables was significantly associated with invasive species abundance. This strengthens the conclusion that the invasive species were the cause of the decline in biotic diversity. These results indicate that invasive plants have the ability to reduce biotic diversity across multiple trophic levels. In addition, management plans may need to consider simultaneous control of multiple plants if diversity is to be maintained in some ecosystems. Therefore, it is imperative that we understand the underlying causes of plant invasion and community dominance if we are to successfully manage plant communities.



Shon Schooler

Nutrient dynamics in the St. Louis River Estuary and Other Lake Superior Bays

Gaston E. Small[1], Jacques C. Finlay[1], Robert W. Sterner[1], and Emily H. Stanley[2]
[1]University of Minnesota - Twin Cities
[2]University of Wisconsin – Madison

Excessive nutrient loading is listed among the "Beneficial Use Impairments" in the St. Louis River Estuary (SLRE). Although algal growth in the estuary is likely to be constrained by low light penetration in the estuary, the discharge of nitrogen, phosphorus, and organic carbon into Lake Superior has the potential to affect ecosystem dynamics in oligotrophic Lake Superior. Therefore, the processing and retention of these nutrients within the estuary is important both in the functioning and restoration of the estuarine ecosystem and also in affecting water quality that enters the lake. We present preliminary measurements of nitrate removal from microbial denitrification in sediments in the SLRE and northern bays of Lake Superior, which are 1-2 orders of magnitude higher than rates in the open lake. The actual amount of nutrient processing in bays and estuaries depends on the spatial configuration of nutrient loading and the complex hydrology of the estuary, in addition to rates of microbial activity. We describe our planned sampling efforts measuring algal production and microbial processing rates in the SLRE over the next two years, 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

Lake Superior Estuaries: Closing the Knowledge and Information Gaps

Amy Staffen and Ryan O'Connor
Wisconsin DNR - Natural Heritage Inventory

By implementing this Wisconsin Coastal Management Grant-funded project, we will: 1) Close a knowledge gap on Lake Superior estuaries by conducting a review of published literature, ongoing research, and restoration projects. A major focus of this objective will be building partnerships with researchers and land managers to identify past successes and emerging issues. Deliverables include a Lake Superior Estuaries online bibliographic database and an interactive online project directory.2) Conduct coarse-level inventory on 21 estuaries not covered in the NHI Coastal Wetlands Assessment (Epstein et al. 2002), closing a significant information gap. This will facilitate better monitoring, prioritization, and restoration among all 35 of Wisconsin Lake Superior estuaries.3) Create a prioritized plan to guide future inventory work on Wisconsin's Lake Superior estuaries, focusing on the most critical sites, and allow for targeted, systematic monitoring and updates of high-quality natural communities and associated rare species. This will outline the biotic inventory needed to assess the biodiversity composition of, significance of, and threats to these estuaries.

What makes climate change adaptation work? A comparative study of the engagement of stakeholders in environmental governance of coastal zones

Kathleen Williams
University of Wisconsin-Milwaukee

Coastal zones are centers of activity for a multitude of activities like commerce, transportation, recreation and preservation, uses not always in harmony with each other. The intensity of human use of the coasts leaves these zones are especially vulnerable to hazards like floods, erosion and strong storms, all of which could be exacerbated by the expected results of climate change. While there has been research on the factors that contribute to the vulnerability and resilience of communities and systems, very little of that research has been directed towards freshwater coastal zones. In order to better identify some of the factors that contribute to resilience, this study will compare the adaptation processes in two areas of Lake Superior, the St. Louis River and St. Mary's River. Theories of resilience and adaptive management hypothesize that more democratic environmental governance, expressed through the engagement of stakeholders, is a means of increasing resilience (Boyd et al, 2010.). Drawing and building on theories of public participation and political ecology, this study will compare how effectively democratic processes are integrated into planning for climate change through an examination of the roles of institutions, organizations, and individuals in the management of the coasts. Initial research shows that there is an emerging interest in integrating "stewardship," ecological restoration, and enhancing resilience into coastal and estuarine management. This study will investigate how these ideas are articulated in legal and outreach materials, as well as events and programs. This research will advance the understanding of stakeholders and the public by examining both the means of bringing individuals and organizations into the process and how individuals and organizations participate in the environmental governance process.

Kathleen Williams

Abstracts for Poster Presentations

Baseline Survey of Invasive Plants on Wisconsin Point

Dan Fraser, Glenn Belde, and Nicholas Danz
University Wisconsin-Superior

Wisconsin Point is a 3-mile barrier sand spit associated with the entry of the St. Louis River into Lake Superior. Dune and forest plant communities on Wisconsin Point are uncommon and especially sensitive to human disturbance compared to most of Wisconsin's Lake Superior coast. Yet, this area experiences high levels of recreational traffic. Our study had two components: 1) an extensive survey of invasive plant species across the entire Wisconsin Point and 2) an intensive survey of spotted knapweed in a 4-acre parcel of backdune habitat near the north end of the point. Surveys were conducted during July and August 2011. In the extensive survey, we visited 255 points evenly distributed at 60-m intervals spanning the peninsula. At each survey point, we counted the number of individuals per m2 of 39 invasive species on the current working list of the Invasive Plant Association of Wisconsin. We found 27 of 39 invasive species present; the top five most abundant species were Kentucky bluegrass, spotted knapweed, Canadian bluegrass, quackgrass and reed canary grass. Across the point, mean density was 77 individuals per m2, with a range of 0-931. The greatest densities of invasive species were found close to roads and parking lots compared to forested areas and beaches, particularly at the north end of the point. In the intensive survey, spotted knapweed individuals per m2 were counted at 156 randomly spaced points. Mean density of spotted knapweed was 111 individuals per m2 (range 0-800). Greatest spotted knapweed densities were found in the open field compared to the forested area in this parcel. The survey provides a baseline for invasive plant monitoring on Wisconsin Point and will be used to direct invasive plant control and habitat restoration.

Attracting Nesting of Piping Plovers in the St. Louis River Area of Concern

Julene Boe[1], Amy Eliot[2], Ted Koehler[3], Sumner Matteson[4], and Christine Ostern[5]
[1]St. Louis River Alliance
[2]UWS-LSRI
[3]US Fish and Wildlife Service
[4]WDNR
[5]Douglas County LWCD

Piping plovers are one of the most endangered shorebirds in the world, and have not been known to nest in the St. Louis River Area of Concern in over 25 years. Fewer than 70 breeding pairs exist in the Great Lakes, mostly in Michigan. The US Fish and Wildlife Service is funding this five-year project to help support its goals of restoring the population of plovers in the Great Lakes to 150 breeding pairs, and maintaining a viable plover population within a critical area of the region so that the species can be removed from the Threatened and Endangered Species List. The project will also help restore habitat and wildlife populations to the estuary as part of the process to have it delisted as a Great Lakes Area of Concern. The St Louis River Alliance is partnering with a number of local and state agencies. These include: Wisconsin Department of Natural Resources, the City of Superior, Douglas County, and the UWS-Lake Superior Research Institute. The project will involve continuing WDNR and Douglas County Land Conservation Department efforts to restore and enhance nesting habitat on two sites: the Wisconsin Point Wildlife Area on the St. Louis River bay side of Wisconsin Point and Shafer Beach on the Lake Superior side of Wisconsin Point. USFWS and WDNR biologists identified these areas as high priority for piloting an intensive recovery effort that will encompass protecting these sites from predators and providing public outreach that will educate and promote public participation in these efforts. This project will also support the development of a Plover Management Plan for Douglas County, which will help guide the long range need and efforts to retain piping plovers in the St. Louis River estuary.

Wisconsin's Ballast Water Program

Cordell Manz
Wisconsin DNR

Growing concern over aquatic invasive species introduced via ballast water and their impacts in the Great Lakes demonstrated the need to regulate ballast discharge from commercial fishing vessels. Wisconsin felt more stringent standards were necessary than those in the EPA Vessel General Permit and developed its own general permit to regulate ballast discharge in Wisconsin waters. Our permit became effective in February 2010, with implementation of a full ballast program in 2011.

Technical Assistance for Aquatic Resource Conservation and Management in the St. Louis River Estuary

Gary Czypinski, Henry Quinlan and Mark Brouder
U.S. Fish & Wildlife Service

The U.S. Fish and Wildlife Service Ashland Fish and Wildlife Conservation Office (Ashland FWCO), works to conserve, manage and rehabilitate native aquatic species and their habitats for citizens of the Lake Superior basin. In the St Louis River Estuary, Ashland FWCO provides technical assistance to many agencies and organizations that conduct fishery assessment, management and research. Technical assistance is provided for aquatic species conservation, to detect and monitor for aquatic invasive species, leadership in new science and technology applications and to Tribes as they exercise their sovereignty in the management of their fish and wildlife resources within Federal Indian trust land and in treaty reserved areas.

Jane Anklam, Nancy Larson, Becky Sapper, and Sue OHalloran

The History, Ecology, Harvest, and Management of Manoomin (wild rice)

Peter David and Lisa David
Great Lakes Indian Fish & Wildlife Commission

This poster will provide an overview of what wild rice is, some of its cultural significance, threats that it faces, and management techniques.

High Resolution Elevation Data for the Saint Louis River

Tom Hollenhorst[1], Ted Angradi[1], Brent Bellinger[1], David Bolgrien[1], Mark Pearson[1], Debra Taylor[1] and Matthew Starry[2]

[1]EPA ORD MED
[2]SRA International, Inc.

Several data collections in the area of the Saint Louis River Estuary have recently become available. These include the Minnesota Elevation Mapping Project (MN Statewide LIDAR collect), South Shore LIDAR project (WI Collect), and NOAA's bathymetric LIDAR. The EPA Mid-Continent Ecology Lab has also created a high resolution bathymetry layer (10 meter horizontal resolution) for the Saint Louis River Estuary interpolated from USACE Microstation surveys, NOAA/NOS hydrographic surveys, and supplemented with NOAA ENC soundings & contours. Our poster will illustrate these products with a few examples of how they might be used to address research and management needs in the estuary. This abstract does not necessarily reflect USEPA policy.

Habitat Programs at the Ashland Fish and Wildlife Conservation Office

Ted Koehler and Mark Brouder
U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service's (Service) Habitat Restoration Programs focus resources on sensitive Federal trust resource areas. They include the Partners for Fish and Wildlife Program, Coastal Program - Great Lakes, National Fish Passage Program and the National Fish Habitat Action Plan. The programs feature non-regulatory, partnership-based efforts that restore and protect fish and wildlife habitats, enhance fish passage, and control invasive species. By applying Service funding and technical expertise to locally-led projects and leveraging the participation of other groups, the Service habitat restoration programs help identify resource priorities and achieve on-the-ground results in a manner that would present difficult for any single entity. Many of these programs have been active in the St. Louis River watershed for a number of years, and the Service is continually looking for new partnerships which provide benefit to priority trust species as well as partner priorities. Into the future, the Service will continue to help foster a team approach to conservation in the St. Louis River watershed and Great Lakes by continuing to identify common conservation goals and achieving results.

Lisa Angelos, Susan Hanson, Clinton Little

Spruce-Peatland Responses Under Climatic and Environmental change: an in situ warming by CO2 manipulation of a northern Minnesota bog

Randall K. Kolka[1], Paul J. Hanson[2], Colleen Iversen[2], Stephen D. Sebestyen[1], Richard J. Norby[2], Brian Palik[1], Peter Thornton[2], Jeffrey Warren[2], Stan D. Wullschleger[2], and Les Hook[2]
[1]USDA Forest Service, Marcell Experimental Forest, Grand Rapids, Minnesota
[2]Oak Ridge National Laboratory, Oak Ridge, Tennessee

Identification of critical environmental response functions for terrestrial organisms, communities, and ecosystems to rapidly changing climate conditions are needed to evaluate ecological consequences and feedbacks. Such research has the most 'real-world' relevance when conclusions are drawn from controlled manipulations operating in natural field settings. We are constructing an experimental platform to address climate change response mechanisms in a Picea/Larix/Sphagnum ombrotrophic bog ecosystem located in northern Minnesota. This ecosystem located at the southern extent of the spatially expansive boreal peatland forests is hypothesized to be especially vulnerable to climate change and to have important feedbacks on the atmosphere and climate. The replicated experiment will allow us to test mechanisms controlling vulnerability of organisms and ecosystem processes changes for multiple levels of warming (up to +9°C) combined with elevated CO2 exposures (900 ppm). New methods for whole-ecosystem warming at plot scales of 12 to 14-m diameter have been developed for this study. Through the execution of this experiment we plan to quantify thresholds for organism decline or mortality, limitations to regeneration, biogeochemical limitations to productivity, and changing greenhouse gas emissions to the atmosphere. The experiment will allow for the evaluation of responses across multiple spatial scales including: microbial communities, bryophyte populations, various higher plant types, and some faunal groups. Direct and indirect effects of these experimental perturbations will be tracked and analyzed over a decade for the development and refinement of models needed for full Earth system analyses.

Incidence Rates of Fish Tumors and Deformities in the St. Louis River Area of Concern: A Preliminary Assessment

Tracey Ledder[1], Joel Hoffman[2], Vicki Blazer[3], Pat Collins[4], John Lindgren[5], and Rick Gitar[6]
[1]Wisconsin Department of Natural Resources
[2]US-EPA MED
[3]USGS
[4]US Fish and Wildlife Service
[5]Minnesota Department of Natural Resources
[6]Fond du Lac Reservation Office of Water Protection

The goal of this study was to determine the current incidence rate of fish tumors and deformities in the St. Louis River and compare that to the rate in a relatively unimpaired waterbody on Lake Superior. These data are necessary to remove the "Fish Tumors and Deformities" Beneficial Use Impairment (BUI) in the St. Louis River Area of Concern (AOC). During the development of the Stage 1 Remedial Action Plan (RAP), the Fish Tumors and Deformities BUI was included in the St. Louis River AOC because there were recorded observations of external tumors and lesions and because there were contaminated sediments in the river. No data, however, were available to establish tumor and deformity incidence rates. Since that time, wastewater treatment has been improved dramatically and two major contaminated sediment areas known to have elevated levels of poly-aromatic hydrocarbons (PAHs; a tumor-causing class of chemicals) have been remediated. In May 2011, 50 white suckers from each of four regions across the AOC (Superior Bay, St. Louis Bay, "Middle estuary", and above Fond du Lac Dam) were collected and analyzed. Liver, kidney, spleen, gill, gonad and visible skin lesion samples were collected in the field to determine tumor incidence rates. Histopathological methods will be utilized to distinguish tumors that may be contaminant related from viral or parasitical related deformities. In addition, dorsal muscle tissue plugs were taken for carbon stable isotope analysis, a natural diet marker, to provide information on whether these fish are largely feeding in Lake Superior or in the St. Louis River. The expected outcome of the project is to obtain the first comprehensive documentation of fish tumor incidence rates in the St. Louis River estuary, on which to base future actions related to the removal of this BUI.

Tracey Ledder

Shoreline classification of the St. Louis River Estuary using geographic information systems and standard landuse/landcover data sets

Mark Pearson[1], Ted Angradi[1], Dave Bolgrien[1], Tom Hollenhorst[1], Deb Taylor[1], and Matthew Starry[2]

[1]USEPA/ORD/NHEERL/MidContinent Ecology Division
[2]SRA International, Inc.

The St. Louis River Estuary (SLRE) shoreline is ~300 km in length and borders MN and WI from the MN highway 23 downstream to Lake Superior. The shoreline is a complex and diverse mixture of many features from industrial docks and slips in the lower SLRE to complex wetlands and natural areas in the middle and upper SLRE. Healthy and productive shorelines are valuable resources and if managed in a sustainable manner can provide social, economic, and environmental benefits to the Twin Ports community. To this purpose we developed a GIS based scheme to classify and estimate shoreline cover types (rock, vegetation, structures, ore docks, rip-rap, forests, grass/shrub, wetland, etc.) within 60m buffers for both the riparian and littoral shoreline of the SLRE. Point features (recreational docks) and linear features (sheet piling) will also be enumerated. To our knowledge no contiguous shoreline cover estimates have been developed for the SLRE. Potential benefits of this classification scheme include: baseline data to guide restoration and development projects, assist in identification of sensitive areas (erosion, flooding, etc), increase community awareness of healthy shoreline practices, and assist in the development of an estimate of condition for SLRE shoreline. The results of this works will be presented in a poster format. The views expressed here are those of the authors and do not necessarily reflect the views and policies of the US Government.

Deanna Erickson, Jane Anklam, Christine Ostern

Lakewide Juvenile Lake Sturgeon Index Survey - The St. Louis River Estuary Link

Henry Quinlan and Joshua Schloesser
U.S. Fish and Wildlife Service

In 2011, the Lake Superior Lake Sturgeon Work Group, a subcommittee of the Lake Superior Technical Committee developed and initiated a juvenile Lake Sturgeon index survey for Lake Superior to meet assessment needs identified in the rehabilitation plan. Surveys were conducted at the river mouth of every known historic and current spawning tributary to Lake Superior. At the St. Louis River Estuary, five agencies (Minnesota DNR, Wisconsin DNR, 1854 Treaty Authority, Fond du Lac Band of Lake Superior Chippewa, and U.S. Fish and Wildlife Service) collaborated to implement the standardized lakewide juvenile lake sturgeon index survey protocol in Lake Superior waters adjacent to the Duluth and Superior entries. Relative abundance (number per 1000' of net) of juvenile lake sturgeon in nearshore Lake Superior waters was slightly higher than the lakewide average based on seventeen locations. This is the first year of a long-term coordinated lakewide effort to monitor recruitment, year class strength, and population trends over time. Over time, biological characteristics of juvenile lake sturgeon will be compared within and among historic and current Lake Superior spawning tributaries.

Effects-based monitoring with caged Fathead Minnows: An exposure gradient case study in the Duluth-Superior Harbor, USA.

Stevens, KE[1], Berninger, JP[3], Cavallin, JE[2], Durhan, EJ[1], Jensen, KM[1], Kahl, MD[1], LaLone, CA[1], Makynen, EA[1], Severson, MN[1], Skolness, SY[4], Thomas, LM,[5] Villeneuve, DL[1], Ankley, GT[1]

[1]US EPA, Duluth, MN
[2]ORISE Program, US EPA, Duluth, MN
[3]National Research Council, US EPA Duluth, MN
[4]University of Minnesota Duluth, US EPA Duluth, MN
[5] US Fish and Wildlife Service, Bloomington, MN

Abstract:

Within the Great Lakes there is an increased focus on contaminants of emerging concern (CECs) and consideration of potential effects of chemical mixtures. To further characterize the utility of caged fathead minnows (*Pimephales promelas*) for effects-based monitoring of CECs, we conducted a combination of laboratory and in-situ exposures representative of a gradient associated with wastewater discharge into the Duluth-Superior Harbor, Duluth MN, USA. Sexually mature fathead minnows were exposed at varying distances (proximal, distal, and far distal) from the treated effluent discharge of the Western Lake Superior Sanitary District treatment plant (WLSSD) and sampled after four, seven, and 14 days of exposure. Concurrently, a four day in-lab flow-through exposure was conducted with varying dilutions of final treated effluent collected from WLSSD (50% effluent, 5% effluent, and Lake Superior water control) as well as a single concentration of bisphenol A (10 µg/L), a CEC which had been previously detected in the effluent and receiving water. Preliminary results show modest androgenic (assessed using MDA-kb2 cell assays) and estrogenic (vitellogenin protein induction in male fathead minnows) activity associated with the 50% effluent exposure. Following dilution into receiving water, the activity was no longer detectable based on targeted endpoints, even for exposure durations up to 10 days longer. Initial analyses of targeted endpoints will be complemented with more open-ended transcriptomic and metabolomic analyses to further characterize biological responses along this exposure gradient.

Area of Concern Special Session

Introduction

The State of Minnesota (MPCA) and State of Wisconsin (Department of Natural Resources) are responsible for implementation of the St. Louis River Remedial Action Plan (RAP) associated with the St. Louis River Area of Concern (AOC) which was designated in 1989. The Great Lakes Restoration Initiative funded St. Louis River Implementation Framework and associated activities will provide for the development of priorities and a clear pathway for removing Beneficial Use Impairments (BUI) and moving the St. Louis River AOC to Recovery status and eventual delisting. The Implementation Framework will be designed to clearly define BUI removal and AOC delisting objectives to be achieved through a focused effort involving remediation to restoration projects, data compilation, management and analyses, monitoring, land management, and erosion prevention activities. This effort will also involve identification of sediment contamination, remediation of legacy sediments, restoration of previously impacted habitats where appropriate, and protection of the estuary's most special places in a fashion that will allow for movement from Area of Concern to Area of Recovery and eventual delisting through removal of all nine Beneficial Use Impairments. BUI Blueprints, Measurement strategies and stakeholder involvement efforts will be described as will progress on priorities and projects. Ultimately this effort will improve the quality of life for recreational users of the estuary as well as contribute to a robust, healthy local economy.

As part of the session progress on system-wide and individual project priorities will be addressed including overarching framework, contaminated sediment analysis, managing data in the AOC, wildlife habitat and species restoration and recovery, and emerging integrated remediation to restoration efforts at several priority sites. Several posters will also be presented.

Nelson French


Nancy Larson

Doug Beckwith

Zach Jorgenson

Matt Lindon

John Lindgren

Oral presentations:

Introduction: (Lisa Angelos, MDNR; Nelson T. French, MPCA; Nancy J. Larson, WDNR)
Implementation Framework: The Road to Recovery (Virginia Briedenbach, LimnoTech; Marc Hershfield, MPCA)
SLRAOC Contaminated Sediment Strategy Development – A view from 3,000 feet (Doug Beckwith, MPCA; Nancy J. Larson, WDNR)
SLRAOC Data Systems – A Work in Progress (Tracey Ledder, WDNR; Matt Lindon, MPCA)
Sturgeon Recovery and Radio Tower Bay Restoration (John Lindgren, MDNR; Daryl Peterson, MLT)
Remediation to Restoration in the SLRAOC (Zach Jorgenson USFWS; Pat Collins, USFWS)

Posters:

SLRAOC Pamphlet in Poster Format: (MPCA/WIDNR-WI Extension)
Piping Plover Recovery Project; (USFWS-SLRA)
Stryker Bay-Interlake: (MPCA)
SLRAOC Fish Tumor Study Update (WDNR, USEPA, USFWS)

St Louis River Estuary Science Summit Program 2012

Thursday March 8th

Event	Description/Title	Speaker	Time
Registration	Please register and pick up a name tag		8:00am
Introduction **Chair: Shon Schooler, LSNERR**	Housekeeping	Shon Schooler, LSNERR	9:00am
	Opening Remarks	Mary Morgan, City of Superior	9:05am
	Habitat Restoration in the St. Louis River Estuary: Past and Present	Patrick Collins, US-FWS	9:20am
	Management Considerations for Red Clay Soils in the Nemadji River Basin	Christine Ostern, Douglas County; Jane Anklam, West Wisconsin Land Trust	9:50am
Morning Break	Morning Break		10:20am
Session 1: Restoration **Chair: Nick Danz, UWS**	Restoration conversion of boreal forest in Pokegama Carnegie Wetlands natural area, Wisconsin	Jens Jensen, Cardno JFNew	10:50am
	Lake Superior Estuaries: Closing the Knowledge and Information Gaps	Amy Staffen and Ryan O'Connor, W-DNR	11:10am
	Spatial modelling for Ecological Design of Remediation-to-restoration sites in the St Louis River Estuary	George Host, UMD-NRRI	11:30am
Panel Discussion **Facilitator: Ralph Garono, LSNERR**	Building the Bridge Between Research and Management Panelists: Nelson French, MPCA; George Host, NRRI-UMD; Mary Balcer, LSRI-UWS; Nancy Schuldt, Fond du Lac Reservation; Jeff Gunderson, MN Seagrant; Nancy Larson, WI-DNR	Invited panelists and public participation	11:50am
Lunch	Lunch		12:30pm
Session 2: Pollutants **Chair: Rick Gitar,** **Fond du Lac Reservation**	Presence of Selected Endocrine Active Chemicals and Pharmaceuticals in Water and Sediment from the St. Louis River, St. Louis Bay, and Superior Bay, Minnesota and Wisconsin, 2010	Kathy Lee, USGS	1:30pm
	Study the Water Quality of Two Urban Streams Newton and Faxon Creeks in Superior, Wisconsin	William Bajjali, UWS	1:50pm

	Chemicals of Emerging Concern Within the St. Louis River and Their Effects on Wildlife	Zachary Jorgenson, US-FWS	2:10pm
	The Lake Superior National Estuarine Research Reserve	Ralph Garono, LSNERR	2:30pm

Afternoon Break	Afternoon Break		2:50pm

Session 3: Education and Outreach Chair: Deanna Erickson, LSNERR	Sharing our Estuary: Unveiling the Lake Superior NERR Education Program	Deanna Erickson, LS-NERR	3:20pm
	Using Stories to Teach Estuary Science	Cynthia Hagley, Minesota Sea Grant	3:40pm
	Marshall 6th Grade Students Monitor Brewery Creek	Jessica Jahn, Jack Burt, Lily Braafladt, David Johnson, Marshall School	4:00pm
	The St.Louis River - River Watch Program: Working with Youth on Water Quality Issues	Courtney Kowalczak, Fond du Lac Tribal and Community College	4:20pm
	What makes climate change adaptation work? A comparative study of the engagement of stakeholders in environmental governance of coastal zones	Kathleen Williams, UWM	4:40pm

Poster Session	Poster viewing and discussions with presenters	Poster authors (please stand near poster)	5:00pm

Day 1 Finish			6:00pm

Friday March 9th

Event	Description/Title	Speaker	Time
Registration	Please register and pick up a name tag		8:00am
Plenary Speakers Chair: Patrick Collins, US-FWS	Wild rice soup: A mix of the ecology, history and management of manoomin.	Peter David , GLIFWC	9:00am
	The Creation of a Stormwater Management Utility	Diane Nelson, City of Superior	9:30am
Morning Break	Morning Break		10:00am
Session 4: SLRE AOC Delisting Chair: Nelson French, MPCA	Introduction	Lisa Angelos, MDNR; Nelson T. French, MPCA; Nancy J. Larson, WDNR	10:30am

	Implementation Framework: The Road to Recovery	Virginia Briedenbach, LimnoTech; Marc Hershfield, MPCA	10:35am
	SLRAOC Contaminated Sediment Strategy Development – A view from 3,000 feet	Doug Beckwith, MPCA; Nancy J. Larson, WDNR	10:50am
	SLRAOC Data Systems – A Work in Progress	Tracey Ledder, WDNR; Matt Lindon, MPCA	11:05am
	Sturgeon Recovery and Radio Tower Bay Restoration	John Lindgren, MDNR; Daryl Peterson, MLT	11:25am
	Remediation to Restoration in the SLRAOC	Pat Collins, USFWS; Zach Jorgenson USFWS	11:45am

Lunch	Lunch	12:00noon

Session 5: Stressors and Water **Chair: David Bolgrien, US-EPA**	Relationship between water quality and anthropogenic stressors in the St. Louis River Estuary	Will Bartsch, UMD-NRRI	1:00pm
	Linkages between marsh biota and anthropogenic stress in tributary mouth wetlands of the St Louis River Estuary	Nicholas Danz, UWS	1:20pm
	Nutrient dynamics in the St. Louis River Estuary and Other Lake Superior Bays	Gaston Small, UMN	1:40pm
	Nutrient limitation of attached algae production in the St. Louis River Estuary	Richard Kiesling, USGS	2:00pm
	Development of a model to examine the effect of barrier islands on local water currents near a treated sewage outfall	Matt James, UMD-LLO	2:20pm
	Time series analysis of water level and temperature in the St Louis River Estuary	David Bolgrien, US-EPA	2:40pm

Afternoon Break	Afternoon break		3:00pm

Session 6: Invasives and Historical **Chair: John Jereczek, MDNR**	Early Detection of Non-Native Fishes in the St. Louis River Estuary	Joshua Schloesser, US-FWS	3:30pm
	Douglas County AIS program	Carrie Sanda, UWS-LSRI	3:50pm
	Environmental impacts of two invasive wetland plants, purple loosestrife and reed canary grass	Shon Schooler, UWS-LSNERR	4:10pm
	Rectification & Digitization of 1861 Hearding Chart for the St. Louis River	John Kubiak, Community GIS Services, Inc.	4:30pm

Conclusion and farewell	Concluding Remarks		4:50pm

Posters	Presenter
Baseline Survey of Invasive Plants on Wisconsin Point	Glenn Belde, UWS
Attracting Nesting of Piping Plovers in the St. Louis River Area of Concern	Julene Boe, St. Louis River Alliance
Technical Assistance for Aquatic Resource Conservation and Management in the St. Louis River Estuary	Gary Czypinski, US-FWS
The history, ecology, harvest and management of manoomin (wild rice)	Peter David, GLIFWC
High Resolution Elevation Data for the Saint Louis River	Tom Hollenhorst, US-EPA
Habitat Programs at the Ashland Fish and Wildlife Conservation Office	Ted Koehler, US-FWS
Spruce-Peatland Responses Under Climatic and Environmental change: an in situ warming by CO2 manipulation of a northern Minnesota bog	Randall Kolka, US-FS
Incidence Rates of Fish Tumors and Deformities in the St. Louis River Area of Concern: A Preliminary Assessment	Tracey Ledder, WDNR
Shoreline classification of the St. Louis River Estuary using geographic information systems and standard landuse/landcover data sets	Mark Pearson, US-EPA
Lakewide Juvenile Lake Sturgeon Index Survey - The St. Louis River Estuary Link	Henry Quinlan, US-FWS
Effects-based monitoring with caged Fathead Minnows: An exposure gradient case study in the Duluth-Superior Harbor, USA.	Kyle Stevens, US-EPA
St Louis River AOC Poster	MPCA, WIDNR, WI Extension
The Lake Superior National Estuarine Research Reserve	Lake Superior NERR
What's Going On? Tell Us About Your Research and Projects	John Jereczek, MN-DNR
Wisconsin's Ballast Water Program	Cordell Manz, WDNR
Stryker Bay-Interlake Restoration Project	MPCA

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