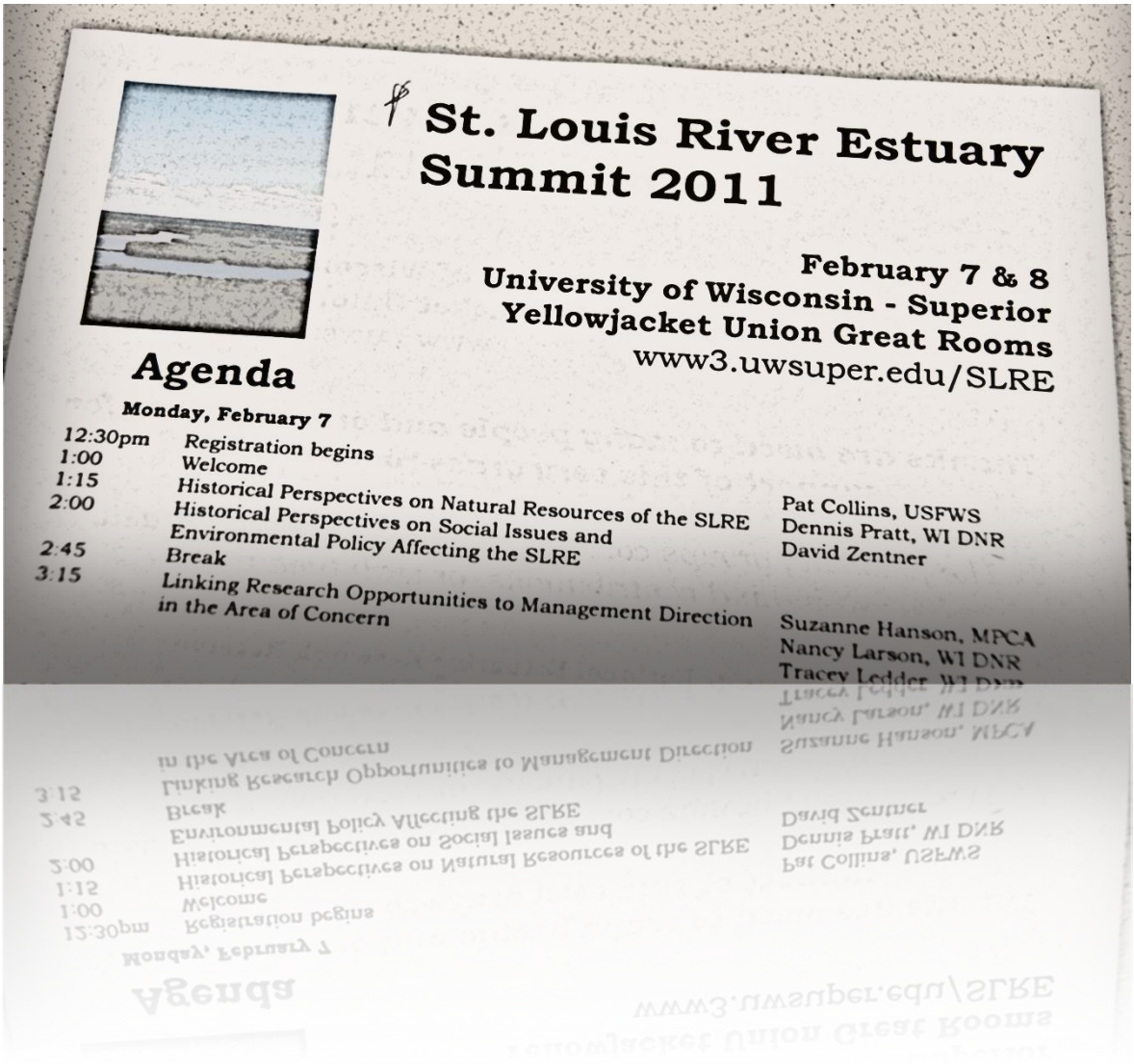
Proceedings of the St Louis River Estuary 2011 Science Summit



St. Louis River Estuary Summit 2011

February 7 & 8

University of Wisconsin - Superior

Yellowjacket Union

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Introduction

A St. Louis River Estuary Summit was organized to provide a venue for St. Louis River Estuary (SLRE) researchers and resource managers to share information, collaborate on projects and strengthen partnerships. Participants saw this as an opportunity to learn about current research and management priorities in the SLRE, and identify opportunities for collaboration. This workshop, entitled "St. Louis River Estuary Summit 2011: From Research to Management and Back Again" took place on the University of Wisconsin Superior campus on February 7 and 8, 2011.

Key partners in the planning and coordination of this event included: the Lake Superior National Estuarine Research Reserve (NERR), University of Wisconsin-Extension, US Environmental Protection Agency, US Fish and Wildlife Service, University of Minnesota-Duluth, Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources, MN and WI Sea Grant Programs. The target audience for this workshop was research and management professionals working in the St. Louis River Estuary. The agenda was developed to provide a mix of formal presentations, informal project mapping and networking opportunities. The first day set the stage with invited presentations that provided historical perspectives on the natural resource and social issues of the SLRE. Wisconsin and Minnesota management agency representatives presented an overview of the regulatory framework they work within when dealing with an Area of Concern on the Great Lakes. The day ended with the poster reception and time for networking.

Day two followed with several formal presentations, an interactive mapping exercise, issue-oriented break-out session and concluded with a discussion of next steps. The Great St. Louis River Estuary Data Slam, organized by George Host of the Natural Resources Research Institute and Tom Hollenhorst of the U. S. Environmental Protection Agency, challenged participants to enter information about sources of St. Louis River Estuary data. More than 90 data records were entered by the time the Summit was over. The Data Slam remains open (www.tinyurl.com/slr-data-slam) for people interested in entering information or viewing the results. Prior to the summit researchers Jeff Gunderson (Minnesota Sea Grant) and Ted Angradi (EPA-MED) developed and distributed a survey to gauge participants' perceptions

about ecosystem services provided by the SLRE. Results were presented at the Summit. Lake Superior NERR staff created a summit website that included the agenda, abstracts, participant contact information, delisting targets for the beneficial use impairments for the St. Louis River Area of Concern and links to the data-slam and exit survey.

Over the two day summit there were 142 participants representing over 40 groups that included state, tribal, and federal agencies, private, non-profit, municipal, county and citizen groups. We successfully recruited our target audiences of SLRE researchers and managers as these groups attended in the highest numbers with federal agencies and university researchers each representing 25% (36 participants each) and state agencies at 25% (35 participants) of the total number of attendees. The information collected during this summit has provided an extensive compilation of information that Lake Superior NERR staff will utilize to identify collaborative opportunities for addressing and prioritizing research and management needs for the SLRE.

Participants were asked to fill out an exit survey that was available on the SLRE Summit website. Twenty-nine attendees responded and results indicated that participants thought that the SLRE Summit met their expectations (93%) and thought that it was a good use of their time (97%). Most of the respondents attended the Summit to find out about projects going on in the SLRE (83%). Respondents thought that Summit topics were appropriate (72%) and felt that the networking time and formal presentations were the most valuable components of the summit. Eighty-six percent of participants surveyed indicated that they would be interested in participating in another summit in the future.

Abstracts for Poster and Oral Presentations

Perception of ecosystem services in the St. Louis River Estuary: Preliminary results from the ecosystem services questionnaire

Ted Angradi[1], Dave Bolgrien[1], Brent Bellinger[1], Jan Keough[1], Marisa Mazzotta[2], Jeff Gunderson[3]

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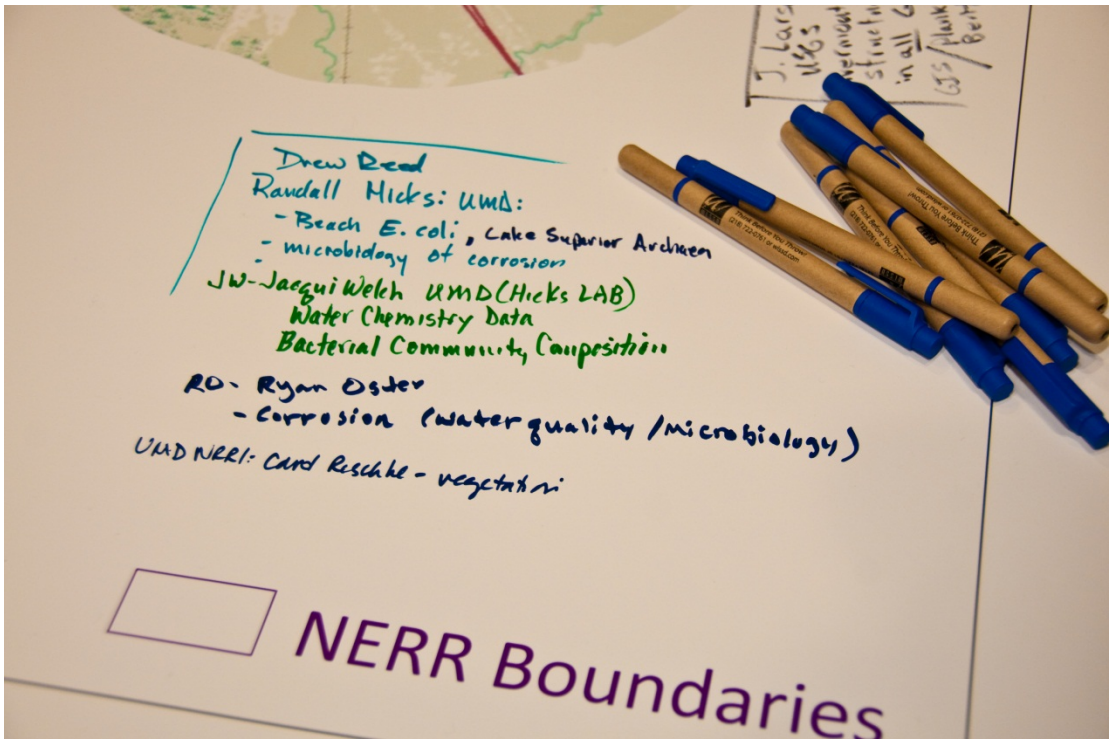
[2]US EPA Atlantic Ecology Division Laboratory, Narragansett, RI
[3]Minnesota SeaGrant, Duluth, MN

Ecosystem services are the ways that nature contributes to our personal well-being and health of the economy. Some services are bought and sold in market; other services are not. EPA ORD and MN SeaGrant are interested in research on ecosystem services in GL and region. The Summit was seen as an opportunity to learn more about perceptions of ES in the SLRE. We hoped to raise awareness of ES concepts and how they can be useful. Preference data (ranking) supports valuation and decision-making. The survey included 4 perception questions. It was sent to about 257 email addresses associated with the estuary or the summit and was active for 22 days. We received about 109 useable responses (42%). To the question "What is your affiliation?"Academic (33%) and federal (26%) were the most frequent responses. To the question, "What do you consider your primary role with regard to the St. Louis River Estuary?" researcher (32%) and recreational user (22%) were the most frequent responses. Respondents ranked the importance of the ecosystem services in this order (from highest): water quality, biodiversity, recreation, food, commercial navigation (tied), cultural spiritual and tourism (tied). Ranking was not independent of affiliation. Respondents ranked the value of recreational opportunities in this order: kayaking/canoeing, fishing, birding, hiking (3-way tie), camping/picnicking, water contact sports, sailing, waterfowl hunting (tied), power boating. Respondents were asked to rank the relative value of each of several options for increasing the ecosystems services and overall benefits from the St. Louis River Estuary. The options were ranked as follows: preserve existing natural habitats, improve storm/wastewater management, restore shallow water habitat, restore emergent wetlands, control unwanted/invasive species (3-way tie), remove contaminated sediments, enhance hunting and angling opportunities, revitalize brownfields (tie), improve recreational amenities, improve maritime infrastructure, increase tourism amenities. Some potential biases with the survey were identified. We infer that the full range of ecosystem services in the estuary is not fully appreciated, even by local experts.

Minnesota's Lake Superior Coastal Program (MLSCP)

Lisa Angelos, Amber Westerbur, and Clinton Little
MN DNR Lake Superior Coastal Program, MN

The MLSCP proposes to prepare a poster for the St. Louis River Estuary Summit which will give participants a better understanding of the role our program can play in assisting them in reaching their objectives on projects through grant funding, sharing of deliverables, and the provision of technical assistance. We plan to provide an overview of our mission and program goals, as well as examples of some projects that have been completed in the AOC or that are relevant to the types of activities that may be of interest to those working in the AOC. Additionally, we intend to provide information on the categories of projects potentially eligible for funding or program support, and an indication of key timeframes to consider such as typical annual grant cycle deadlines. We believe the poster will be a starting point to spark more in depth conversations about opportunities for collaboration and partnership that more specifically relate to the individual interests of the viewer.



Weather & Water: Stream, lake, harbor, and beach water quality data animations to protect the Lake Superior coastal zone

R. Axler[1], G.Host[1], N.Will[1], J.Henneck[1], E.Ruzycki[1], G.Sjerven[1], C.Hagley[2], J.Schomberg[2], T.Carlson[3], C.Kleist[3], J.Austin[4], and N. Dobiesz[4].

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Coastal communities across the northern Great Lakes are increasingly facing 'tipping points' – points at which fish can no longer survive due to thermal, oxygen, or other stress; beaches become unswimmable due to *E. coli* violations; or streams and harbors require costly TMDL studies and remediation strategies because they exceed threshold turbidity and other pollutant levels. The *LakeSuperiorStreams.org, MinnesotaBeaches.org,* and *GlobalGreatLakes.org* website-based projects have been developing novel on-line, interactive animations and maps of automated, remote water quality data, and manually collected St. Louis River and Lake Superior Beach Advisory monitoring data to help link weather and landuse to the condition of Western Lake Superior water resources. This includes: sensor data from a nearshore Lake Superior buoy (Temp, Meteorology); the Duluth Inlet of St. Louis River Estuary (WQ, Flow, Precip); the discharge from WLSSD (Flow, Turbidity, Precip); seven (7) MN trout streams (WQ, Flow, Precip); weekly MN Superior/SLRE Beaches (*E. coli*, ancillary data); historical SLR (WQ, fecals; harbor fish trawls); and Citizen Stream Monitoring Program transparency tube data (prototype). On-line and downloadable data vignettes created from these tools are being developed and used to inform and/or educate a variety of public and private sector audiences about how these aquatic systems "work", how they can be degraded by stormwater from our activities in the watershed, and what actions can be taken by individual homeowners, businesses, contractors, developers, consultants, resource agencies and municipal officials to better protect and manage these sensitive waters.

Making St. Louis River project information transparent to the public and agencies

Julene Boe and Marie Zhuikov
St. Louis River Alliance

At least 33 organizations and agencies work on St. Louis River issues and research projects. Tracking who is working on what and disseminating the resulting information is becoming an increasing challenge. The St. Louis River Alliance proposes a session outlining ideas for several efforts to meet this challenge. These include formation of a Public Outreach Work Group, a St. Louis River E-newsletter and a project clearinghouse. One of the tasks of the Public Outreach Work Group would be to create a Public Outreach Plan for the St. Louis River Area of Concern. The Public Outreach Plan will provide public outreach activities in support of efforts to remove the nine Beneficial Use Impairments associated with the St. Louis River AOC's contaminated sediments and degraded habitat. Stakeholder and public input is necessary to determine which BUIs will fall into short-term, mid-term, or long-term categories. Other goals for the Public Outreach Plan include fostering closer collaboration between natural resource managers and river researchers, assessing needs for new communications products and coordinating use of existing communications products. One of these products is an E-newsletter about the river that the Alliance recently received a grant to produce. Another is an information clearinghouse of river habitat and research projects that is accessible by the public.

Linking human actions to ecosystem-derived benefits in the St. Louis River estuary and watershed: an integrated research program

David Bolgrien, Brent Bellinger, Ted Angradi, Tom Hollenhorst, Mark Pearson, Debra Taylor, Colleen Elonen, Brian Hill
United States Environmental Protection Agency, Mid-Continent Ecology Division, Duluth, MN

We describe a research program aimed at increasing our understanding of the benefits humans obtain from the St. Louis River estuary and watershed (SLREW). Over 3-5 years, we will relate human actions to human benefits in three focus areas: 1) the extent and distribution of submerged aquatic vegetation (SAV); 2) biogeochemical attributes of SAVs, wetlands, and sediments; and 3) land use decisions. In Focus Area 1, we will use hydroacoustic surveys of SAV to develop spatial models predicting SAV distributions from biophysical drivers (e.g., depth, substrate, water quality, and physical disturbance). Results will include maps, biophysical thresholds for SAV establishment, and models to predict SAV response (and associated benefits) to human-use scenarios. In Focus Area 2, we will measure the spatiotemporal dynamics of nutrients as mediated by SAVs, emergent vegetation, and hydrophysical drivers (e.g., tributary inputs, seiche). Results will determine the roles and potential fate of nutrients from soils, sediment, and vegetation. In Focus Area 3, we will examine the benefits from the SLREW related to land use decisions and community investments. We will use hedonic models to quantify the importance of market and non-market variables in property purchasing and land use decision-making (i.e., zoning and BMPs). There is overlap between the focus areas and we expect our research to complement on-going and planned habitat restoration, sediment remediation, fisheries assessment, and ecological research in the SLREW. This abstract does not necessarily reflect U.S. EPA policy.

Microbiological and chemical aspects of corrosion of steel in the Duluth-Superior Harbor

J. R. Bostrom, J. S. Lee, R. J. Oster, B. J. Little, R. E. Hicks
Department of Biology, University of Minnesota Duluth, MN

Sheet steel structures in the Duluth-Superior harbor show unusual corrosion patterns characterized by extreme pitting and rusty blisters called tubercles. A laboratory microcosm experiment was designed to evaluate the effects of microorganisms and water quality on the corrosion process. Duplicate steel coupons were evaluated in five treatments: unaltered harbor water, autoclaved harbor water, autoclaved harbor water with iron-oxidizing bacteria (FeOB), harbor water supplemented with sulfate (44 mg Na_2SO_4/L), and Lake Superior water. Terminal-restriction fragment length polymorphism (T-RFLP) analyses showed that bacterial communities on steel were different from one another in microcosm treatments with different types of water (e.g. autoclaved Duluth-Superior harbor water vs. unaltered Duluth-Superior harbor water and Lake Superior water vs. Duluth-Superior harbor water). The abundance of the dissimilatory sulfite reductase (*dsr*A) gene, an indicator of sulfate-reducing bacteria (SRB), increased several orders of magnitude on coupons in harbor water. After five months, coupons in harbor water (with or without added sulfate) had more copies of the *dsr*A gene than coupons exposed to Lake Superior water. By the end of the experiment, there were more iron-oxidizing bacteria on coupons immersed in harbor water (with or without added sulfate) than in any of the other treatments. The abundance of SRB and to a lesser degree the abundance of FeOB correlated with the overall differences in bacterial community. Further, these differences correlated with inverse polarization resistance, a value used to approximate instantaneous corrosion rate. Our data indicate that microorganisms and water chemistry may influence the corrosion of steel structures in the harbor.

The St. Louis River and the Natural Resources Research Institute

Dan Breneman et al.
Natural Resources Research Institute, Center for Water and the Environment, University of Minnesota Duluth, MN

The University of Minnesota Duluth's Natural Resources Research Institute (NRRI) has been at the forefront of helping develop a sustainable Northern Minnesota natural resource economy for over 25-years, including numerous projects involving the St. Louis River Estuary (SLRE). From the mid-1970's to present, scientists at NRRI have helped advance our knowledge of the St. Louis River watershed by completing numerous studies and publishing documents on topics ranging from avian nesting success, aquatic macroinvertebrates and sediment contamination, to public input and attitudes regarding water resources. Although impairments to the SLRE have been addressed for decades, this highly valued natural resource remains instrumental in the regional economy, and is the focus of continued research. This poster is a summary of historical NRRI projects contributing to our understanding of the SLRE, and the continued dedication to evaluating watershed interactions throughout the Great Lakes region.

A new web tool for integrating fisheries and environmental data

Norine E. Dobiesz and Robert E. Hecky,
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Aquatic ecosystems around the world have been impacted by the human populations within their watersheds and many of these impacts have directly or indirectly affected the fish communities. Increased siltation covers rocky habitats, negatively impacting fish spawning locations; contaminants from industrial pollution, agricultural runoff, and atmospheric deposition impair water quality and stress fish populations; and excess nutrients from wastewater, agricultural runoff, and urban storm water runoff have caused eutrophication leading to degraded food webs, water quality, and habitat. Climate change is predicted to further impact aquatic ecosystems by increasing water temperature, decreasing dissolved oxygen levels, increasing contaminant toxicity, altering lake mixing regimes that influence fish habitat availability; and changing the magnitude and seasonality of runoff. Tracking the evolving state of our aquatic ecosystems will require easier and timelier access to essential data to detect and manage these emerging threats. The tools available through the GlobalGreatLakes.com web site provide key data integration and visualization techniques to address these complex issues. The western arm of Lake Superior was selected as the prototype for this project, with the St. Louis River Estuary a key ecosystem of concern. We will demonstrate the tools available on the web site to promote integration of fisheries and environmental data that impact the St. Louis River Estuary.

Birds as indicators of contaminant exposure in the Great Lakes

Christine M. Custer, Thomas W. Custer
U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

Many locations in the Great Lakes are contaminated with historical (e.g., organochlorine insecticides, polychlorinated biphenyls [PCBs], dioxins, mercury, polycyclic aromatic hydrocarbons) and newly emerging contaminants (e.g., perfluorinated compounds [PFCs], and flame retardants [PBDEs]). Some locations may have high levels such as the Areas of Concern (AOCs). This study will use select species of birds (tree swallows and colonial waterbirds) as indicators of chemical contamination exposure and adverse effects in the Great Lakes including the St. Louis River system. Avian samples will be collected throughout the Great Lakes and analyzed for environmental pollutants and biological indicators. Emphasis will be placed on newly emerging contaminants (e.g., PFCs and PBDEs) in addition to legacy contaminants (e.g., PCBs, mercury). The data will dovetail with the Great Lakes Restoration Initiative (GLRI) projects of the U.S. Fish and Wildlife Service, with the GLRI enhanced Mussel Watch Program of the National Oceanic and Atmospheric Administration, and with existing programs of the Environmental Protection Agency (EPA). The avian sampling provides data beyond, but complimentary to that collected by these other programs. Changes in chemistry and biological indicators in avian samples will be used to interpret the success of remediation activities already completed or in progress. Additionally, the monitoring and effect studies will provide important data for EPA and other regulators to determine on a site basis the degree of beneficial use impairment (BUI) including both Degradation of Fish and Wildlife Populations and Bird or Animal Deformities or Reproduction Problems BUIs.

Dune vegetation research and restoration on Wisconsin Point

Nicholas Danz, Matthew Jahnke, and Donald Lisdahl
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Wisconsin Point and Minnesota Point comprise one of the world's longest freshwater barrier sand spits naturally divided by the outlet of the St. Louis River. Compared to the typical red clay substrate along Wisconsin's south shore of Lake Superior, Wisconsin Point dune sands are home to dune grass and dune heath communities uncommon in the region. While these plant communities are especially sensitive to human disturbance, Wisconsin Point continues to be an attractive recreational spot for beachgoers and birders alike, drawing tens of thousands of visitors annually. We are working on two projects related to dune communities and human disturbance on Wisconsin Point. In the first, we are evaluating vegetation change over the past 50 years by revisiting sites originally surveyed in 1956 by John Curtis during fieldwork for his landmark text 'Vegetation of Wisconsin'. In summer 2010 we surveyed 135 1-m^2 quadrats in dune plant communities and are currently carrying out statistical analysis of vegetation change. In the second project, N. Danz's undergraduate course *Plants and People* is working with the City of Superior, WI to remove Spotted Knapweed and restore a 4-acre piece of backdune habitat. Absent from Wisconsin Point as recently as 1983, Spotted Knapweed is now the dominant plant in some dune areas. In Fall 2010, students estimated knapweed density >50 plants per m^2 and seed production > 10 million seeds per acre in this backdune habitat. Over 200 garbage bags of knapweed were removed by hand-pulling by UWS undergraduates.

St. Louis River Estuary fish community surveys: 1989–2004

Lori M. Evrard and Mark R. Vinson
U.S. Geological Survey, Lake Superior Biological Station, Ashland, WI

The U.S. Geological Survey Lake Superior Biological Station conducted a long-term fish survey program in the St. Louis River Estuary between 1989 and 2004 to investigate population dynamics and impacts of ruffe (*Gymnocephalus cernuus*). Over 1,800 bottom trawl samples were collected as part of a seasonal spatially randomized study design. Ruffe were first discovered in 1987 and their density increased from about 6 fish per hectare in 1989 to a high of 227 per hectare in 1997. They quickly became the most abundant fish in the Estuary and expanded their range along the south shore of Lake Superior. It was assumed ruffe would have a negative impact on the native fish community but a conclusion from the International Symposium on the Biology and Management of Ruffe in 1998 was that ruffe may occupy an "open niche" (see Gunderson, Klepinger, Bronte, and Marsden 1998). By 2004 ruffe densities decreased to less than 25 fish per hectare. Another invader, the round goby (*Apolonia melanostomus*) was first collected in 1995 and increased to a density of about 5 fish per hectare by 2004. In 2001 tubenose gobies (*Proterorhinus marmoratus*) were first collected but populations remained low. These data provide a historical record of St. Louis River Estuary invasive fish populations and will be a valuable resource to researchers currently trying to characterize and quantify current and future impacts to native biota in the St. Louis River Estuary.

Long-term trends in St. Louis River water quality

Joel C. Hoffman
U.S. EPA Mid-Continent Ecology Division, Duluth MN

Water quality impairments caused by sewage and industrial waste discharge into the St. Louis River have been a primary concern for clean-up efforts throughout the last century. Surveys dating back to 1928 reveal severely degraded water quality in much of the river below Fond du Lac dam. The Minnesota Pollution Control Agency began regular monitoring in 1953 at MN Hwy 23 Bridge and by 1973 were sampling at multiple locations in the lower river. Long-term trends demonstrate a dramatic recovery in water quality, concurrent with the establishment of the Western Lake Superior Sanitary District. Since 1973, there has been a significant increase in dissolved oxygen concentrations, as well as declines in total suspended solids and total phosphorous (TP) concentrations throughout the lower river. Total inorganic nitrogen has also declined at the Hwy 23 Bridge (annual mean = 0.20 mg L^{-1}), but, after an initial decline, has recently increased at Blatnik Bridge (annual mean = 0.42 mg L^{-1}). Nutrient and sediment targets should be evaluated in the context of current biogeochemical processes and historical pollution sources. Current annual mean TP concentrations are higher at Blatnik Bridge (0.04 mg L^{-1}) than at the Hwy 23 Bridge (0.03 mg L^{-1}). Recent surveys indicate that sediments above Grassy Point remain a source of phosphorous and nitrogen to the river. Long-term data, however, demonstrate that the rate of TP reduction has increased faster in the lower river than the upper river since the mid-1990s, implying a significant, positive change in nutrient dynamics in the lower river. [*This abstract does not necessarily reflect U.S. EPA policy.*]

Ecological status of the St. Louis River system, as informed by spatially comprehensive surveys and comparison to coastal wetlands elsewhere

Joel Hoffman, Anett Trebitz, Anne Cotter, Jack Kelly, John Morrice, Greg Peterson, Mike Sierszen, Matthew Starry, Jo Thompson, Peder Yurista, Corlis West
U.S. EPA Mid-Continent Ecology Division, Duluth MN

Extensive data on biota and the physical/chemical environment were collected across the lower St. Louis River in 2004-2007 as part of multiple studies undertaken by EPA. The 2005-2007 work provides a spatially highly-resolved assessment of conditions across the system, while the 2004 survey (that sampled Allouez, Pokegama, and Rask Bays within the St. Louis system as well as many other coastal wetlands across the Great Lakes) places the system's condition in a broader context that helps to inform restoration and management targets. Geo-referenced data collected by EPA includes habitat structure (sediment type, vegetation type and cover); water quality (temperature, conductivity, pH, dissolved oxygen, turbidity, nutrients, cations, anions, particulate matter, dissolved organic carbon); primary producers (Chl a, periphyton taxa); and faunal composition (benthic invertebrates, zooplankton, fish – all enumerated to genus or species). Besides describing the data we have available to share, this poster presents maps and ordination diagrams showing spatial variability across the system (both a longitudinal gradient and depth zonation are evident), and highlights the condition of St. Louis River wetlands relative to others in the Great Lakes (relatively poor for Lake Superior but good compared to the lower lakes). [*This abstract does not necessarily reflect U.S. EPA policy.*]

Modeling Peak Discharge within the Marengo River Watershed – Lessons for Restoration in the Saint Louis River Watershed

Tom Hollenhorst[1] and Matt Hudson[2]
[1]U.S. EPA Mid-Continent Ecology Division, Duluth MN
[2]Bad River Watershed Association, Ashland WI

To more fully understand the hydrologic condition of the Marengo River Watershed, and to map specific locations most likely to have increased discharge and flow velocity (leading to more erosion and higher sediment loads) we modeled peak discharge for 35 different sub-watersheds delineated expressly for this purpose. This effort largely follows the approach used in the report; "Marengo River Watershed Test Case: Assessing the Hydrologic Condition of the Marengo River Watershed, Wisconsin" prepared by the Wisconsin Lake Superior Basin Partner Team. Just as the Marengo River Watershed Test Case modeled peak discharge for 5 Marengo River Sub-watersheds using the National Flood Frequency model, we modeled peak discharge more specifically for these same 5 sub-watersheds and again for a higher resolution set of 30 sub-watersheds. We also refined the inputs to the model using GIS overlay techniques and area weighted averages. Our initial results compared closely with the test case results with similar estimated discharge and rank order from lowest to highest discharge. The higher resolution set of 30 sub-watersheds was then used to execute the model, and to summarize the amount of open lands, allowing sub-watersheds with excessive discharge and relatively more open land to be identified. Future efforts will likely include adding additional sub-watersheds for tributaries along the lower main stem of the Marengo River, adding custom watersheds for culverts and developing a similar analysis for the Nemadji River. We believe this approach provides a useful technique for prioritizing sub-watersheds for erosion mitigation efforts. This abstract does not necessarily reflect USEPA policy.

Stressor gradients and spatial narratives of the St. Louis River Estuary

George Host[1], Richard Axler[1], Janet Silbernagel[2], Nicholas Danz[3], Jeff Schuldt[3], David Hart[4], Annette Drewes[5], Mark Wagler[6], Jim Mathews[6], Cynthia Hagley[7], and Jesse Schomberg[7]

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[7]Minnesota Sea Grant, MN

The St. Louis River Estuary, simultaneously an EPA area of concern and now a National Estuarine Research Reserve (NERR), is a complex mosaic of high quality aquatic and riparian habitat intermingled with areas of heavy industrial use and effluents from an urban landscape. Communities surrounding the estuary are actively developing land use plans that will determine their future environmental and socioeconomic health, and it is important that decision makers have access to data, tools and technologies that provide for socially and ecologically sound decisions. Through joint funding from Minnesota and Wisconsin Sea Grant, our project team will provide an assessment of reference and at-risk aquatic habitats in the St. Louis River estuary to guide future monitoring, restoration, remediation, land use planning, along with community awareness and stewardship. This project characterizes water quality, and plant and macroinvertebrate communities along a watershed-based human stressor gradient, and uses the results to map reference and at-risk habitats. This gradient will also be used to develop spatial narratives through multifaceted land, ship, and Internet-based outreach and collaborative learning activities, available online at www.StLouisRiverEstuary.org. Communication and education tools include an open geospatial archive, a 'deep map' that incorporates vignettes of local communities, augmented reality games and geo-tours of the estuary, ship-based activities, and a diverse array of complementary online resources. Results of this study are intended to help guide implementation of the St. Louis River Habitat Plan, help prioritize monitoring, restoration, and remediation activities, and enhance public awareness and understanding of this unique environment.

The use of cell bioassays and caged fish studies to detect and monitor contaminants of emerging concern in the St. Louis Harbor

M. Kahl, L. Thomas, D. Villeneuve and G. Ankley
US EPA, Mid-Continent Ecology Division, Duluth, MN

The US EPA Mid-Continent Ecology Division is conducting effects-based monitoring studies in support of Great Lakes Restoration Initiative (GLRI) in the St Louis Harbor. The goal of this research is to develop and validate methods using in-vitro cell based systems (with field collected water samples) and caged fish exposures suitable for detecting and monitoring contaminants of emerging concern (CECs) in the Great Lakes such as pharmaceuticals and endocrine-disrupting chemicals (EDCs). Site locations for the 2010 field season focused primarily on wastewater treatment plant discharges as representative of areas where EDCs may be present. Test sites were the upper St. Louis River in Fond du Lac (reference), two locations near the Western Lake Superior Sanitary District, and one location near the Superior Wastewater Treatment Plant. The 2010 field season focused on development of state-of-the-art water sampling techniques, and the development of a caged fish exposure system for studies ranging from 2 to 10 days, with sexually mature fathead minnows *(Pimephales promelas)*. A pilot study helped refine organism transport, deployment techniques, sampling optimization and provided molecular data from the caged fish that were suggestive of exposure to EDCs. Techniques developed this past summer will be used during 2011 and 2012 for additional studies in the St. Louis Harbor, as well as at other areas of Concern in the Great Lakes including locations in Ohio, Michigan and Wisconsin. Agency partnerships for this work include the US Geological Survey (USGS), the Minnesota Pollution Control Agency (MPCA), Fish and Wildlife Service (FWS), and the University of St. Thomas.

City of Duluth sediment control and stream bank stabilization projects

Ally Kramer[1], Natalie White[1], Scott Weyandt[1], and Gary Minck[2]

[1]Short Elliott Hendrickson Inc. (SEH)
[2]City of Duluth Department of Public Works, MN

Traditional methods of dealing with storm water runoff can lead to big problems: in Duluth, these include 15 foot deep channels where none existed before, areas where all vegetation has washed away, and sediment that blankets streambeds and floodplains, eventually choking vegetation and aquatic habitat. Although not always so dramatic, the increased peak flows in urbanized areas and resultant erosion increase sediment and nutrient loading to the SLRE and Lake Superior. Stabilization projects decrease erosion and help improve water quality in receiving water bodies. Recent projects in the City of Duluth highlight approaches to stabilization appropriate for different situations, from hard armor to native vegetation. One project near Morningside Avenue included redirecting storm water through vegetated swales into catch basins to eliminate areas where a storm water had down-cut a deep channel into forested upland habitat. In the upper Woodland Avenue residential neighborhood, a severely eroded tributary to Tischer Creek was stabilized with a combination of rock and native plants. Below Hawk's Ridge near 58th Avenue East, a tributary to Amity Creek was stabilized with native vegetation, with the addition of hard armor in high energy sections where failure could lead to damage to structures above the creek. Tailoring stabilization techniques to each project leads to improved outcomes, in particular, reduced nutrient and sediment loads to downstream water resources that ultimately drain to the St. Louis River and Lake Superior.

Linking Research Opportunities to Management Direction in the Area of Concern

Tracey Ledder[1], Marc Herschfield[2], John Lindgren[3], Nancy Larson[1], and Suzanne Hanson[2]

[1]Wisconsin Department of Natural Resources, Superior, WI
[2]Minnesota Pollution Control Agency, Duluth, MN
[3]Minnesota Department of Natural Resources, Duluth, MN

The St. Louis River is listed as an Area of Concern (AOC). The Great Lakes Areas of Concern are severely degraded geographic areas within the Great Lakes as defined by the 1987 Amendments to the Great Lakes Water Quality Agreement (Annex 2). Each AOC was charged with developing Remedial Action Plans to identify specific management strategies to restore beneficial uses in the AOC. Beneficial Use Impairments on the St. Louis River relate to loss of habitat and contamination of sediments. Planning targets were drafted by Minnesota and Wisconsin with input from local stakeholders to establish long-term goals for the AOC. This presentation contains information on these targets for potential partners interested in working on issues related to the restoration and delisting of the AOC. The AOC Coordinators from Wisconsin and Minnesota provide updates on projects to assess and remediate contaminated sediment and restore habitat in the AOC. The states' priorities for future work related to delisting the AOC include further contaminated sediment characterization, updates and maintenance to a shared sediment database, sediment remediation and site restoration.

Linking Fisheries Populations to Habitat Restoration: If We Build it Who Will Come?

John Lindgren[1] and Joel Hoffman[2]

[1]Minnesota Department of Natural Resources, Duluth, MN
[2]US EPA, Mid-Continent Ecology Division, Duluth, MN

Water quality within the St. Louis River estuary improved greatly after Western Lake Superior Sanitary District came on line in 1979. Water quality improvements triggered a dramatic shift in fish populations. State and Federal resource management agencies also increased their index sampling of fish populations after 1979, which corroborated the dynamic nature of the system. Analysis of sampling results indicated an increased diversity of both native and non-native fish species. Documented increases in species diversity can be attributed to improved water and habitat quality, intentional introduction and natural expansion of native species, un-intentional introduction of exotic species and shifts in species abundance as a result of climate change. The dynamic nature of the system will confound efforts to use fish population indexing as a measureable indicator for determining outcomes of habitat restoration within the estuary. Regardless, fisheries managers intend to use traditional gears for determining impacts of restoration projects on early life stages of select fish species. They will also use non-traditional methods such as carbon^{13} tissue sampling to determine use of specific areas by select species.

Seasonal abundance and movement of the invasive round goby (*Neogobius melanostomus*) on rocky substrate in the Duluth-Superior Harbor of Lake Superior

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Despite its small size (adult: 60 to 130 mm, TL), and reported home range of 5 m^2, the round goby, *Neogobius melanostomus*, has quickly become established throughout the Laurentian Great Lakes watershed. Little information is available, however, on the natural dispersal pattern of this species. This capture-mark-recapture study utilized alphanumeric tags subcutaneously inserted into round gobies (n = 1,228) along a 550 meter stretch of the Duluth-Superior Harbor shoreline to observe their movement over a 13 month period. Recaptured round gobies (n = 415) exhibited highly leptokurtic movement distributions, and observed movement events were not correlated with fish size, gender, or month. Our work indicates round gobies (> 50 mm, TL) generally occupy an area less than our minimum sampling interval (25 m); however, occasional movement up to 50 meters per day could facilitate range expansion in the Laurentian Great Lakes watershed.

Historical perspectives on birds of the St. Louis River Estuary

Gerald J. Niemi
Department of Biology and the Natural Resources Research Institute, University of Minnesota, Duluth, MN

From 1976 to 1979 I was involved in an extensive inventory of the breeding, wintering, and migratory bird species that occur in the St. Louis River Estuary (SLRE). Since that time there has been no systematic coverage of the Estuary, but selected species such as gulls and terns have been monitored regularly. Over 300 species of birds have been identified in the SLRE. Wisconsin Point, a designated Important Bird Area in Wisconsin, has a list of 286 bird species alone. Minnesota Point and the Minnesota portion of the SLRE has also recently been designated an Important Bird Area. Several bird species that are designated as endangered, threatened, and species of special concern occur or have occurred in the SLRE. The Piping Plover, a federally endangered species has not been recorded breeding in > 20 yrs, but significant opportunities for potential restoration exist. The Peregrine Falcon nests at the MN Power Steam Plant, periodically on the Blatnik Bridge, and most successfully at the Greysolon Building in Duluth. The Common Tern, endangered in Wisconsin and threatened in Minnesota, has nested on Interstate Island since 1990. Several Bald Eagles also currently nest within the SLRE. Other species of interest and with restoration opportunities in the Estuary, especially in wetlands, include the Black Tern, Forster's Tern, Trumpeter Swan, several species of rails and grebes, and the American and Least Bittern. The SLRE is noted for its large concentration of birds, rare and unique species, long term monitoring of gulls and terns, and its opportunities for outdoor recreation close to an urban setting. Its future lies in our continued ability to protect its habitats and manage the gulls, predators, and people within its borders.

Analysis of historic water quality changes to develop a tool to assess the risk of corrosion of port infrastructure

Ryan Oster and Randall Hicks
Department of Biology, University of Minnesota Duluth, Duluth, MN

Accelerated corrosive loss of steel infrastructure in the Duluth-Superior Harbor (DSH) has become a major concern. It has been predicted that the loss of steel infrastructure is 2 to 12 times faster than normal and will cost in excess of $100 million to replace. It may be possible to predict if similar rates of corrosion occur in other regions of the St. Louis River estuary and sites in other harbors using water chemistry and microbiological information. Water chemistry data collected from the mid 1970's-1990's and the Larson-Skold corrosivity index calculated from this data shows how water quality has changed over time and its potential impact on local steel infrastructure. The concentration of ions such as chloride and sulfate either decreased or remained constant over time at all sites analyzed. Whereas, alkalinity ($CaCO_3$) remained constant at around 50-55 mg/L at all sites. Dissolved oxygen increased at Burlington Northern Rail Road bridge and Oliver Bridge and remained constant at the Bascule Bridge site. Finally, the Larson-Skold Index of corrosivity decreased or was relatively constant over time. Our analysis indicated that water chemistry alone may not be the cause of localized accelerated corrosion in this harbor. Microbiologically influenced corrosion caused by iron-oxidizing bacteria (FeOB) and sulfate-reducing bacteria (SRB) in conjunction with water quality may be responsible for the dissolution of iron from the steel. The ability to assess corrosive risk to steel structures will be essential for local governments and businesses who must deal with costs involved with their replacement

Hog Island Remediation to Ecological Restoration Project – A Success Story

Christine Ostern[1] and Paul Hlina[2]

[1]Douglas County Land and Water Conservation Department, Superior, WI
[2]Lake Superior Research Institute, University of Wisconsin Superior, Superior, WI

Hog Island is part of the St. Louis River Area of Concern in the Superior, WI/Duluth, MN harbor. Hog Island is one of the first sites in the Great Lakes to move from remediation to landscape scale restoration returning ecological function, structure, and biotic diversity to a heavily contaminated portion of the harbor; addressing several beneficial use impairments. In a short period of time, vegetative buffers were installed along riparian areas; unique woody habitat structures were installed in open waters; wild rice seeded; invasive species eliminated via chemical-free methods, and planted and seeded with native emergent vegetation; and biocontrol methods introduced for other invasive species. Restoration activities were conducted by Douglas County through a regional partnership with NOAA, Great Lakes Commission, and Lake Muskegon, MI; in collaboration with the Lake Superior Research Institute – UWS with more than 12 UWS undergraduate students, two native plant restoration companies, and numerous state and federal agencies.

Cloning and sequencing of bacterial 16S rRNA genes associated with a corroding steel structure in the Duluth-Superior Harbor

A.J. Reed, J.M. Bergin, R.J. Oster, and R.E. Hicks
Department of Biology, University of Minnesota Duluth, Duluth, MN

Steel structures in the Duluth-Superior Harbor on Lake Superior are reportedly corroding at an accelerated rate. Accelerated corrosion has been observed beneath tubercles on steel structures, and it is believed that microbial biofilms and tubercles growing on the steel surfaces create anaerobic zones at the metal surface, which is conducive to accelerated corrosion. As part of an effort to examine the role of microbiologically-influenced corrosion, the bacterial community of tubercles on a rapidly corroding steel structure (Hallet Dock 5) as well as the adjacent water was sampled and investigated using molecular phylogenetic analysis. The total microbial community DNA was extracted and bacterial 16S rRNA genes were amplified by PCR, cloned and sequenced. Shannon-Weaver diversity measures of bacteria were higher in the tubercle scraping clone library. The resultant clone libraries from both sample types were dominated by members of the *Actinobacteria*, the *Bacteroidetes* and the *Alpha-* and *Betaproteobacteria*. Members of the *Deltaproteobacteria*, the *Cyanobacteria*, the *Acidobacteria* and the *Deferribacteres* were detected in the tubercle scraping clone library and not in the water column clone library. Microorganisms of the *Deltaproteobacteria* are often anaerobic sulfate-reducing bacteria (SRB) and the byproducts of their anaerobic microbial metabolism, including hydrogen sulfide and low pH, have been shown to accelerate corrosion. The abundance of the dissimilatory sulfite reductase (*dsr*A) gene indicated a stronger presence of SRBs on steel surfaces at Hallett Dock 5 compared with less corroded sites like the Duluth Entry. Our data suggest that corroding steel structures in this harbor have different microorganisms that were not detected in the adjacent water column.

Aquatic vegetation of the St. Louis River Estuary: initial analysis of point-intercept data collected in 2010 for restoration modeling

Carol Reschke[1], John Lindgren[2], Tom Hollenhorst[3], Terry Brown[1], George Host[1], Valerie Brady[1], Joel Hoffman[3]

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[3]US EPA, Mid-Continent Ecology Division, Duluth, MN

A new effort to model aquatic vegetation patterns in the St. Louis River Estuary was initiated in summer of 2010 for the purpose of informing wetland restoration planning in the St. Louis River Area of Concern (AOC) at 40th Avenue West in Duluth. Aquatic vascular plants were documented using a point-intercept sampling method at two scales. At a coarse scale, we sampled a grid of 687 points evenly spaced at intervals of 200 m apart throughout the St. Louis River estuary from the Duluth/Superior harbor to the Fond du Lac dam. At a finer scale, we sampled 51 random points in the 40th Avenue West remediation site, 56 random points in five high quality reference sites near Clough Island and Spirit Lake, selected to represent conditions similar to the 40th Ave West site. In addition, we sampled two grids of 30 points spaced at intervals of 3 m apart in near-shore sites of two reference areas. At each sample point we recorded plant species present in a $1m^2$ area, as well as water depth, water clarity (Secchi depth), and up to three dominant substrate textures. Aquatic vegetation patterns are being correlated with wind fetch, water depth and clarity, and sediment data. The finer scale analysis of the five reference sites and the 40th Ave West remediation area revealed strong correlations between wind fetch and vegetation composition, with 10 plant species identified as probable indicators of low energy/protected bay conditions. Initial results of the coarse scale vegetation analysis will be presented.

Designation of the Lake Superior National Estuarine Research Reserve: a collaborative opportunity for Great Lakes research and education

Becky Sapper[1], Ralph Garono[1], Sue O'Halloran[1], Travis Olson[2], Patrick Robinson[1], Cathy Techtmann[1]

[1]University of Wisconsin-Extension, Madison, WI
[2]Wisconsin Coastal Management Program, Madison, WI

The National Estuarine Research Reserve System is a network of 28 coastal areas representing different regions of the United States. Each site is operated through a federal-state partnership, that together with local communities and partners, address long-term research, water quality monitoring, education and stewardship needs of coastal areas. In October 2010, the National Oceanic and Atmospheric Administration officially designated portions of the St. Louis River Freshwater Estuary as a National Estuarine Research Reserve, including nearly 16,700 acres of land and water area. The University of Wisconsin-Extension is the lead agency for the Reserve, but will work closely with a wide range of partners. For example, a Reserve Advisory Board including the city of Superior, Douglas County, Fond du Lac Band of Lake Superior Chippewa, University of Wisconsin-Sea Grant Institute, University of Wisconsin-Superior, Wisconsin Coastal Management Program, and Wisconsin Department of Natural Resources will provide advisory guidance for Reserve management, research and monitoring, stewardship, and educational programs and activities. The Reserve represents the culmination of a collaborative designation effort that spanned over 10 years and involved representatives from more the 50 organizations. Designation of a NERR site allows Wisconsin to capture approximately $500,000 in federal funds annually for freshwater estuary research, education, and stewardship. A management plan outlining the mission, vision, guiding principles, goals, objectives, and outcomes for the first five years of the Reserve's operation has been completed and will help guide early Reserve activities.

Status of aquatic non-indigenous species in the St. Louis River system

Anett Trebitz, Greg Peterson, Joel Hoffman, Jack Kelly, Corlis West
US EPA, Mid-Continent Ecology Division, Duluth, MN

As part of a study to develop recommendations for aquatic non-indigenous species (NIS) monitoring in Great Lakes areas at risk of invasion, we conducted comprehensive, multi-year sampling in the lower St. Louis River in 2005-2007. This effort represents the most spatially and taxonomically comprehensive NIS survey of this complex, invasion-vulnerable Great Lakes subsystem to date. In this poster, we identify the NIS and their invasion timeline, describe their abundance and distribution, and evaluate which sampling gears were most effective in finding them. Our study confirms that this major shipping port remains a NIS invasion "hotspot". Ten of the 41 fish species and 19 of the ~240 benthic invertebrate taxa recorded were non-indigenous. Eight of the benthic invertebrates, including the New Zealand mud snail (*Potamopyrgus antipodarum*), a Eurasian-origin amphipod (*Echinogammarus ischnus*), and the quagga mussel (*Dreissena bugensis*), were first-detection records. Notably, zebra mussel (*Dreissena polymorpha*), round goby (*Neogobius melanostomus*), and Eurasian ruffe (*Gymnocephalus cernuus*) were abundant and widespread in the system (potentially "invasive"), while other NIS were less common and more localized ("non-invasive", at present). A few NIS were extremely rare and required considerable sampling effort to detect. Because the sampling gear differed substantially in the habitats covered and the species composition recovered, monitoring multiple habitats with multiple gear types provided the most complete and nuanced picture of aquatic NIS status. [*This abstract does not necessarily reflect U.S. EPA policy.*]

Comparing planktonic bacterial communities across the Duluth-Superior Harbor

J. B. Welch and R. E. Hicks
Department of Biology, University of Minnesota Duluth, Duluth, MN

The transport of microorganisms in ship ballast water is of global concern and the Duluth-Superior Harbor receives more ballast water discharge than any other harbor within the Great Lakes. Currently, little is known about the diversity of natural microbial communities within this harbor, yet this information is crucial for identifying future introductions of potentially harmful microorganism via ballast water discharge. Water samples were collected at six sites along a transect from Lake Superior, through the Duluth-Superior Harbor, and into the Lower St. Louis River to characterize the structure of planktonic bacterial communities. Seiche activity in Lake Superior results in lake water periodically entering and mixing with water in the Duluth-Superior Harbor. DOC was measured and SUVA values were determined to estimate the relative contributions of lake and river water at each site. These measurements were used to estimate the contributions of lake and river water at sites in this harbor and in artificial communities constructed from defined mixtures of Lake Superior and St. Louis River water (Minor, et al., 2008). Additional water samples were collected from ship ballast water and the Western Lake Superior Sanitary District because discharges from these sources may alter the composition of bacterial communities within the Duluth-Superior Harbor. DNA was extracted from microbes collected on membrane filters and used for T-RFLP DNA fingerprint analysis to compare the molecular similarity of bacterial communities in the harbor with artificially constructed communities and potential sources of bacteria to this harbor from the lake, river, ballast water, and wastewater effluent.

Enbridge Wetland Restoration Project

Natalie White[1], Scott Weyandt[1], and Rachael Shetka[2]

[1]Short Elliott Hendrickson Inc. (SEH)
[2]Enbridge Energy, Limited Partnership and Enbridge Pipelines (Southern Lights)

When well-planned, required mitigation for permitted wetland impacts can also provide larger benefits to the St. Louis River Estuary. A site being restored and preserved as mitigation for impacts in the Nemadji River watershed is poised to improve fish and wildlife habitat and reduce sedimentation and nutrient loading in the river. Enbridge is required to mitigate for wetland impacts resulting from construction at its Superior Terminal and recent pipeline projects. When searching for an appropriate site for compensatory wetland mitigation, a parcel on Darrow Road south of Superior offered some compelling benefits: located in the Nemadji River watershed immediately adjacent to an existing State Natural Area, it contained degraded pasture ripe for wetland restoration, forested floodplain wetland in danger of being impacted, and an opportunity for vegetation restoration leading to diverse native plant communities with good habitat value. Restoration activities include rehabilitating compacted soils, moving pastured horses out of the wetland and channels draining directly to the river, seeding and planting of native species, and preserving existing floodplain wetland previously impacted by peat removal and harvesting of ostrich ferns. The Nemadji River has been targeted as a major contributor of non-point source pollution to Lake Superior, and managing for forest cover in the floodplain is recommended to reduce surface runoff rates. In addition to meeting wetland mitigation requirements, the Darrow Road site contributes to the goals of improving watershed health upstream of the St. Louis River Estuary.

Appendices

St. Louis River Area of Concern Complete Delisting Targets

The Great Lakes Areas of Concern (AOCs) are severely degraded geographic areas within the Great Lakes. A total of 43 AOCs have been designated; 26 in the U.S., 17 in Canada (5 are shared between the two countries). The St. Louis River was designated as an Area of Concern in 1987. The Great Lakes Water Quality Agreement (GLWQA) charged each of the AOCs, including the St. Louis River AOC, with developing Remedial Action Plans to identify specific management strategies to control sources of pollution, abate environmental contamination already present, and restore beneficial uses in the AOC. The GLWQA defines a beneficial use impairment (BUI) as a change in the chemical, physical, or biological integrity of the Great Lakes system.

Nearly all of the BUIs for the St. Louis River AOC are tied to historic habitat loss from the extensive filling of wetlands and dredging of shallow aquatic habitat, and to releases of harmful chemicals that contaminated the sediments and water in the estuary. Since 1861, nearly 3,000 acres of wetlands have been filled, and 4,000 acres have been dredged or deepened for navigation (Lower St. Louis River Habitat Plan. p. 15). The Area of Concern also contains several sites that have been known historically to contain hazardous wastes and chemical contaminants.

Many of these contaminated sites are being addressed by regulatory and resource management programs for the states of Minnesota and Wisconsin, such as state hazardous waste remediation programs, or federal programs, such as the CERCLA ("Superfund") program, since specific federal and state dollars necessary to maintain an active RAP program are uncertain (see *Wisconsin's Great Lakes AOCs*). Several contaminated sites in the AOC have been or are being addressed by these programs, including the Superfund site of St. Louis River Interlake Duluth Tar and U.S. Steel Duluth Works well as the former site of Koppers Company Superior Plant. In 2006, Great Lakes Legacy Act funds, which are funds specifically designated to clean up U.S. Areas of Concern, were used to remediate 40,000 cubic yards of petroleum-contaminated sediment and soil from Hog Island Inlet and Newton Creek in the Wisconsin portion of the St. Louis River AOC. Additionally, the state of Wisconsin created the St. Louis River Streambank Protection Area in 1995 by purchasing 6,900 acres of land upstream from Oliver, WI, including five miles along the St. Louis River and 13 miles along the Red River and its tributaries.

The restoration of the chemical, physical and biological integrity of the St. Louis River AOC will be implemented by removing beneficial use impairments and, ultimately, delisting the AOC. The partners will utilize the following principles in the BUI removal process.

1. The states will seek appropriate concurrence of the Fond du Lac Band of Lake Superior Chippewa for any Beneficial Use Impairment (BUI) removal or AOC delisting.

2. Beneficial Use Impairment delisting will occur based on scientific merit as reviewed and approved by state staff expertise.

3. The following BUIs are closely tied with the presence of contaminated sediments. Removal of these BUIs will occur only when the related sediment contamination has been addressed. These BUIs are: Fish Consumption Advisories, Degraded Fish and Wildlife Populations, Fish Tumors and Deformities,

Degradation of Benthos, Restrictions on Dredging, Beach Closings and Body Contact, and Degraded Fish and Wildlife Habitat.

4. The states view partners, such as the St. Louis River Alliance and the Fond du Lac Band, as being valuable in the delisting process and will continue to collaborate, as appropriate, with them.

In 2008, the states of Minnesota and Wisconsin submitted a list of planning targets for the St. Louis River AOC to the U.S. EPA. These targets were drafted by the two states with input from local stakeholders and establish what the long-term goals are for the AOC. The remaining portion of this document contains valuable information for potential partners who are interested in working on issues related to the AOC. For each impairment, there is a the target ("Target"), which is the desired outcome that should be attained before delisting can occur, the International Joint Commission (IJC) guidelines that were established by that agency for a particular BUI listing ("IJC Criteria"), the basis for why a particular impairment was listed for the AOC ("Rationale for Listing"), and the basis for why the particular target was chosen ("Rationale for Removal"). Each of these descriptors provides insight into the recent history of a particular impairment.

Agenda

Monday, Feb 7		
12:30pm	Registration begins	
1:00	Welcome	Pat Collins, USFWS
1:15	Historical Perspectives on Natural Resources of the SLRE	Dennis Pratt, WI DNR
2:00	Historical Perspectives on Social Issues and Environmental Policy Affecting the SLRE	David Zentner
2:45	Break	
3:15	Linking Research Opportunities to Management Direction in the Area of Concern	Suzanne Hanson, MPCA Nancy Larson, WI DNR Tracey Ledder, WI DNR Marc Hershfield, MPCA John Lindgren, MN DNR
4:15	Coming Together Data Slam – Who's Got Data and Who's Doing Science? (www.tinyurl.com/slr-data-slam)	George Host, UMD-NRRI
4:30-6:30	Poster Session and Reception	Sponsored by UWEX, SEH, and Barr Engineering
Tuesday, Feb 8		
8:30am	Registration reopens	Coffee and tea available
9:00	Housekeeping and other details	Pat Collins, USFWS
9:05	Information and the LSNERR	Ralph Garono, LSNERR
9:35	Tribal Goals and Interests in the SLRE	Nancy Schuldt, FDLEP Rick Gitar, FDLEP
10:05	Break	Sponsored by UWEX
10:30	Current and Future Support for the SLRE	Julene Boe, SLRA
11:00	Area of Concern Delisting Targets Overview	Tracey Ledder, WI DNR
11:15	Water Quality Trends in the SLRE	Joel Hoffman, USEPA MED
11:30	Map Your Projects – Environmental / Microbiology / Benthos Projects, Studies, and Data	Ralph Garono, LSNERR
11:45	Networking Lunch – provided	Sponsored by UWEX
12:30pm	Historical Perspectives on Birds of the SLRE	Jerry Niemi, UMD/NRRI
12:50	Linking Fish Populations to Habitat Restoration	John Lindgren, MN DNR
1:15	Map Your Projects – Fish and Wildlife Projects, Studies, and Data	Ralph Garono, UWEX
1:30	Round Table Networking – Gaps, Collaboration, Outcomes	
2:30	Data Slam Prize Drawing	
2:35	Ecosystem Services from the SLRE	Ted Angradi, Jeff Gunderson, Dave Bolgrien, Brent Bellinger, Jan Keough, Marisa Mazzotta, USEPA & MN Seagrant
2:50	Coming Together – Staying Together – What's Next?	Facilitator: Jan Keough, USEPA
3:30	Adjourn	

List of Posters (alphabetical by first author's last name)

Title	Authors	Affiliations
Minnesota's Lake Superior Coastal Program (MLSCP)	Lisa Angelos, Amber Westerbur, Clinton Little	MN DNR Lake Superior Coastal Program
Weather and Water: Stream, lake, Harbor, and beach water quality data animations to protect the Lake Superior Coastal Zone	R. Axler, G. Host, N. Will, J. Jenneck, E. Ruzycki, G. Sjerven, C. Hagley, J. Schomberg, T. Carlson, C. Kleist, J. Austin, N. Dobiesz	UMD-NRRI, Minnesota Sea Grant, City of Duluth Stormwater Utility, UMD Large Lakes Observatory
Making St. Louis River Project Information Transparent to the Public and Agencies	Julene Boe, Marie Zhuikov	St. Louis River Alliance
Linking Human Actions to Ecosystem-derived Benefits in the St. Louis River Estuary and Watershed: An Integrated Research Program	David Bolgrien, Brent Bellinger, Ted Angradi, Tom Hollenhorst, Mark Pearson, Debra Taylor, Colleen Elonen, Brian Hill	USEPA Mid-Continent Ecology Division
Microbiological and Chemical Aspects of Corrosion of Steel in the Duluth-Superior Harbor	Jon R Bostrom, J. S. Lee, R. J. Oster, B. J. Little, R. E. Hicks	University of Minnesota - Duluth Biology Department
The St. Louis River and the Natural Resources Research Institute	Dan Breneman and others	UMD NRRI
Birds as Indicators of Contaminant Exposure in the Great Lakes	Christine M. Custer, Thomas W. Custer	USGS Upper Midwest Environmental Sciences Center
Dune Vegetation Research and Restoration on Wisconsin Point	Nicholas Danz, Matthew Johnke, Donald Lisdahl	University of Wisconsin - Superior
A New Web Tool for Integrating Fisheries and Environmental Data	Norine E. Dobiesz, Robert Hecky	Large Lakes Observatory, Univ. Minnesota
St. Louis River Estuary fish Community Surveys, 1989 - 2004	Lori M. Evrard, Mark Vinson	USGS Lake Superior Biological Station
Ecological Status of the St. Louis River System, as informed by Spatially Comprehensive Surveys and Comparion to Coastal Wetlands Elsewhere	Joel Hoffman, Anett Trebitz, Anne Cotter, Jack Kelly, John Morrice, Greg Peterson, Mike Sierszen, Matthey Starry, Jo Thompson, Peder Yurista, Corlis West	USEPA Mid-Continent Ecology Division
Modeling Peak Discharge within the Marengo River Watershed - Lessons for Restoration in the Saint Louis River Watershed	Tom Hollenhorst, Matt Hudson	USEPA Mid-Continent Ecology Division; Bad River Watershed Association
Stressor Gradients and Spatial Narratives of the St. Louis River Estuary	George Host, Richard Axler, Janet Silbernagel, Nick Danz, Jeff Schuldt, David Hart, Annette Drewes, Mark Wagler, Jim Mathews, Cynthia Hagley, Jesse Schomberg	UMD NRRI, UW Nelson Inst. For Environmental Studies, UWS Natural Sciences Dept, UW Seagrant Institute, Save our Rice Alliance, UW Local Games Laboratory, MN Seagrant Institute

The Use of Cell Bioassays and Caged Fish Studies to Detect and Monitor Contaminants of Emerging Concern in the St. Louis Harbor	Michael Kahl, Linnea Thomas, Daniel Villeneuve, Gary Ankley	USEPA Mid-Continent Ecology Division
U. S. Fish and Wildlife Service Habitat Restoration Partnership Opportunities	Ted Koehler, Pam Dryer	US Fish and Wildlife Service
City of Duluth Sediment Control and Stream Bank Stabilization Projects	Allyz Kramer, Natalie White, Scott Weyandt, Gary Minck	Short Elliott Hedrickson, Inc; City of Duluth Department of Public Works
City of Duluth Stream Rehabilitation Projects for Improved Fish Passage	Allyz Kramer, Natalie White, Scott Weyandt, Gary Minck	Short Elliott Hedrickson, Inc; City of Duluth Department of Public Works
Seasonal abundance and movement of the invasive round goby (*Neogobius melanostomus*) on rocky substrate in the Duluth-Superior Harbor of Lake Superior	Michael P. Lynch and Allen F. Mensinger	Department of Biology, University of Minnesota-Duluth
Analysis of Historic Water Quality Changes to Develp a Tool to Assess the Risk of Corrosion of Port Infrastructure	Ryan Oster, Randall Hicks	University of Minnesota - Duluth, Dept. of Biology
Hog Island Remediation to Ecological Restoration Project - A Success Story	Christine Ostern, Paul Hlina	Douglas County Land and Water Conservation Dept.; UW Lake Superior Research Institute
Cloning and Sequencing of Bacterial 15S rRNA Genes Associated with a Corroding Steel Structure in the Duluth-Superior Harbor	A. J. Reed, J. M. Bergin, R. J. Oster, R. E. Hicks	University of Minnesota - Duluth, Dept. of Biology
Aquatic vegetation of the St. Louis River Estuary: Initial analysis of point-intercept data collected in 2010 for restoration modeling	Carol Reschke, John Lindgren, Tom Hollenhorst, Terry Brown, George Host, Valerie Brady, Joel Hoffman	UMD NRRI, MN DNR, USEPA
Designation of the Lake Superior National Estuarine Research Reserve: A Collaborative Opportunity for Great Lakes Research and Education	Becky Sapper, Ralph Garono, Sue O'Halloran, Travis Olson, Patrick Robinson, Cathy Techtmann	University of Wisconsin - Extension; Wisconsin Coastal Management Program
Status of Aquatic Non-indigenous species in the St. Louis River System	Anett Trebitz, Greg Peterson, Joel Hoffman, Jack Kelly, Corlis West	USEPA Mid-Continent Ecology Division
Comparing Planktonic Bacterial Communities Across the Duluth-Superior Harbor	J. B. Welch, R. E. Hicks	University of Minnesota Biology Department
City of Superior Faxon Creek Demonstration Project	Natalie White, Scott Weyandt, Diane Nelson	Short Elliott Hedrickson, Inc; City of Duluth Department of Public Works
Enbridge Wetland Restoration Project	Natalie White, Scott Weyandt, Rachael Shetka	Short Elliott Hedrickson, Inc; Enbridge Energe

Raw Notes Compiled from Roundtable Discussions

Note: *These were very informal conversations and are not meant to reflect consensus or priority setting by Summit participants. This document is reflective of some highlights of the various conversations that occurred over the course of both the networking lunch and the brief round-table session.*

Fish and Wildlife Population Round Table with some Habitat Restoration (Terrestrial) input

Participants: Lori Evrard, Gerald Niemi, Ted Koehler, Tom Custer, Ed Burkett, Andy Edwards, Martha Minchak, and Christine Custer

Following are the metrics and actions discussed by round table participants to assess whether fish and wildlife populations are limited by physical habitat, food sources, water quality, or contaminated sediments per the BUI delisting criteria. St. Louis River is abbreviated SLR. Great lakes Restoration Initiative is abbreviated GLRI.
The following are presented in the order discussed.

- Create habitat, both island and emergent marsh habitat, to support nesting birds such as common and black terns, various heron and rail species, etc. These habitat improvements would also benefit some fish species populations. Habitat improvements should also include surrounding river systems such as the Nemadji River.
- Redo the 1976 – 79 avian surveys emphasizing migratory waterbirds.
- Explore funding options for post remediation assessments. It is important to know whether actions, sediment cleanup, habitat restorations, etc. actually accomplished the stated goal. If GLRI is reduced or eliminated, funding for post remediation assessments may disappear as well.
- Identify where the great blue heron colony may have re-established itself.
- Continue the 1988 – 2004 trawl surveys from Hwy. 23 to the SLR mouth. These surveys were restarted in 2010 and should be continued.
- Document whether sturgeon reproduction is occurring in the SLR.
- Conduct amphibian and reptile monitoring, and coordinate with existing GLRI and LAMP (Lakewide Area Management Plan) amphibian and reptile monitoring activities. Reptiles of concern include blandings turtle. Productivity and deformities metrics are important as well, but there are extra costs involved with these two metrics.
- Support the ongoing piping plover recovery activities and habitat modification activities. Consider adapting the piping plover recovery plan to clearly identify activities and actions specific to the SLR situation. Maintain (rid area of invasive knotweed, etc.) the existing breeding exclosure on Wisconsin Point.
- Address the human disturbance issue on piping plover breeding areas. This might entail better signage, better enforcement, and better education of the public. The public needs to stay out of breeding areas, whether they like it or not, if that is one of the key reasons for failed breeding.
- Invasive species may be limiting native populations of fish and wildlife life including limiting their food base.
- Inventory the natural resources of Clough Island and prepare a management plan.
- Identify additional species of special interest such as blanding turtles, Franklins ground squirrels, white pelicans and others.
- Is there any historical documentation of whitefish spawning in the SLR?

Outreach and Education Roundtable

Influence Legislators

- Get legislators/Gov. up here on a tour to see jobs related to GLRI
  - Tie to existing political event
  - Use ex-mayor Ross, invite to kick off of the new building (Lake Superior Day?)
- Get business community on board
  - Tout the economic impact of the estuary
- Use superior Days in Madison and Great Lakes Days in Washington DC as avenues
- City staff could invite former Mayor who invites Gov.
- Get chamber at the event; their support essential
- Sue would like to be involved in the Alliance on behalf of the NERR
- E-newsletter great
- Fly-in for individuals to get to D.C.

Invasive Species

- 1854 Treaty Authority resumed bottom trawl sampling of native/non-native fish community per USGS protocol, intended to maintain on annual basis, also to serve as a means of detecting new AIS and track sturgeon reproduction when occurs

Planning and Process

- Develop a matrix of funding sources
- Develop a process that enables partners to effectively get plugged in / connected.
  - Who talks to who and why?
  - Visual representation of the relationships within the Great Lakes / AOC process
  - Figure out what collaborations (collaborative teams) that are working within the AOC.
- Can the NERR strongly participate in AOC issues ➔ keep track of AOC activities
  - Can another entity take on the responsibility
  - Learn the capabilities of the NERR
- Opportunity to build MN/WI partnerships to meet the needs of both
- Share process success – 40th Ave. W for example.
- Short turn-around for grants – how can respond in time with projects ready to go (i.e., AOC land acquisition grant)
- Relationship mapping – who is doing what, where, when etc… Big Picture
- Make use of Grad students
- How to build and maintain lasting relationships … MOUs
- Grant Competition
- Disconnect between state vs. local vs. Federal priorities

Water Quality

- Corrosion in Duluth-Superior Harbor
  - Next step is to carry out fine scale microbiological sampling in conjunction with fine-scale microelectrode measurements
- What is the pattern of nutrient limitation in the estuary?
- Nutrient limitation studies
- Need to look at periphyton production

- Questions:
    - What is the pattern of nutrient limitation
    - What do primary production gradients look like

Invertebrates

- Money to process and ID bugs
- Survey of native mussels and T/E species
- Are there naturally depauperate areas in SLRE

Vegetation

Participants: George Host, Carol Reschke, Nick Danz, Darren Vogt, Ryan Maganga, Frank Koshere

- What opportunities exist for wild rice restoration?
    - Locations?
    - Methods, rice varieties?
    - What is the historical and current distribution of wild rice?
- What do we know about invasive plant species?
    - Current and historical distributions
    - How to minimize colonization of sites by invasives during restoration activities?
    - Possibly plan for some identified high-quality areas to have zero-tolerance management plan for invasives

Contaminated Sediments

- Beginning process of estuary wide sediment characterization
- Identification of hot spots needing attention
- Identify areas that are restoration ready
- GLRI funding opportunities
    - 100% for assessment
    - Match for remediation
- Sediment clean-ups completed, large superfund sites
    - Interlake,
    - Hog Island
- US Steel remedial investigation underway leading toward remedy
- Additional Staff in MN & WI to do the work
- Research on Hg methylation & also current stormwater inputs (i.e., PAHs)

Sediments and Nutrients

- Time Series
    - Fine scale map of nutrient conc. In the water column. Mg^{+} as a LS influence tracer
- Native material as a source of P (soil P)
- Sediment release studies
- N:P ratios, nitrogen budget, NH_4^{+} spatial resolution every river Km.
- Diurnal DO data
- Enhanced sediment core analysis
- Zebra mussels – are they driving plankton dynamics

Fish Tumors and deformities

- NRRI scientist and grad student are developing a project related to tumors and deformities – Sea Grant pre-proposal
    - Ovo-testes in small-mouth bass
- EPA Scientist worked on studies near Clough Island and 2 other sites
    - Electrofishing project
    - Includes notes on external deformities and lesions
    - Project was entered in Data Slam
- Much of the Fish survey data includes notes about external deformities but will not be useful for internal deformities. Liver tumor data is not available/data gap
- DNR can provide fish for sampling
- USGS fish contaminant expert will be here and we might be able to achieve cost savings
- Could Chequamegon Bay be a useful reference site?
- Can we use an inland lake as a reference?
- Would it be valid to do a study for incidence rate for the SLRE and not try to establish a reference site?
    - Set the endpoints, parameters, species in 2011
    - Perhaps do a 2012 study of reference areas
- Need to identify likely species w/ reasonable site fidelity
- Need to determine # Sites, #samples/site
- Need study design
- "We have time to refine; we don't have time to relax."

Unlabeled card #1

- LSNERR Nonprofit: Why create new "Friends of …" nonprofit when existing SLRA already exists
    - These two nonprofits would be pulling the same group of citizens
    - Competing for the same grants
    - Duplicating management and program development
- Utilize the CARD project (identify local and regional values) from the Binational Program
- Social marketing - need to change behavior
- Outcome based results
- Need to focus on protection – need people and money resources
- Cost benefit analysis of resource exploitation vs protection
    - Economic value of less obvious elements
    - Human health values
- Collaborative estuary stewardship education initiative
- Social change need to affect values – we can't do it alone

Unlabeled card #2 (likely invasives)

- What is the adaptation potential of species (i.e., zebra mussels)
    - Are species expanding their due to climate change and/or adaptation (DNA)
- Pursue creative means to convey awareness of threats and measures that can be taken. (Science and Art)
- Discuss different strategies for aquatics and terrestrial / animal & plants. Do we invest resources on Monitoring, Control, Outreach, Prevention?
- 1854 Treaty Authority - resume bottom Trawl sampling to serve as a means of detecting new AIS

- Importance of anticipating future threats

Unlabeled Card #3

- Forest restoration/historical wetland plant communities
- Wild rice re-establishment
- Regulatory considerations in restoration
    - State differences
- Mitigation siting using watershed approach and landscape approach in St. Louis River Watershed
- Hog island wetland restoration

Minutes for Tuesday, Feb 8
Session Titled: "Coming Together – Staying Together – What's Next?"

Jan Keough/USEPA facilitated this discussion. She explained the reason for the summit was so many varied organizations, states, tribes, etc. are moving forward with work on the estuary but all this is done individually. Often one group doesn't know what another group is doing. The question she raised is: How can we work as a group, working together to accomplish more. How can we keep in touch? The Newsletter recently put out by the St. Louis River Alliance is a great tool. The monthly meetings of Twin Ports Freshwater Folk also are a great resource.

Jon Jereczek/WDNR mentioned the newly appointed AOC coordinators and asked people to remember Tracey Ledder/WDNR, Marc Hershfield/MPCA and John Lindgren/MDNR when they are doing various projects so they can facilitate coordination.

Suzanne Hanson/MPCA asked that more people consider attending the meetings of Freshwater Folk. She mentioned they have received more funding dollars for developing the framework focusing on delisting targets. More effort will be focused on pulling together the interested stakeholders as this work continues. This will help broaden the support for things like the management plan.

Tom Hollenhorst/EPA suggested that list serves may be an easy inexpensive way to keep connected and they tend to work great.

Howard McCormick/SLRA mentioned that even though the group present was a valuable diverse group, we need to bring in the Chamber of Commerce. They need to realize the value of the resource to the local economy. People don't come to see a golf course, they come to see the great view of Clough Island from the hillside or to visit the waterfront.

We should work more to engage the business community.

Nancy Larson/WDNR mentioned that the Data Slam was a very effective efficient way to find out what kind of information is available for the area. Keeping an interactive website with easy searching to see what is available would be a great help. She suggested the NERR website might be a good fit for this data.

Howard McCormick/SLRA suggested we should do this again, another summit would be good.

Jan Keough/USEPA asked if others would like to see this happen again in maybe 18 months. There was no real response, but several heads nodded.

Jan Keough/USEPA closed the session, thanking everyone for participating.

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Datasets Collected from the Data Slam

To add more data or get updated results visit:
www.spreadsheets.google.com/viewform?formkey=dGJnd1lVeEZLdmlHWkJvbERYak9aUVE6MQ

The raw data are presented in the following tables.

Note that it is difficult to compile the data in a printed document in a format that is easy to interpret.

The appendix below is intended to be a permanent archive of the data collected during the 2011 SLRE Science Summit.

The online database will remain open for continued project and dataset information uploads.

To download a more user-friendly spreadsheet visit the site listed above, or contact Shon Schooler (sschoole@uwsuper.edu).

ID number	Name	Organisation	Date
1	Patrick Collins	MN DNR	Winter 1995
2	Lori Evrard	U.S. Geological Survey	1989-2004 spring, summer, fall
3	Katie Nummi	Lake Superior Research Institute	2007-2010
4	Mark Pearson	EPA Duluth,MN	spring-summer 2004
5	Amy Eliot	WDNR/UWEX	2007-2009
6	John Lindgren	MNDNR	1983 through 2010
7	John Lindgren	MNDNR and WDNR	1983 - 2010
8	John Lindgren	MNDNR	2005 to 2010
9	John Lindgren	MNDNR	2007 through 2010
10	John Lindgren	MNDNR	2007 through 2010
11	John Lindgren	MNDNR	2003
12	Charlene Johnson	City of Superior	2002-2006
13	Charlene Johnson	City of Superior	2000-2011
14	Charlene Johnson	UMD- Graduate Thesis; Charlene Johnson	2002-2003
15	Nicholas Danz	Dept of Natural Sciences, Univ Wis-Superior	2010
16	George Host	MN Lake Superior Coastal Program	2007
17	Sara Goehl	US EPA	October 2010
18	Matthew Starry	US EPA, MED	compiled 2006
19	Will Bartsch	NRRI	Summer 2010
20	Andy Edwards	1854 Treaty Authority	2005 - 2008 open water seasons
21	Andy Edwards	1854 Treaty Authority	spring 2010
22	Andy Edwards	1854 Treaty Authority	August 2010
23	Anett Trebitz	U.S. EPA - Mid Continent Ecology Division	summer 2004
24	Anett Trebitz	U.S. EPA Mid Continent Ecology Division	summers 2005-2008

ID number	Name	Organisation	Date
25	Brian Borkholder	Fond du Lac Resource Management	summers 2007 - 2010
26	Rick Gitar	Fond du Lac Office of Water Protection	1995-1998; 2004
27	Marc Hershfield	MPCA	Summers 2007 and 2008
28	Elaine Ruzycki	NRRI CWE	2002 through 2010 (ongoing)
29	Frank Koshere	Wisconsin DNR	Summer 2008, 2009, 2010
30	Elaine Ruzycki	NRRI and MPCA	May - Sept 2009, June - August 2010
31	Jill Jacoby	MPCA St Louis River Watch	1994 or 1995
32	Jill Jacoby	MPCA St Louis River Watch	spring/summer 1993-95
33	Jill Jacoby	MPCA St Louis River Watch	1992-1995
34	George Host	NRRI-UMD	Fall 2010
35	George Host	NRRI-UMD	GIS data circa 2000
36	Clinton Little	City of Duluth	2001
37	Clinton Little	MN DNR Natural Heritage and Nongame Research Program	June - August 2002
38	Clinton Little	Minnesota County Biological Survey	Summer 2003
39	Clinton Little	Natural Resources Research Institute University of Minnesota Duluth Dulu	2008
40	Clinton Little	City of Duluth	Winter 2006
41	Clinton Little	Department of Biology University of Minnesota Duluth, Duluth, MN	2005
42	Clinton Little	Fond du Lac Reservation	2004
43	Clinton Little	MPCA	2005
44	Clinton Little	Fond du Lac Reservation	Fall 2002
45	Clinton Little	City of Hermantown	2002
46	Clinton Little	MN GEO	May 2009
47	Clinton Little	Minnesota's Lake Superior Coastal Program	Spring 2007
48	Clinton Little	Minnesota's Lake Superior Coastal Program	Spring 2002

ID number	Name	Organisation	Date
49	Clinton	Wisconsin Coastal Management	Spring 2007
50	Richard Kiesling	USGS and MPCA	Aug-Sept 2010
51	Richard Kiesling	USGS and WI DNR	Sept-Oct 2010
52	Clinton Little	St. Louis County	2005
53	Clinton Little	University of Minnesota Sea Grant	August, 2006
54	Clinton Little	City of Carlton	2006
55	Clinton Little	City of Duluth	2006
56	Clinton Little	St. Louis County	2007
57	Clinton Little	St. Louis County	2007
58	Clinton Little	City of Carlton	2006
59	Clinton Little	University of Minnesota, Duluth Center for Sustainable Community Develo	August, 2008
60	Clinton Little	City of Duluth	2008
61	Clinton Little	City of Duluth	2009
62	Clinton Little	Carlton County	2009
63	Clinton Little	City of Duluth	2010
64	Richard Kiesling	USGS	2011-2012
65	Clinton Little	United States Army Corps of Engineers	2009
66	Clinton Little	NOAA	Varies
67	Clinton Little	National Oceanic and Atmospheric Administration (NOAA) Special Project	Varies
68	Clinton Little	The National Geospatial-Intelligence Agency (NGA)	In Progress
69	Dan Breneman	NRRI-UMD	1993
70	Clinton Little	The National Geodetic Survey	1996 - Present
71	Joel Hoffman	MED	Aug-Sep 2006, April-July 2007
72	Clinton Little	NOAA Coastal Services Center	1996, 2001, 2006

ID number	Name	Organisation	Date
73	Joel Hoffman	US EPA/STORET	1953-2008 and 1973-2008
74	Dan Breneman	NRRI-UMD, MPCA	19951996
75	Clinton Little	NOAA CoastalServices Center	1996, 2001, 2006
76	Clinton Little	Multi-Resolution Land Characteristics (MRLC) Consortium	1992 & 2001
77	Tom Hollenhorst	from EPA remote sensing archive	1953, 1975, 1976, 1977, 1980, 1981, 1984
78	Clinton Little	NRCS	Varies
79	Clinton Little	Minnesota's Lake Superior Coastal Program	Late 1890's to early 1900s
80	Tom Hollenhorst	EPA-MED	
81	Heidi Bauman	MPCA (transfering to MDH)	2002-present, summer only
82	P. Sandstrom	USDA-NRCS/FS	1990-98
83	Julene Boe	ST LOUIS RIVER ALLIANCE	2008-2010
84	Ted Koehler	USFWS and Partners	2010 - Ongoing
85	Nicholas Danz	UWS or NRR	Summer 2010
86	Carol Reschke	UMD NRRI	2010
87	Carol Reschke	MN DNR, MCBS	1999, 2000, 2001, 2002
88	Christine Custer	USGS, UMESC	2010, 2011 and ????
89	Michael Lynch	University of Minnesota	July 1, 2009 to July 22, 2010
90	Henry Quinlan	USFWS Ashland FWCO	2009, 2010, ...
91	Patrick Collins	MPCA (contractors EOR, Desotelle, Schoolderman, Beaster)	Draft plan released 2005
92	Diane Desotelle	Many groups - mostly MPCA	
93	Chad Scott	AMI Consulting Engineers	1997 to 2011
94	Amy Eliot	UWS-Lake Superior Research Institute and WDNR	2011-2013
95	Judy Crane, Ph.D.	various organizations, but this work was done by the MPCA in collaboratio	1990 - 2006

ID number	Goals of the study
1	To determine depth and extent of wood waste at Grassy Point.
2	Determine what effects if any ruffe were having on the native fish community of the estuary.
3	The major goal of the project was to pilot coastal wetland biological indicators developed by the Great Lakes Coastal Wetland Consortium and th
4	In support of Aquatic stressors: Framework and implementation plan for effects research. USEPA 2002.
5	Train volunteers to collect stream data in the Lake Superior basin.
6	Monitor juvenile and adult fish populations
7	Monitor spawning walleye
8	Monitor the recruitment of naturally spawned muskellunge to the first fall
9	Develop a visual index of spawning lake sturgeon by making observation from the Fond du Lac Dam
10	Capture and pit tag lake sturgeon within the St. Louis River estuary
11	Determine angler pressure and harvest
12	Identify wetlands in otherwise developable areas of the City, evaluate their functions, update the wetland boundaries (estimated- not wetland del
13	Design, implement, administer, and monitor compensatory wetland mitigation sites in the Lake Superior watershed supporting the City of Superi
14	Determine if dredged material used to create wetland habitats in the harbor would house enough viable seeds in the seed bank to provide densi
15	To evaluate vegetation change 1956-2010 on lakeward dune vegetation near the tip of Wisconsin Point. John Curtis surveyed 4 plots on Wisco
16	These oblique aerial photographs along the north shore and parts of the St. Louis River estuary were collected in 2007 with funding through Min
17	The purpose of the St. Louis Bay site characterization project was to define the nature and extent of chemical contaminants in the sediment, loca
18	A bathymetric surface raster for the St. Louis River estuary was compiled as a base layer for ongoing research projects at the US EPA Mid-Cont
19	The goal is to investigate relationships between land use stressor gradients and water quality.
20	Examine movements and areas utilized by juvenile lake sturgeon in the St. Louis River estuary
21	test effectiveness of larval drift netting with goal of implementing additional monitoring to determine if larval sturgeon are being produced in the S
22	Resume annual bottom trawling survey (previously initiated and conducted by USFWS/USGS) to monitor abundance and distribution of native a
23	Evaluate condition of coastal wetlands along a gradient of eutrophication, using comprehensive suite of data (water quality, hydrology, habitat st
24	Use SLRE as case study for evaluating strategies for efficient early detection monitoring.

ID number	Goals of the study
25	Using hydroacoustic equipment, collect bathymetric data and substrate type data for the lower SLR. Data collected to coincide with juvenile lake
26	Determine the current location of wild rice on the Lower St. Louis River, determine locations with suitable substraight, water depth, and protectio
27	Establish AOC reference sites in both WI and MN for baseline vegetation data, defining restoration objectives and targets, invasives distribution,
28	
29	The goal was a basic plant inventory at each location. A point intercept method was used to sample aquatic vegetation at several locations asso
30	To monitor water quality in 33 stream sites within the St Louis River watershed
31	To determine the incidence of tumors and lesions on Bullhead livers found in the St. Louis Harbor area.
32	To collect data on Anuran Populations along the St Louis River.
33	To collect bethic macroinvertebrate data along the St Louis River.
34	Collect vegetation data for modeling SAV habitat based on environmental variables.
35	To create and distribute an index of watershed stressors to aquatic systems, using a high-resolution delineation of watersheds; funded by EPA-O
36	The City of Duluth identified a need for detailed wetland data to assistin development planning that protects wetlands, and subsequentlythe City's
37	Account for the mussel resources of rivers and streams throughout Minnesota's Lake Superior Drainage. Measure the sentinels of river health a
38	To properly manage and protect native herpetofauna it is necessary to have knowledge of the species present and sites known to provide essen
39	Accurate maps of the type and locations of wetlands are critical for land use planning, particularly for watersheds undergoing rapid develoment o
40	The City of Duluth has 12 designated trout streams within City limits. These streams demand an increased level of protection to insure that appr
41	There is mounting concern over the source and genetic history of propagules used in restoration projects. This is because genetic mixing betwe
42	Create a GIS parcel layer for the Fond du Lac Reservation.This project was funded in part under the Coastal Zone Management Act, by NOAA's
43	The lower St. Louis River provides an important coastal resource to western Lake Superior. In particular, this transboundary waterway provides
44	Acquire georeferenced ortho low-level leaf off aerial photography for the west half of Township 49 Range 17, which is the area encompassed by
45	Produce and implement a comprehensive wetland protection plan for Hermantown. Project included acquiring land imagery and digitizing wetlan
46	The goal of the Spring Aerial Imagery Program is to acquire 4-band leaf-off imagery statewide.The State of Minnesota has provided funding thro
47	This project is an update of the 2002 Lake Superior's North Shore Oblique Aerial Photography Project with an added extension into the St. Louis
48	Acquire oblique photography of Minnesota's Lake Superior coast to be used to determine potential erosion hazards and update erosion hazard o

ID number	Goals of the study
49	Collect oblique imagery of Wisconsin's coastline
50	The overall goal was to document the distribution emerging contaminants and to understand how the characteristics of depositional environmen
51	The overall goal of the study was to document the extent of the presence of emerging contaminants and to understand how the characteristics o
52	This dataset contains the spatial representation of the tax parcels in St. Louis County, Minnesota This project was funded in part under the Coas
53	To measure impervious surfaces within Minnesota's Lake Superior Coastal Program Boundary while comparing different methods of calculating
54	In response to the need for updated parcel mapping, the City desired to complete a GIS parcel mapping project within the City of Carlton corpora
55	The completion of parcel mapping in these areas will help the city public works department better manage storm water mitigation plans and 'Inflo
56	Enhance St. Louis County's Geographic Infromation System (GIS) capabilites by developing a digital GIS parcel layer for the City of Hermantow
57	Enhance St. Louis County's Geographic Infromation System (GIS) capabilites by developing a digital GIS parcel layer for the City of Proctor, loca
58	The purpose of this project was to accurately map the water, sanitary sewer and storm sewer systems using mobile GPS technology and then us
59	The overall project was designed to achieve three primary objectives: 1. Obtain a minimum of one years worth of quality wind speed data from e
60	This project represents the completion of the third year of a five-year project to map the property ownership within the City of Duluth. The compl
61	This project represents the completion of the fourth year of a five year project to map the property ownership within the City of Duluth. In 2008, v
62	The project was to digitally map all platted and unplatted property in Thomson Township and the City of Cloquet. This project was funded in part
63	This project completes the fifth and final year of Duluth's effort to map the property ownership of the whole city. This project was funded in part b
64	Continuous water quality and event-based sampling of toxics and nutrients to provide baseline information, measure progress towards restoratio
65	The LiDAR-derived data were collected by the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) using the Compact Hyd
66	This shoreline was originally intended to support NOAA nautical chart production. Other applications include shoreline change analysis, boundar
67	This data set was derived from NOAA National Ocean Service (NOS) nautical charts to capture the representative shoreline. Other potential app
68	This data set is intended to replace the existing World Vector Shoreline with higher resolution satellite-derived data. Potential applications includ
69	Compare benthic macroinvertebrate community composition among impaired and reference habitats
70	The National Geodetic Survey (NGS) has been collecting aerial imagery over coastal regions since 1945 using traditional metric cameras and, n
71	Evaluate stable isotopes of larval fish as indicator of wetland connectivity and condition
72	To develop an understanding of the effects that forest fragmentation has on coastal uplands and wetlands.

ID number	Goals of the study
73	To analyze long-term trends in St. Louis River water quality based on PCA data from 1953-present, as well as old reports from 1928-29 and 194
74	Evaluating sediment quality in a Great Lakes embayment
75	The Coastal Change Analysis Program (C-CAP) is developing a nationallystandardized database on land cover and habitat change in the coasta
76	The Multi-Resolution Land Characteristics (MRLC) Consortium is a group of federal agencies who first joined together in 1993 (MRLC 1992) to p
77	Aerial photos usually associated with Superfund sites
78	Collect soil data More detail at the Soil Data Mart http://soildatamart.nrcs.usda.gov/
79	Document cultural and historic coastal features identified in historic digital plat maps available at http://www.mngeo.state.mn.us/glo/index.html.
80	Develop high resolution bathymetry from NOAA Electronic Navigational Charts. Soundings from the charts were interpolated to create a DEM o
81	To monitor Lake Superior beaches for bacteria that may be a threat to human health.
82	Watershed assessment and recommendations
83	TO COLLECT DATA ON VARIOUS PARAMETERS FOR STREAM ASSESSMENT. THIS DATA WAS PROVIDED TO THE MPCA.
84	Fish and Wildlife Habitat Restoration
85	Study relationships between wetland vegetation condition and anthropogenic stress
86	To model aquatic vegetation patterns in the St. Louis River Estuary for the purpose of informing wetland restoration planning in the St. Louis Riv
87	Documentation and mapping of biologically significant natural areas in the St. Louis River Estuary landscape in Minnesota. Also mapping of veg
88	To use birds to assess1. Exposure to legacy and emerging contaminants2. Establish temporal trends3. Determine effects (genetic to population
89	1. Investigate seasonal demographic patterns in the round goby population living among the rocky shoreline substrate in the Duluth-Superior Ha
90	To detect new introductions of fish and monitor aquatic invasive fish species in the St. Louis River estuary.
91	The overarching goal of this project was to assist the MPCA and other key stakeholders in developing a sediment quality management plan that
92	To assist MPCA and other key stakeholders in developing a sediment quality management plan that will facilitate the restoration of the economic
93	Corrosion measurements, water quality measurements, underwater video, soundings, structure information, soils info, water temps, etc...
94	Upcoming 2011-2013. Collect baseline water quality and land cover data in 17 WI Lake Superior basin watersheds identified as priority areas b
95	Organize sediment quality data collected from within the St. Louis River AOC into a comprehensive MS Access database, in addition to preparin

ID number	Habitats sampled	Variables measured
1	wetland	soil borings of wood waste, limited chemical contaminant analysis
2	shallows, undredged channels, dredged channels	Fish density using bottom trawls, temperature
3	Stream bed and coastal wetland	Water Chemistry, invertebrates and plant community
4	main channel borders	Fish, macroinvertebrates, algae, water quality, physical habitat
5	wadeable stream	DO, flow, temp, transparency, habitat, biotic index
6	sheltered bays, flats and channels	species, number, length, weight, age
7	stream channel	number, sex, length, age
8	emergent wetlands along the channel and within sheltered ba	number, length
9	large boulder riffles	number
10	large boulder riffles	length, weight, age
11	All habitats	pressure, harvest, species, number, length
12	Wetland habitats	Qualitatively (functional assessments); quantitatively by estimate of wetland area
13	Wetland; Upland Buffers	Wetland restoration, enhancement, creation, preservation
14	Harbor	seed bank composition; soil characters of dredged samples
15	Dunes	Plant species percent cover in 1-m2 quadrats (n=135)
16	shoreline	Low altitude photography
17	ate contaminated areas of focus for further evaluation, delinea	Metals, PCBs, PAH's in the sediment
18	inent Ecology Division (MED) laboratory.	Estimated water depths
19	thalweg, tributaries and near-shore by the tributaries	T-tube, Depth, Temperature, Conductivity, Turbidity, DO, pH, Color, Chlorophyll-a,
20	shallow flats, dredged areas, natural channels	
21	riffle/run channel areas	
22	nd invasive fish species in the St. Louis River estuary. Addition	location and cpue (fish/ha trawled)
23	wetlands	Bathym, hydrology, broad suite of water quality, sediment type, vegetation structur
24	various	Fish, zooplankton, and benthos composition (species or genus level) WQ via field

ID number	Habitats sampled	Variables measured
25	e sturgeon tracking data.	bottom depth and substrate type
26	wetlands; sheltered bays	vegetation, substraite composition, water depth
27	Sheltered Bays, Clay-Influenced River Mouths, Industrially Int	Vegetation, substrate and some macroinvertebrates
28	stream	continuous insitu stage ht, temperature, sp conductivity, turbidity. Grab samples fo
29	Littoral area	Aquatic Plants, depth, substrate type
30		Temp, DO, sp conductivity, pH, nutrients, SO4, hardness, suspended sediments, t
31		tumors/lesions
32		Frog calls
33		Benthic communities
34	shallow nearshore habitat	Point surveys of aquatic vegetation
35	GLNPO	Density of point sources, roads, population, others
36	Wetlands	Wetlands
37	Estuary and tributaries	Mussels
38	herpetofaunal habitat	rare herpetofaunal species
39	wetlands	Wetlands
40	Streams	GPS Stream Alignments
41	Beach Grass	Beach grass species
42	terrestrial	Parcels
43	river bottom	sediment
44	imagery	N/A
45	Wetlands	Wetlands
46	N/A	N/A
47	N/A	N/A
48	Coastline	N/A

ID number	Habitats sampled	Variables measured
49	Shoreland	
50	ts may contribute to the observed distribution of these compounds. The identied the extent to which pharmaceuticals, including hormones, and ot	
51	depositional environments throughout the SLRE	Approximately 83 separate compounds in water and sediment at each site.
52	Human	Parcels
53	Human	Impervious Surfaces
54	Human	Parcels
55	Human	Parcels
56	Human	Parcels
57	Human	Parcels
58	Human	City infrastructure
59	Air	Wind
60	Human	Parcels
61	Human	Parcels
62	Human	Parcels
63	Human	Parcels
64	n goals, and to assess new threats.	Discharge, temp, conc, pH, DO, nutrients, susp. sediment, toxics
65	Bathymetry	Bathymetry
66	Shoreland	Great lakes Shoreline
67	Shoreland	Shoreland
68	Shoreland	Shoreland
69	shallow embayments near tributaries	benthic macroinvertebrates
70	N/A	Aerial imagery
71	thalweg, including upriver stations above seiche influence	water quality (temp,scond, turbidity), chemistry (NOx, NH4, TN, SRP, TP,Si, cation
72	Forests	Forest Fragmentation

ID number	Habitats sampled	Variables measured
73	thalweg	DO, TSS, TP, NH4/NH3, NOx
74	shallow and channel	habitat characteristics, water and sediment chemistry, sediment toxicity, benthic m
75	Land Cover	Land Cover / Land Change
76	Land Cover	Land Cover
77		
78	Soil	Soils
79	N/A	N/A
80	f bathymetry for the river and estuary at about 8 meter pixel re	depth
81	beaches (public water access points)	fecal coliform and e. coli
82	instream	Data analysis -sediment sources
83	STREAM MOUTHS	WATER QUALITY PARAMETERS, PHYSICAL, CHEMICAL AND BIOLOGICAL PA
84	Coastal Areas, dunes, etc	Habitat Gain
85	Tributary mouth wetlands	Percent species cover of emergent and submergent plants
86	wetlands and open water	aquatic plants - presence/absence; water depth; Secchi depth; up to 3 most promi
87	wetlands, forests, many types	vegetation composition, landscape setting
88	shoreline	inorganic and organic contamiants in avian tissues; biomarker analyses including E
89	Shoreline	Fish abundance, growth, movement
90	all types in the estuary	Fish, water temperature, water depth
91	will facilitate the restoration of the economic, ecological, and c	synthesis of sediment quality data
92	, ecological, and cultural components of the Lower St. Louis R	Sediment data was analyzed across the AOC
93	River / Harbor / Lake	All Depths
94	Stream; estuary; nearshore zone	Streams: Habitat assessment; transparency; flow; DO; pH; Chorophyll a; turbidity;
95	various habitats throughout the AOC	sediment chemistry, sediment toxicity, benthic invertebrate community, and tissue

ID number	Where data was collected
1	Duluth, MN at Grassy Point
2	From Allouez Bay to 1/2 mile east of Fond du Lac in the St. Louis River.
3	Data was collected on the Little Pokegama, Pokegama, Newton Creek, Allouez bay and Bark Bay watersheds.
4	3 locations in the SLRE.1) Hwy 23 bridge2) Indian Point 3) Nemadji River
5	Bear Creek @ city limits road; Bear Creek north of Hwy 53; Bluff Creek @ City Limits Road. These streams are located in Douglas County
6	21 locations from Wisconsin Entry to just above Boy Scout Landing
7	From the Fond du Lac Hydro Station down stream to below Highway 23 Bridge
8	From Nekuk Island to Grassy Point
9	Just below Fond du Lac Dam
10	Below Fond du Lac Dam
11	Throghout estuary
12	City of Superior
13	City of Superior; Douglas County
14	Duluth-Superior Harbor
15	T49N, R13W, Section 28
16	Minnesota shoreline of the SLRE
17	The area defined as St. Louis Bay in includes 90 sample locations in:-Hibbard Power Plant Bay-Erie Pier Slip-Erie Pier Bay-Erie Pier Ponds
18	The raster surface represents the water area of the St. Louis River Estuary from the Fond du Lac dam to the harbor areas of Duluth/Superi
19	Data was collected from the MN and WI outlets up to the Highway 23 bridge.
20	sturgeon were captured from Boyscout landing to Blatnik Bridge and received external radio transmitters
21	immediately downstream of Hwy. 23 bridge
22	40 randomly selected locations stratified by depth/habitat type (i.e. shallow flats, natural river channel, and dredged channel)
23	Sampled 58 different coastal wetlands around the Great Lakes (US side of all 5 Great Lakes). Wetlands sampled within the SLRE were Al
24	Over 200 stations spanning area from Fond du Lac dam to Lake Superior. Combination of randomized point design and targeted area desi

ID number	Where data was collected
25	A river mile + / - downstream of Hwy 23 bridge, all the way downstream to include Spirit Lake. Also part of the AOC in the 40th ave West p
26	All coordinates are given in UTM Zone 15.1) Sunset Bay – area along the east shoreline. Only a few stems were observed in 2004. This ar
27	Within nearshore habititats of 12,000 acre estuary in MN and WI below FDL Dam and river mouths.
28	Kingsbury Creek at Lake Superior ZooMiller Creek at LSCDuluth Ship CanalWLSSD outflowChester Creek at St ScholasticaTischer Creek
29	Data was collected over each location named above in Superior Bay and St. Louis River, using a point intercept grid. The scale of point int
30	33 sites within the watershed
31	St Louis Harbor
32	St Louis River from Harbor to Jay Cooke State Park
33	from harbor to Cotton
34	Erie Pier / Bong Bridge
35	Basinwide for Lake Superior
36	City of Duluth
37	St. Louis Estuary and its tributaries; Cloquet, Whiteface, Swan, Paleface, Otter, and several other tributaries. (along tributaries outside of th
38	Minnesota's Lake Superior Coastal Program Boundary
39	Cloquet area wetlands
40	City of Duluth
41	Park Point Duluth, MN
42	The portion of Fond du Lac Reservation within Minnesota's Lake Superior Coastal Program Boundary.
43	St. Louis River AOC
44	the west half of Township 49 Range17, which is the area encompassed by the Fond du Lac Reservation, the City of Cloquet, and the Unive
45	Hermantown
46	NE MN
47	Minnesota's Lake Superior Coast and St. Louis Estuary
48	Park point , to pigeon point, MN

ID number	Where data was collected
49	Wisconsin Coast of Lake Superior and St. Louis Estuary
50	The sampling design include targeted samples sites in the lower St. Louis River, St. Louis Bay, and Superior Bay on the Minnesota side of
51	USGS Minnesota Water Science Center (MN WSC) sampled water and sediment from 10 locations distributed among the three zones of t
52	Midway Township
53	Minnesota's Lake Superior Watersheds
54	City of Carlton, Carlton County, MN
55	Miller and Chester Creek Watersheds
56	City of Hermantown, MN
57	City of Proctor
58	City of Carlton
59	Minnesota's North Shore of Lake Superior, and Canal Park Duluth
60	City of Duluth parcels in the Tischer and Amity Creek watersheds.
61	City of Duluth
62	Thomson Township and City of Cloquet
63	City of Duluth areas mapped included land in Fond du Lac, Gary, Morgan Park, New Duluth, Rice's Point, and Park Point.
64	USGS gage at Scanlon
65	Duluth Harbor, Park Point, Superior Harbor and Wisconsin Point
66	Duluth Harbor
67	Duluth Harbor
68	Lake Superior @ Scale of 1:75,00 and smaller
69	between Spirit Lake and Billings Park landing at 7 locations (a prior reference (3) and impaired (4) habitats)
70	St. Louis River Estuary
71	15 fixed WQ sites every other week and 9-11 ichthyoplankton sits weeklySites spanned three regions: 1) Fond du Lac through Spirit Lake,
72	Coastal Regions of the US

ID number	Where data was collected
73	23 Bridge, Oliver Bridge, Arrowhead Bridge, Blatnik (interstate) Bridge
74	St. Louis River estuary, Thomson reservoir, and Forebay canal
75	Coastal Areas of the US
76	USA
77	Mostly around the US steel site, some over a larger area.
78	St. Louis County, and Carlton County.
79	Project is in progress to date we have completed PLS Townships;T48 R16, T48 R17, T49 R14, T49 R15, T46 R16, T49 R17, T50 R14, T50
80	Across the River and estuary and across Lake Superior. All the available navigational charts for Lake Superior were processed
81	Boy Scout Landing, Clyde Avenue Landing, New Duluth Boat Club on Park Point, Hearding Island beach on Park Point, Southworth Marsh
82	Watershed wide
83	ST LOUIS RIVER AND TRIBUTARIES.
84	WI Point and other locations.
85	15 tributary mouth wetlands distributed across stress and spatially across the SLRE
86	Data were collected in the 40th Avenue West wetland complex, and in five reference areas NE of Dwight's Point, NE of Clough Island, betv
87	From Spirit Lake upstream to the Fond du Lac dam - several sites on the Minnesota side. Wetlands in the estuary and adjacent uplands.
88	Along the St. Louis River at Coffee Ground Flats, mouth of Miller Creek, and near Hog Island. Other AOCs are also being sampled.
89	Rice's Point
90	Lower St. Louis River and Estuary
91	data were integrated and synthesized from a variety of sources and formats. Where feasible, a GIS data management system was incorpo
92	Across the AOC
93	Duluth Superior Harbor, Lake Superior, Rivers
94	Watersheds: Little Pokegama, Pokegama; Lower Nemadji wetlands #1 and #2; Allouez Bay; Bois Brule River; Iron River; Flag River; Bark
95	Throughout the St. Louis River AOC and some adjoining areas sampled by the Fond du Lac Band.

ID number	Data format (electronic vs	Availability (free, for a cost et	Website link
1	Paper/hard copy	Free	http://www.d.umn.edu/~pcollins/grassy.html
2	Paper and digital	Available with permission	www.glsc.usgs.gov
3	Digital	Free	http://www.uwsuper.edu/lsri/currentprojects/streammonitoring.cfm
4	Digital	Available with permission	
5	http://www.uwex.edu/erc/w	Free	http://www.uwex.edu/erc/wavdb/
6	Digital	Free	
7	Paper/hard copy	Free	
8	Digital	Free	
9	Digital	Free	
10	Digital	Free	
11	Digital	Free	
12	Paper/hard copy	Available with permission	
13	Digital	Available with permission	
14	Digital	Available with permission	
15	Digital	Available with permission	http://www.uwsuper.edu/acaddept/naturalsciences/employees/nicholas-danz_employe
16	Digital	Free	http://gisdata.nrri.umn.edu/website/northshorephotos/viewer.htm
17	Digital	Not currently available	www.epa.gov/glla
18	Digital	Free	
19	Digital	Not currently available	
20	paper and digital	Available with permission	
21	Paper/hard copy	Available with permission	
22	paper and digital	Available with permission	
23	Digital	Available with permission	
24	Digital	Available with permission	

ID number	Data format (electronic vs	Availability (free, for a cost et	Website link
25	Digital	Available with permission	www.fdlrez.com
26	Digital	Free	
27	Paper/hard copy	Free	
28	Digital	Free	
29	Digital	Free	http://dnr.wi.gov/water/basin/superior/
30	Digital	Free	
31	Paper/hard copy	Free	
32	Paper/hard copy	Free	
33	Paper/hard copy	Free	
34	Digital	Not currently available	
35	Digital	Free	http://www.nrri.umn.edu/lsgis2/
36	Digital	Free	
37	Digital	Free	
38	Digital	Free	
39	Digital	Free	http://www.nrri.umn.edu/CoastalGIS
40	Digital	Free	
41	Digital	Free	
42	Digital	Free	
43	Digital	Free	
44	Digital	Free	
45	Digital	Free	
46	Digital	Free	http://www.mngeo.state.mn.us/chouse/airphoto/spring2009-2015.html
47	Digital	Free	http://www.dnr.state.mn.us/maps/landview.html
48	Digital	Free	http://www.dnr.state.mn.us/maps/landview.html

ID number	Data format (electronic vs	Availability (free, for a cost et	Website link
49	Digital	Free	
50	digital after 6/2011	Free	http://mn.water.usgs.gov/infodata/waterquality.html
51	digital data available after A	Free	http://mn.water.usgs.gov/infodata/waterquality.html
52	Digital	Free	
53	Digital	Free	
54	Digital	Free	
55	Digital	Free	
56	Digital	Free	
57	Digital	Free	
58	Digital	Free	http://gis.msa-ps.com/MAPS/MN/Cities/Carlton/GISviewer/viewer.htm
59	Digital	Free	
60	Digital	Free	
61	Digital	Free	
62	Digital	Free	
63	Digital	Free	
64	Digital	Not currently available	http://mn.water.usgs.gov/infodata/waterquality.html
65	Digital	Free	http://www.csc.noaa.gov/digitalcoast/data/chartstopobathy/download.html
66	Digital	Free	http://shoreline.noaa.gov/data/datasheets/index.html
67	Digital	Free	http://shoreline.noaa.gov/data/datasheets/medres.html
68	Digital	Free	http://shoreline.noaa.gov/data/datasheets/pgs.html
69	Digital	Free	
70	Both Digital and Hard Copy	Available with a cost	http://www.csc.noaa.gov/digitalcoast/data/aerialphoto/index.html
71	Digital	Available with permission	
72	Digital	Free	http://www.csc.noaa.gov/digitalcoast/data/forestfrag/download.html

ID number	Data format (electronic vs	Availability (free, for a cost et	Website link
73	raw data from Enviromappe	Available with permission	
74	Digital	Free	
75	Digital	Free	http://www.csc.noaa.gov/digitalcoast/data/ccapregional/download.html
76	Digital	Free	http://www.csc.noaa.gov/digitalcoast/data/nlcd-canopy/download.html
77	Digital	Free	
78	Digital	Free	http://soildatamart.nrcs.usda.gov/
79	Digital	Free	
80	Digital	Free	
81	Digital	Free	www.mnbeaches.org
82	Paper/hard copy	Free	www.lrcd.org
83	Digital	Free	www.stlouisriver.org
84	Database	Available with permission	
85	Digital	Available with permission	http://www.uwsuper.edu/acaddept/naturalsciences/employees/nicholas-danz_employe
86	Digital		www.nrri.umn.edu
87	Paper/hard copy	Available with permission	www.dnr.state.mn.us/eco/mcbs
88	Paper/hard copy	Not currently available	www.usgs.umesc.gov
89	Digital	Available with permission	
90	Digital	Available with permission	
91	Digital	Free	
92	Digital	Free	
93	Digital	Available with permission	www.amiengineers.com
94	Digital	Not currently available	http://www.uwsuper.edu/lsri/
95	Digital	Free	http://www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/contamina

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ID number	Name of the project or dataset
1	Grassy Point Subsurface data
2	SLR Fish Community
3	Lake Superior Coastal Wetland and Stream Monitoring Project
4	Great Lakes Case Study
5	Lake Superior Water Action Volunteers
6	Summer experimental gillnet index
7	Spring Spawning Walleye Electrofishing Index
8	Fall YOY Muskellunge Electrofishing Assessment
9	Spring Spawning Lake Sturgeon Observations
10	Lake Sturgeon Taggin
11	Angler Creel Survey of St. Louis River Estuary
12	City of Superior Special Area Management Plan
13	City of Superior Mitigation Banking Document
14	Predicting vegetation from wetlands created from dredged material in the Duluth-Superior Harbors
15	Fifty years of vegetation change on Wisconsin Point
16	Oblique aerial photography
17	St. Louis Bay 2010 Sampling
18	St. Louis River Estuary Bathymetry
19	Stressor Gradients and Spatial Narratives of the St. Louis River Estuary
20	Juvenile Sturgeon telemetry
21	Monitoring for larval sturgeon production
22	Monitoring Native and Invasive Fish Communities with Bottom Trawling
23	Great Lakes coastal wetlands
24	Invasive species detection research

ID number	Name of the project or dataset
25	SLR Substrate Type data
26	Lower St. Louis River Wild Rice Restoration
27	Field Truthing and Vegetation Assessment of NRRI-GLEI Reference Sites for Near Shore Ecotypes in the SLR -AOC (2007-2008)
28	LakeSuperiorStreams.org
29	St. Louis R Estuary Aquatic Plant Assesment
30	SWA-SLR
31	Liver Watch
32	Frog Watch
33	St Louis River Watch
34	40th Ave West Remediation Site
35	SumRel Environmental Stressors
36	Duluth Wetland Iventory and Evaluation
37	Lake Superior Drainage Mussel Survey: Distribution and Abundance of Unionids and Zebra Mussels
38	Rare Herpetofauna And Important Seasonal Ponds Within The Minnesota Lake Superior Coastal Region
39	Wetland Inventory and Classification for Carlton and South St. Louis Counties
40	Field Identification and Mapping of Duluth Trout Stream Tributaries
41	The risk to native Minnesota beach grass posed by historical restoration efforts that used Michigan plants
42	Parcel GIS layer for the area encompassed by Fond du Lac Reservation and the City of Cloquet
43	Phase III GIS-based Sediment Quality Database for the St. Louis River Area of Concern (AOC)—Minnesota Focus
44	Low-level leaf off aerial photography
45	Hermantown Wetland Inventory
46	Spring Aerial Imagery of Northeast Minnesota: May 2009
47	2007 Coastal Oblique Imagery
48	20027 Coastal Oblique Imagery

ID number	Name of the project or dataset
49	2007 Oblique Imagery of Wisconsin's St. Louis Estuary
50	2010 Endocrine-active Compounds sampling
51	Endocrine-active and pharmaceutical compounds in the SLRE
52	Midway Township Parcel Layer
53	Coastal Area Imperviousness Assessment and Education
54	City of Carlton GIS Parcel Mapping Project
55	Parcel Mapping of Chester Creek and Miller Creek Watersheds
56	Parcel Layer Development for the City of Hermantown
57	Parcel Layer Development for the City of Proctor
58	City of Carlton – Utility Mapping Project
59	Wind Resource Development in the Minnesota Coastal Zone
60	Duluth Digital Plat & Parcel Development for Lake Superior Watershed Protection
61	Duluth Digital Plat & Parcel Development for Lake Superior Watershed Protection
62	Thomson Township and the City of Cloquet Parcel Layer Mapping Projec
63	Duluth Digital Plat & Parcel Development for Lake Superior Watershed Protection
64	GLRI Tributary Water Quality threat assessment
65	United States Army Corps of Engineers Topo/Bathy Mapping
66	NOAA National Shoreline
67	NOAA Medium Resolution Shoreline
68	Prototype Global Shoreline Data
69	Benthic Macroinvertebrate Survey of the St. Louis River Estuary in the Vicinity of the US Steel and Interlake Tar Superfund Sites
70	National Geodetic Survey aerial imagery
71	SLR larval fish
72	C-CAP Forest Fragmentation Data

ID number	Name of the project or dataset
73	water quality trends
74	REMAP
75	C-CAP Land Cover
76	NLCD Percent Canopy Closure Surface
77	Scanned aerial photos of SLR
78	NRCS Soil Data Access
79	Georeferenced Original Public Land Survey Maps in the Coastal Area
80	High Resolution Bathymetry
81	Lake Superior Beach Monitoring and Notification Program
82	Nemadji River Basin Project
83	CITIZEN STREAM MONITORING
84	SLR Habitat Plan / Piping Plover Habitat Restoration
85	Stressor Gradients and Spatial Narratives of the SLRE -- Wetland Vegetation
86	40th Avenue West Remediation and Restoration
87	Minnesota County Biological Survey (MCBS)
88	GLRI - Birds as Indicators
89	Duluth-Superior Round Goby
90	AIS Early Detection and Monitoring
91	Draft SLR AOC Sediment Quality Management Plan
92	St. Louis River AOC Sediment Management Plan Sept 2005
93	General Harbor Information
94	Implementing WDNR's Lake Superior Nearshore Monitoring Program
95	Phase IV GIS-based Sediment Quality Database for the St. Louis River AOC