PROCEEDINGS OF THE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

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PROCEEDINGS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

VOLUME 35

MISSISSIPI RIVER RESEARCH CONSORTIUM, INC.

34th ANNUAL MEETING
24-25 APRIL 2003
RADISSON HOTEL
LA CROSSE, WISCONSIN

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PLATFORM PROGRAM
HOTEL BALLROOM A
THURSDAY, APRIL 24, 2003

8:00 - 8:10 AM Welcome and Announcements
Jeff Arnold, MRRC President

SESSION I – WATER QUALITY AND HYDROLOGY (Moderator: John Chick)

8:10 – 8:30 AM A SATELLITE-BASED ASSESSMENT OF THE 2001 FLOOD EVENT FOR LA CROSSE, WI. **Cynthia J. Berlin**. Department of Geography and Earth Science and River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

8:30 – 8:50 AM MATHEMATICAL MODELING FOR ARTIFICIAL ISLAND CONSTRUCTION WITHIN THE LOWER PEORIA LAKE. **Nani G. Bhowmik.** Watershed Science Section, Illinois State Water Survey, Champaign, IL 61820.

8:50 – 9:10 AM TWELVE YEARS OF WATER QUALITY TRENDS IN POOL 26 OF THE UPPER MISSISSIPPI RIVER. **Lori Soeken-Gittinger** and John H. Chick. Illinois Natural History Survey, Great Rivers Field Station, Brighton, IL 62012.

SESSION II – VEGETATION (Moderator: John Chick)

9:10 – 9:30 AM DETECTING AND PROTECTING WILD RICE (*ZIZANIA AQUATICA* L.) IN THE UPPER MISSISSIPPI SYSTEM (UMRS) –1975, 1989-2001. **J. Therese Dukerschein.** Wisconsin Department of Natural Resources Long Term Resource Monitoring Program (WDNR/LTRMP) Field Station, 575 Lester Avenue, Onalaska, Wisconsin 54650.

9:30 – 9:50 AM AQUATIC PLANT GROWTH MODEL REFINEMENT FOR THE UPPER MISSISSIPPI RIVER-ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY. **Elly P. H. Best[1]**, Gregory A. Kiker[1], Beth A. Rycyzyn[1], Kevin Kenow[2], Jim Fischer[3], Shyam K. Nair[4], and Dan B. Wilcox.[5] [1] U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, MS 39180, [2] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602, [3] Wisconsin Dept. Natural Resources, Upper Midwest Environmental Sciences Center, Onalaska, WI 54650, [4] The Cadmus Group, Inc., Oak Ridge, TN 37830, [5] U.S. Army Corps of Engineers, St. Paul District, St. Paul, MN 55101.

9:50 – 10:10 AM **BREAK**

SESSION II – VEGETATION *cont.* (Moderator: Sean Jenkins)

10:10 – 10:30 AM SUBMERSED AQUATIC VEGETATION [WILDCELERY (*VALLISNERIA AMERICANA)* AND SAGO PONDWEED (*POTAMAGETON PECTINATUS*)] RE-ESTABLISHMENT EFFORTS IN LAKE CHAUTAUQUA, ILLINOIS RIVER. **Thad R. Cook** and Mark A. Pegg. Illinois Natural History Survey, Illinois River Biological Station, Long Term Resource Monitoring Program, 704 North Schrader Ave., Havana, IL 62644.

10:30 – 10:50 AM SPATIAL AND TEMPORAL DYNAMICS BETWEEN OVERSTORY STRUCTURE AND GROUND FLORA DIVERSITY OF TWO LIMESTONE GLADES IN PIKE COUNTY, ILLINOIS. **Michael J. C. Murphy** and Sean E. Jenkins. Department of Biological Sciences, Western Illinois University, Waggoner Hall, 1 University Circle, Macomb, IL 61455.

10:50 – 11:10 AM PREDICTING SEED/SEEDLING DYNAMICS: THE NON-TAROT CARD APPROACH. **Robert Cosgriff**[1], Yao Yin[2], Theresa Blackburn[3], Thad Cook[4], Heidi Langrehr[5], and Megan Moore[6]. [1]Great Rivers Field Station, Illinois Natural History Survey, 8450 Montclair Avenue, Brighton, IL 62012, [2]USGS, Upper Midwest Environmental Sciences Center, 575 Lester Avenue, Onalaska, WI 54650, [3]Iowa Department of Natural Resources, Mississippi River Monitoring Station, 206 Rose Street, Bellevue, Iowa 52031, [4]Illinois River Biological Station, Illinois Natural History Survey, 704 North Schrader Avenue, Havana, IL 62644, [5]Wisconsin Department of Natural Resources, Onalaska Field Station, 575 Lester Avenue, Onalaska, WI 54650, [6]Minnesota Department of Natural Resources, Lake City Field Station, 1801 South Oak Street, Lake City, MN 55041.

11:10 – 11:30 AM PHYSICAL AND CHEMICAL INFLUENCES ON THE DISTRIBUTION AND ABUNDANCE OF *VALLISNERIA AMERICANA* MICHX. **Rebecca M. Kreiling** [1], Yao Yin [2], Daniel T. Gerber [1], and Abdulaziz Elfessi [1]. [1]University of Wisconsin-La Crosse, La Crosse, WI 54601, [2]U.S. Geological Survey, Upper Midwest Environmental Services Center, La Crosse, WI 54603.

11:30 – 11:50 AM FOREST COMMUNITIES OF A HYDROLOGICALLY MODIFIED FLOODPLAIN ALONG THE LOWER KASKASKIA RIVER. **Susan P. Romano**[1,2] , James J. Zaczek[1], Sara G. Baer[1], and Karl W. J. Williard[1]. [1]Department of Forestry, Southern Illinois University, Carbondale, IL 62901-4411, [2]Department of Plant Biology, Southern Illinois University, Carbondale, IL 62901-6509.

11:50 AM– 1:00 PM **LUNCH** (on your own)

SESSION III – BIRDS (Moderator: Megan Moore)

1:00 – 1:20 PM BALD EAGLE NEST SITE SELECTION AND PRODUCTIVITY RELATED TO HABITAT FEATURES. **Jeremy E. Guinn** and James W. Grier. Department of Zoology, North Dakota State University, Fargo, North Dakota 58105.

1:20 – 1:40 PM REPRODUCTIVE SUCCESS AND TERRITORY RE-OCCUPATION RATES FOR RED-SHOULDERED HAWK (BUTEO LINEATUS) WITHIN THE MILAN BOTTOMS. **Jon W. Stravers**[1], Kelly J. McKay[2] , and Gary Swenson[3]. [1]National Audubon Society, Upper Mississippi River Campaign, McGregor, IA 52157, [2]Midwest Raptor Research Fund, Hampton, IL, [3]U.S. Army Corps of Engineers Natural Resources Management Section, Rock Island District.

1:40 – 2:00 PM BREEDING BIRDS OF YOUNG FLOODPLAIN FORESTS GROWING ON ABANDONED AGRICULTURAL LAND. **Melinda G. Knutson**, and Laura E. McColl. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

2:00 – 2:20 PM SPATIALLY-EXPLICIT HIERARCHICAL MODELS OF ANIMAL COUNTS. **Wayne E. Thogmartin**[1], Melinda G. Knutson[1], and John R. Sauer[2]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602,
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD 20708.

2:20 – 2:40 PM GENE FLOW IN THE ILLINOIS POPULATION OF WILD TURKEY, AN INVESTIGATION USING MTDNA. **Jessica L. Petersen** and Michael A. Romano. Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

2:40 – 3:00 PM **BREAK**

SESSION IV – NATIVE BIVALVES (Moderator: Mark Pegg)

3:00 – 3:20 PM SIMPLE STOCHASTIC MODELS TO EXPLAIN POPULATIONS OF THE FINGERNAIL CLAM, *MUSCULIUM TRANSVERSUM.* **Jim Eckblad.** Department of Biology, Luther College, Decorah, Iowa 52101.

3:20 – 3:40 PM WHY IS THE MUSSEL FAUNA DIFFERENT AROUND THE CORNER FROM THE ST. CROIX? RECOVERY OF THE UNIONID FAUNA IN MISSISSIPPI RIVER MARGINAL HABITAT, LOWER POOL 2, MINNESOTA. **Marian E. Havlik.** Malacological Consultants, 1603 Mississippi Street, La Crosse, WI 54601-4969. havlikme@aol.com (608-782-7958).

3:40 – 4:00 PM HABITAT SUITABILITY ANALYSIS FOR MUSSELS IN THE MISSISSIPPI RIVER. Yenory Morales[1], **Larry J. Weber**[1], and Arthur Mynett[2]. [1] IIHR Hydroscience and Engineering, University of Iowa, Iowa City, IA 52242-1585, [2] WL | Delft Hydraulics, Rotterdamseweg 185, 2629 HD Delft, The Netherlands.

4:00 – 4:20 PM THREE-DIMENSIONAL HYDRODYNAMIC SIMULATIONS OF THE MISSISSIPPI RIVER – POOL 16. **Andrew McCoy**, Larry Weber, Yong G. Lai, and Tatsuaki Nakato. Civil & Environmental Engineering, IIHR-Hydroscience and Engineering, University of Iowa, 300 S. Riverside Dr., Iowa City, IA, 52242-1585.

4:20 – 4:40 PM HYDRODYNAMIC CHARACTERIZATION OF FRESHWATER MUSSEL HABITATS IN THE UPPER MISSISSIPPI RIVER. **Nathan Young,** Larry Weber, and Tatsuaki Nakato. IIHR – Hydroscience & Engineering, Department of Civil & Environmental Engineering, The University of Iowa, Iowa City, IA, 52242.

5:00 – 6:00 PM **POSTERS**

6:30 – 8:00 PM **BANQUET**

PLATFORM PROGRAM
HOTEL BALLROOM A
FRIDAY, APRIL 25, 2003

SESSION V – FISH (Moderator: Brent Knight)

8:00 – 8:20 AM SUSTAINED HIGH WATER ON THE MISSISSIPPI RIVER: INFUENCES ON FISH ASSEMBLAGES IN COLDWATER TRIBUTARIES. **Neal D. Mundahl.** Department of Biology, Winona State University, Winona, MN 55987.

8:20 – 8:40 AM CHANNEL CATFISH AS POTENTIAL SEED DISPERSAL AGENTS FOR RED MULBERRY AND SWAMP PRIVET IN THE MISSISSIPPI RIVER. **John H. Chick**, Robert J. Cosgriff, and Lori S. Gittinger. Illinois Natural History Survey, Great Rivers Field Station, 8450 Montclair Ave., Brighton, IL 62012.

8:40 – 9:00 AM HIGHLIGHTS FROM 14 YEARS OF FISH MONITORING ON POOL 26 OF THE MISSISSIPPI RIVER. **Eric N. Ratcliff**, Eric J Gittinger, and John H. Chick. Great Rivers Field Station, Illinois Natural History Survey, 8450 Montclair Avenue, Brighton, IL 62012.

9:00 – 9:20 AM COMPARING COMMERCIAL HARVEST AND LONG-TERM MONITORING TRENDS OF FISHES IN POOL 26 OF THE MISSISSIPPI RIVER. **Eric J. Gittinger[1]**, Eric N. Ratcliff[1], John H. Chick[1] and Rob J. Maher[2]. [1]Great Rivers Field Station, Illinois Natural History Survey, 8450 Montclair Ave, Brighton, IL 62012, [2] Illinois Department of Natural Resources, 8450 Montclair Ave, Brighton, IL 62012.

9:20 – 9:40 AM EVALUATION OF A BARRIER TO PREVENT TRANSFERS OF HARMFUL AQUATIC SPECIES BETWEEN THE MISSISSIPPI AND GREAT LAKES BASINS. **Traci L. Barkley[1],** Richard E. Sparks [1], John M. Dettmers [2]. [1]University of Illinois, Natural Resources and Environmental Science, Urbana, IL 61801, [2]Illinois Natural History Survey, Lake Michigan Biological Station, Zion, IL, 60099.

9:40 – 10:00 AM EMP BIORESPONSE MONITORING SUMMARY: LAKE CHAUTAUQUA 1991-2002. **Kevin S. Irons**, T. Matt O'Hara, Michael A. McClelland, and Mark A. Pegg. Illinois Natural History Survey, Illinois River Biological Station, 704 N. Schrader Ave. Havana, IL 62644.

10:00 – 10:20 AM **BREAK, MIDDLE & HIGH SCHOOL STUDENT POSTERS**

SESSION V – FISH *cont*. (Moderator: Heidi A. Langrehr)

10:20 – 10:40 AM FISH RESPONSE TO EMERGENT VEGETATION PRODUCTION IN BACKWATERS OF MISSISSIPPI RIVER POOL 25: AN EVALUATION OF ENVIRONMENTAL POOL MANAGEMENT. **S. Reid Adams**[1,2], James E. Garvey[1,2], Michael B. Flinn[2], Brooks M. Burr[2], Matt R. Whiles[2], and Robert J. Sheehan[1,2]. [1]Fisheries and Illinois Aquaculture Center, Southern Illinois University, Carbondale, IL 62901, [2]Department of Zoology, Southern Illinois University, Carbondale, IL 62901.

SESSION VI – AQUATIC INVERTEBRATES (Moderator: Heidi A. Langrehr)

10:40 – 11:00 AM AQUATIC MACROINVERTEBRATE RESPONSES TO ENVIRONMENTAL POOL MANAGEMENT AND EMERGENT VEGETATION IN BACKWATERS OF MISSISSIPPI RIVER POOL 25. **Michael B. Flinn[1]**, Matt R. Whiles[1], S. Reid Adams[1,2]. [1]Department of Zoology, Southern Illinois University, Carbondale, IL 62901, [2]Fisheries and Illinois Aquaculture Center, Southern Illinois University, Carbondale, IL 62901.

11:00 – 11:20 AM INTERACTIONS BETWEEN THE HYDROID *CORDYLOPHORA SP.* AND THE ZEBRA MUSSEL *DREISSENA POLYMORPHA* IN TWO MIDWEST RIVERS. **Emily Thorn[1], Laura Page[1],** Nadine C. Folino-Rorem[1], Jim Stoeckel [2], Chris Flinn[1]. [1]Biology Department, Wheaton College, Wheaton, IL 60187, [2]Illinois River Biological Station, INHS, Havana, IL 62644.

11:20 – 11:40 AM SPATIAL AND TEMPORAL DIFFERENCES IN TRANSPORT OF MACRO AND MICROZOOPLANKTON IN THE SCHOOLCRAFT LAKE-RIVER SYSTEM. **Debbie L. Guelda** and Erich Westrich. Department of Biology, Bemidji State University. Bemidji, MN 56601.

11:40 – 12:00 PM **MIDDLE & HIGH SCHOOL STUDENT POSTERS**

12:00 – 1:30 PM **LUNCH, BUSINESS MEETING AND RAFFLE**

1:30 PM **ADJOURN**

NOTES

NOTES

POSTER PRESENTATIONS
THURSDAY, APRIL 24, 2003, 10:00 AM – 6:00 PM
Authors Present 5:00 – 6:00 PM
(Listing by topic)

AQUATIC INVERTEBRATES

1) RAREFACTION ANALYSIS TO DETERMINE SUB-SAMPLING EFFORT FOR ESTIMATING CHIRONOMID DIVERSITY IN MINNESOTA FARM PONDS. **Benjamin D. Campbell**[1], Roger J. Haro[1], Melinda G. Knutson[2], and William B. Richardson[2]. [1]Rivers Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601, [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54601.

2) EFFECTS OF ZEBRA MUSSEL INFESTATION ON GENETIC DIVERSITY OF NATIVE MUSSEL SPECIES. **Jason E. Granberg**, Michael A. Romano, Richard V. Anderson. Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

3) A COMPARISON OF MACROINVERTEBRATES AS FACTORS IN DETERMINING BIOLOGICAL INTEGRITY: AN INDEX OF WATER QUALITY FOR MULTIPLE STREAMS. **Byron Karns**[1], Marcey Westrick[2], Leonard Ferrington[3]. [1]St. Croix National Scenic Riverway, National Park Service, P.O. Box 708, St. Croix Falls, WI 54024, [2]Emmons & Olivier Resources, 651 Hale Ave. N. Oakdale, MN 55128, [3]University of Minnesota, 306 Hodson Hall, 1980 Folwell Ave., St. Paul, MN 55108.

4) HABITAT PREFERENCE AND GROWTH OF THE GLASS SHRIMP (*PALAEMONETES KADIAKENSIS*) IN THE UPPER MISSISSIPPI RIVER, DUBUQUE COUNTY, IOWA, AND VERNON COUNTY, WISCONSIN. **Amy Waterman,** Shelly Klein, Rebecca Rogis, and Daniel Call. Environmental Science Program, University of Dubuque, Dubuque, IA 52001.

VEGETATION

5) QUANTITATIVE SELECTION OF A SPECIES LIST FOR REVEGETATION OF REED CANARYGRASS COMMUNITIES. **Jessica A. Bolwahn**, Craig A. Annen, and Robin W. Tyser. River Studies Center and Department of Biology, University of Wisconsin-La Crosse, La Crosse, WI 54601.

6) VEGETATION RESPONSE TO A DEMONSTRATION DRAWDOWN ON POOL 8 OF THE UPPER MISSISSIPPI RIVER. **Kevin P. Kenow**, James E. Lyon, Randy K. Hines, and Larry R. Robinson. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

7) CHANGES IN AQUATIC VEGETATION BETWEEN 1975, 1991, AND 2002 NEAR STODDARD, WI, POOL 8, UPPER MISSISSIPPI RIVER SYSTEM. **Heidi A. Langrehr.** Wisconsin Department of Natural Resources, Onalaska Field Station, Onalaska, WI 54650.

8) EFFECTS OF REED CANARY GRASS (*PHALARIS ARUNDINACEA*) ON TERRESTRIAL ARTHROPOD ABUNDANCE, BIOMASS, AND DIVERSITY IN UPPER MIDWESTERN RIPARIAN WET MEADOWS. **Melissa S. Meier[1, 2],** Eileen M. Kirsch[1], and Robin Tyser[2]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603, [2]University of Wisconsin-La Crosse, La Crosse, WI 54601.

BIRDS

9) TUNDRA SWAN RESEARCH NEEDS ON THE UPPER MISSISSIPPI RIVER. **Kevin P. Kenow[1]**, James M. Nissen[2], Robert Drieslein[3], Erik M. Thorson[4]. [1]U. S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603, [2]U. S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge, Onalaska, WI 54650, [3]U. S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge, Winona, MN 55987, [4]Minnesota Department of Natural Resources, Division of Wildlife, Park Rapids, MN 56470.

10) BOOTSTRAPPING TO CREATE NON-PARAMETRIC CONFIDENCE INTERVALS FOR SELECTION RATIOS OF FEEDING SITES OF GREAT BLUE HERONS ON THE UPPER MISSISSIPPI RIVER SYSTEM. **Sarah Timm[1]**, Christine Custer[1,2], Douglas Olsen[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Science Center, 575 Lester Avenue, Onalaska, WI 54650, [2]U.S. Geological Survey, Upper Midwest Environmental Science Center, 2630 Fanta Reed Road, La Crosse, WI 54603.

11) A REGIONAL WETNESS INDEX MODEL, WITH APPLICATION TO MAPPING AVIAN HABITAT ASSOCIATIONS. Tim J. Fox, **Wayne E. Thogmartin**, and Melinda G. Knutson. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

12) WEB-BASED APPLICATIONS SUPPORT BIRD CONSERVATION PLANNING. **Shawn E. Weick[1]**, Timothy J. Fox[1], J.C. Nelson[1,3], John C. Sauer[2], Wayne E. Thogmartin[1], Melinda G. Knutson[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603. [2]U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, Maryland 20708-4039. [3]University of Wisconsin-La Crosse, River Studies Center, La Crosse, WI 54601.

FISH

13) RELATIONSHIPS BETWEEN FISH COMMUNITIES, HABITAT TYPES, AND ENVIRONMENTAL GRADIENTS IN THE UNIMPOUNDED MISSISSIPPI RIVER. V.A. Barko[1], M.W. Palmer[2], D.P. Herzog[1], and **R.A. Hrabik[1].** [1]Missouri Department of Conservation, Science Division, Open River Field Station, Jackson, MO 63755, [2]Department of Botany, Oklahoma State University, Stillwater, OK 74078.

WATER QUALITY

14) NITROGEN CYCLING DURING SEDIMENT DESICCATION AND REWETTING IN THE UPPER MISSISSIPPI RIVER, NAVIGATION POOL 8. **Jennifer C. Cavanaugh**, Eric A. Strauss, Lynn A. Bartsch, William B. Richardson, and Dave M. Soballe. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, Wisconsin 54603.

15) LONG-TERM WATER TEMPERATURE MONITORING ON THE ST. CROIX NATIONAL SCENIC RIVERWAY. **Randy Ferrin** and Byron Karns. St. Croix National Scenic Riverway, National Park Service, P.O. Box 708, 401 Hamilton St., St. Croix Falls, WI 54024.

16) FACTORS INFLUENCING SPATIAL VARIATION IN NITROGEN FIXATION. **Carolyn M. Lipke**, Lynn A. Bartsch, Eric A. Strauss, Willliam B. Richardson and Jennifer C. Cavanaugh. Upper Midwest Environmental Sciences Center, U.S. Geological Survey, 2630 Fanta Reed Rd., La Crosse, Wisconsin 54603, USA.

17) STABLE ISOTOPES AS A SEDIMENT FINGERPRINTING TECHNIQUE. **Thanos N Papanicolaou** and James F Fox. IIHR-Hydroscience and Engineering, University of Iowa, Iowa City, IA 52242.

RESEARCH AND MANAGEMENT

18) COMMUNICATING SCIENTIFIC RESULTS USING MULTIMEDIA VIDEOS. **Andrew J. Kimball**, Shawn E. Weick, and Melinda G. Knutson. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

19) DECISION SUPPORT SYSTEM FOR AQUATIC RESOURCES IN THE MIDDLE MISSISSIPPI RIVER**. Steven J. Zigler**[1], Jason Rohweder[2], and Robert A. Hrabik[3]. [1] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, Wisconsin 54603, [2] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 575 Lester Ave, Onalaska, Wisconsin 54650, [3] Missouri Department of Conservation, Fisheries Research, Assessment, and Monitoring Section, Open River Field Station, 3815 East Jackson Boulevard, Jackson, Missouri.

NOTES

FISH RESPONSE TO EMERGENT VEGETATION PRODUCTION IN BACKWATERS OF MISSISSIPPI RIVER POOL 25: AN EVALUATION OF ENVIRONMENTAL POOL MANAGEMENT.

S. Reid Adams[1,2], James E. Garvey[1,2], Michael B. Flinn[2], Brooks M. Burr[2], Matt R. Whiles[2], and Robert J. Sheehan[1,2, 1]Fisheries and Illinois Aquaculture Center, Southern Illinois University, Carbondale, IL 62901, [2]Department of Zoology, Southern Illinois University, Carbondale, IL 62901

The St. Louis District of the U.S. Army Corps of Engineers implemented Environmental Pool Management (EPM) in 1994 on Mississippi River Pools 24, 25, and 26. The operational goal of EPM is to maintain relatively low, stable water levels in the lower portion of the pools, following maximum drawdown in the spring, in order to better simulate a natural hydrograph without inhibiting commercial navigation. When possible, water levels are held up to 2.0 feet below the target pool elevation at the lock and dam for at least 30 days. Previous investigations of mudflats exposed via EPM showed substantial production of emergent vegetation consisting primarily of millet, chufa, and smartweeds; however, little data exist evaluating the response of other biota to EPM. From 1999-2002, we studied the fish response to EPM by examining fish use of recently flooded vegetation in the fall. Paired study plots (400 m^2), one vegetated and one experimentally devegetated prior to reflood, were established at four sites in lower Pool 25. Sites represented a range of contiguous backwater types (e.g., island slough, island tip, and shallow bay). Fish were collected on multiple trips each fall with 1-m^2 pop nets (first year only) and with a 3.7-m seine (1.6-mm mesh).

Data collection corresponded to three very different drawdown regimes, resulting in variable vegetation responses: 1999 (high vegetation production), 2000 (little to no vegetation production), and 2001 (moderate vegetation production). A total of 41,065 fish, including 24 species, were collected in the backwater habitats. Four species had higher ($p<0.05$) or marginally higher ($p<0.10$) abundance in vegetated plots (spotfin shiner, common carp, bullhead minnow, and western mosquitofish), and only the emerald shiner was more abundant in devegetated plots. Significantly ($p<0.05$) more individuals of spotfin shiner, channel shiner, and western mosquitofish < 20 mm were collected in vegetated plots in 1999, indicating the vegetation was providing nursery habitat for these late season spawners. In 1999, some vegetated plots had very low dissolved oxygen values (< 3.0 mg/l), and were dominated numerically by western mosquitofish and common carp. Not surprisingly, fish assemblages between study plots in 2000 were very similar (Percent Similarity Index = 0.75), as there was no structural difference between plots. Higher, stable water levels in the summer of 2000 resulted in a dramatic (9-fold) increase in abundance of YOY orangespotted sunfish and bluegill. In 2001, sunfish abundance remained high, the vegetation provided nursery habitat for late season spawning fishes, and chronically low dissolved oxygen was not found. Our data suggest the fish response to EPM will vary depending on vegetation characteristics, summer hydrology, and location. We observed positive responses by fish in all three years, however, the drawdown regime resulting in moderate vegetation production (2001) tended to provide the most benefits.

Key Words: Mississippi River, Environmental Pool Management, fish, vegetation, nursery habitat

EVALUATION OF A BARRIER TO PREVENT TRANSFERS OF HARMFUL AQUATIC SPECIES BETWEEN THE MISSISSIPPI AND GREAT LAKES BASINS.

Traci L. Barkley [1], Richard E. Sparks [1], John M. Dettmers [2]
[1]University of Illinois, Natural Resources and Environmental Science, Urbana, IL 61801,
[2]Illinois Natural History Survey, Lake Michigan Biological Station, Zion, IL, 60099.

The Chicago Sanitary and Ship Canal, located in northeastern Illinois, links two of the largest drainage basins in North America: the Mississippi and the Great Lakes-St. Lawrence and has become a gateway for the transfer of aquatic nuisance species between the two basins. Nuisance organisms that have moved through the canal from Lake Michigan to the Mississippi drainage in the past decade include the zebra mussel (*Dreissena polymorpha*) and the round goby (*Neogobius melanostomus*). Other nonindigenous fish are poised to enter the Mississippi River Basin by way of the canal, such as the European river ruffe (*Gymnocephalus cernuus*). The ruffe is a small, spiny fish that is neither a desirable forage item for other fishes, nor a commercial or sport species and is likely to compete with highly-valued species. The ruffe entered northern Lake Michigan in September 2002 and will eventually work its way south along the shoreline to Chicago and the canal system. Kolar and Lodge (2002), using a modeling approach to assess risk to the Great Lakes from potential unintentional ballast water introductions from the Ponto-Caspian region, predict five more fishes will become nuisance species. Currently moving in the opposite direction, two Asian fishes, the bighead carp (*Hypophthalmichthys nobilis*) and the silver carp (*Hypophthalmichthys molitrix*) are rapidly approaching Lake Michigan via the canal. An electric dispersal barrier was constructed by the U.S. Army Corps of Engineers in the canal and activated 9 April 2002. It provides an opportunity for rapid assessment and development of barrier technology. Because the barrier is experimental, its performance needs to be assessed promptly to optimize field strength, configuration, and the electric pulse rate *before* the impending arrival of the Asian carps and the European ruffe. A combined radio and acoustic telemetry system tracks movements of fish, implanted with transmitters, in the vicinity of the barrier. The transmitters emit coded sonic and radio signals so individual fish can be identified and movements from one side of the barrier to the other can be detected. Barge traffic and high flow events, which may affect the electric field and the movement of fish, are monitored with a web-accessible video camera, hydrophones, and several U.S. Geological Survey acoustic velocity meters mounted just downstream of the barrier. If any tagged fish move through the barrier, barrier operators will be notified and the microprocessor-controlled electric field can be modified. Each modification of the electric field is tested by the introduction and tracking of tagged fish. Once proven in the field, this electric barrier technology could be used to retard or prevent invasions of unwanted fishes, not only in the Chicago Sanitary and Ship Canal, but wherever there are interbasin connections.

Keywords: aquatic nuisance species, Chicago Sanitary and Ship Canal, dispersal barrier, monitoring, telemetry.

A SATELLITE-BASED ASSESSMENT OF THE 2001 FLOOD EVENT FOR LA CROSSE, WI.

Cynthia J. Berlin.
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This research examines the spatial extent of the Spring 2001 flood event for the La Crosse, Wisconsin region using satellite images. The 2001 flood was the third highest in recorded history for the La Crosse area and provides an excellent opportunity for assessing the utility of satellite imagery in flood research. The Landsat Enhanced Thematic Mapper (ETM) satellite passed over this region on April 18, 2001, the day the flood peaked in La Crosse. Atmospheric conditions were extremely favorable for satellite observation, with cloud-free skies and low aerosol interference.

The two April 18, 2001 ETM images that cover the La Crosse area were compared to Landsat TM images from September 18, 1984 and May 19, 1992. Comparatively, the 1984 and 1992 dates represent lower and higher Mississippi River water level conditions. The images were subsetted to include the City of La Crosse and nearby communities along the Mississippi River and then classified using a multi-step, "cluster-busting" unsupervised classification approach. For the analysis, land cover/use classes were reduced to three major categories: open water (includes flooded areas for 2001), non-developed lowlands (primarily wetlands), and other land areas (includes all urbanized areas as well as agricultural and non-developed upland areas). The results indicate that although there was slightly more non-developed lowland area and less open water in 1984 than 1992, statistically they are not significantly different. Using either the 1984 or 1992 image classification as representing non-flood conditions, the 2001 flood covered 100% of the areas classified as non-developed lowlands but only 0.42% of the areas classified as other land areas. A matrix analysis of the classified images suggests that of these flooded areas, over 90% are urbanized floodplain areas. This study represents an initial investigation into the utility of satellite images in flood research. A more comprehensive study that includes aerial photography and ground-based data along with satellite images is scheduled for Spring/Summer 2003. Ground observations obtained at the time of a satellite fly-over for non-flood conditions (assuming a flood does not occur this Spring or Summer) will be combined with ground-based data and aerial photography available for the 2001 flood event.

Keywords: 2001 flood, Landsat, remote sensing, La Crosse, Mississippi River

AQUATIC PLANT GROWTH MODEL REFINEMENT FOR THE UPPER MISSISSIPPI RIVER-ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY.

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Simulation models have been developed for two submersed plant species, reproducing vegetatively through tubers. These species, Sago pondweed -a canopy former- and American wildcelery -a non-canopy former, represent the characteristic life forms of submersed aquatic vegetation in the Upper Mississippi River System. The models are based on carbon flow through a vegetation occupying one m^2 water column. They take effects of changes in (1) water depth, (2) shading by seston, (3) self-shading, and (4) temperature on plant biomass formation into account. The models have been validated using field data sets from The Netherlands, California, and India.

For application to the UMR System the models were expanded with equations accounting for effects of current velocity and shading by epiphyton. Calibration data for these effects were derived from new pertinent field data collected in 2002. The effects of current velocity on plant biomass of American wildcelery were quantified in a study on the Red Cedar River, WI. The potential shading effects of epiphyton on Sago pondweed and Wildcelery plants were quantified using plant samples from UMR-Pool 8. A new field data set composed by data on shoot biomass of both species and environmental factors, collected at selected sites in UMR Pool 8 and Pool 13
in 2001 and 2002, was used for model validation.

Output generated by the refined plant growth models agreed largely with the measured data, in that the model output generated for several sites in Pool 8 was within the range of the measured data. Simulated plant development was slightly delayed compared to local plant development. Both increased current velocity and shading by epiphyton decrease plant biomass. The combined effect is expected to be highest at sites with a high current velocity. Current velocities $\geq$ 0.9 m s^{-1} prevent growth of both species. Plant density in established vegetations of both plant species, to which the default model input values pertain, is relatively constant. In one-year runs, simulated plant biomass is sensitive to initial values on tuber density and size, which may deviate from the default values. Simulated biomass from runs started from default tuber density/tuber size consistently overpredicted measured plant biomass of Sago pondweed, leading us to believe that in UMR-Pool 8 this vegetation starts from a far lower tuber density (10 m^{-2}) than the default one (240 m^{-2}). Simulated biomass from runs started from the default values agreed with the measured plant biomass of Wildcelery. Interpretation by comparison of simulated and measured data was greatly impeded by the : (1) large variability in measured plant biomass data, (2) lack of measured plant growth curves, tuber density and –size, (3) relative scarcity of measured environmental data requiring large-scale interpolation and derivation of values pertaining to other sites within the same water body. The refined models can be used to explore possibilities to modify existing river management practice, and to implement operational scenario's aimed at conserving/optimizing submersed aquatic vegetation.

Keywords: Mississippi River, aquatic plant growth model, refinement, validation

MATHEMATICAL MODELING FOR ARTIFICIAL ISLAND CONSTRUCTION WITHIN THE LOWER PEORIA LAKE ALONG THE ILLINOIS RIVER.

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Peoria Lake is the largest bottomland lake along the Illinois River in Illinois. This lake has been losing its capacity for the last 100 plus years. At present, it is estimated that the lake has lost at least 90 percent of its original capacity due to sediment deposition. The average depth of the lake is less than 2 feet compared to about 8 feet or more in the early 1900s. Presently the State of Illinois and the U.S. Army Corps of Engineers are in the process of developing and implementing ecosystem restoration related projects for this lake and ultimately for the entire Illinois River system. As part of this overall goal, one concept that has been thoroughly evaluated is the construction of artificial islands by utilizing the dredged sediments within the Peoria Lake. Initial area of concentration was the Lower Peoria Lake. In order to determine the ideal location, orientation, size, shapes, etc., a hydrodynamic 2D model called RMA-2 was utilized. After testing numerous options, four options have been selected for further engineering analyses for construction purposes. This presentation will show the historical sedimentation problems of Peoria Lake, hydrodynamic modeling results without and with individual islands, and results on spatial velocity structures for four options for a flow having a frequency of occurrence of two years. Animation work has also been completed to show the plan form of the Lower Peoria Lake without and with one potential island. Present plans call for further engineering design for two of these islands.

Keywords: sedimentation, Illinois River, artificial island, hydrodynamic models, sediment removal

CHANNEL CATFISH AS POTENTIAL SEED DISPERSAL AGENTS FOR RED MULBERRY AND SWAMP PRIVET IN THE MISSISSIPPI RIVER.

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Ecologists believe the interaction between water and land is a key process structuring the ecology and productivity of river-floodplain systems. River biota display a variety of foraging and life history adaptations that capitalize on seasonal flood-pulse cycles. For example, seed dispersal by fishes is well documented in tropical river-floodplain systems, though relatively few examples are known from temperate systems. During the spring floods of 2001, we received reports from state researchers who had collected channel catfish (*Ictalurus punctatus*) in Pool 26 of the Mississippi River that had consumed great quantities of red mulberries (*Morus rubra*). A pilot study was initiated to collect channel catfish and determine the viability of any mulberry seeds consumed. We captured 24 channel catfish from an island backwater, 54% of which had consumed mulberries. Over 350 red mulberry seeds were recovered from the lower digestive tract of these fish and planted in seed trays. After a period of 14 days, 72% of these seeds successfully germinated. We repeated this effort during the spring flood of 2002. We captured 30 catfish, 40% of which had consumed mulberries and 30% of which consumed swamp privet (*Forestiera acuminata*) seeds. For both red mulberries and swamp privets, we conducted common garden, randomized block experiments to compare germination success between seeds consumed by catfish with seeds harvested directly from plants. Significantly more mulberry and privet seeds germinated after being consumed by catfish compared to seeds harvested from plants. For mulberries, 78% of seeds consumed by catfish germinated after 10 days compared to 62% from plants. The difference was more pronounced for privets, 55% of which germinated after 10 days when consumed by catfish compared to 17% from plants. Our results suggest that catfish may play a role in dispersing red mulberry and swamp privet seeds in the Mississippi River.

Keywords: channel catfish, seed dispersal, red mulberry, swamp privet, Mississippi River

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SUBMERSED AQUATIC VEGETATION [WILDCELERY (*VALLISNERIA AMERICANA)* AND SAGO PONDWEED (*POTAMAGETON PECTINATUS*)] RE-ESTABLISHMENT EFFORTS IN LAKE CHAUTAUQUA, ILLINOIS RIVER.

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Backwaters of the Middle Illinois River were historically described as having extensive populations of pondweeds *(Potamogeton spp.),* wild celery *(Vallisneria americana),* and coontail *(Ceratophyllum demersom)*. However, submersed aquatic vegetation (SAV) soon began to disappear following the diversion of water from Lake Michigan in 1900. Continued human induced alterations furthered the decline of SAV in the Illinois River and it's backwater lakes. By 1950, only the hardiest of submersed and rooted floating leafed species (coontail and lotus, *Nelumbo lutea*) were present in a few backwater lakes. Similarly, the present distribution of SAV within the Lower Illinois River is very limited and efforts to re-establish this life form in backwaters have been met with limited success. In 2001, we began investigating factors limiting SAV, specifically wild celery and sago pondweed (*Potamogeton pectinatus*) in Lake Chautauqua, an isolated backwater. Wild celery winter buds were planted in Lake Chautauqua at a density of 6.9 buds/m² in two treatments (enclosed 3 x 3-m cage and an unprotected 3 x 3-m area) plus an additional enclosed control with no plantings in 2001. We conducted a similar experiment using sago pondweed winter buds in 2002, where we placed an additional enclosure near the other treatments with a wave barrier to protect against wind and waves. Sites were visited weekly where leaf measurements of each plant were taken to evaluate success. Subsequent daughter plants were also documented and measured. A subset of plants were allowed to complete their annual life cycle and harvested to determine success of winter bud production in all treatments. Results for both years' experiments were similar in that all plantings not protected by enclosures encountered a high occurrence of leaf cropping and 0% survival. Initial growth was good in both years in all treatments, but unprotected plants were immediately cropped following elongation and did not survive the growing season. Reproduction within the enclosures varied, as some sites were unsuccessful whereas others grew and reproduced successfully. Production of winter buds from the initial tubers planted within the enclosures averaged 115/m² with a range of 0/m² to 927/m² for wild celery in 2001 and averaged 122/m² with a range of 0/m² to 659/m² for sago pondweed in 2002. Water quality measurements (e.g., temperature, DO, turbidity) were relatively similar among treatments and sites. However, some were exposed to wind and wave action resulting in varied outcomes. Our study suggests that both biotic and abiotic factors can limit growth and establishment of submersed aquatics in Lake Chautauqua. However, our results show promise in establishing SAV given the appropriate conditions (i.e., protection from herbivory and wind action).

Keywords: Illinois River, *Potamogeton pectinatus*, sago pondweed, *Vallisneria americana*, wild celery

PREDICTING SEED/SEEDLING DYNAMICS: THE NON-TAROT CARD APPROACH.

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Predicting future floodplain forest composition is an arduous task that requires an understanding of how the annual flood pulse, various forms and degrees of herbivory, and inter/intraspecific competition effects seed germination and seedling survivorship. A seed/seedling dynamics study was conducted from 1996-2001 on five key pools of the Upper Mississippi River System (UMRS). Twenty-four species were identified on the five pools in which *Populus deltoides*, *Betula nigra*, *Acer saccharinum*, *Fraxinus pennsylvanica*, *Ulmus americana*, and *Acer negundo* were the most common species encountered. River pool, forest community, species, and month were significant predictors of seed density. Year was not a significant predictor of seed density. This is due to the dominance of light-seeded species, which typically do not have masting years.

River pool and germination year were significant predictors of seedling density, whereas forest community, germination month, and species were not. It is likely that the dominance of a few light-seeded species at all of the forest sites played an integral role in decreasing the effect of forest community and species in determining seedling density.

Although *B. nigra* produced the greatest number of seeds and had high reproductive power, this species had poor representation in the seedling cohorts of the sites studied (germination ranged from 0.0-0.15%). Likewise, *P. deltoides* had no seedling germination in any of the sites studied. The percent germination of *A. saccharinum* varied from 0.35% in the wet forests of the La Grange Pool to 218.2% in the wet forests of Pool 13. Greater than 100% germination rates for *A. saccharinum* seeds may be explained by the additional deposition of seeds following annual flooding. *Fraxinus pennsylvanica* and *U. americana* seed germination ranged from 0.0-25.3% and 0.92-85.0%, respectively. Hard-mast species (*Quercus* and *Carya spp*.) had much lower germination rates than what was expected (0.0-25.3%). This is likely related to high mortality in seed crops due to predation.

Due to low numbers of seedlings in all but five species, survivorship analysis was conducted for *F. pennsylvanica, A. saccharinum, U. americana, Rhamnus cathartica*, and *Zanthoxylum americanum*. Seedling survival was strongly related to species, river reach, and day of mortality. *Fraxinus pennsylvanica, Z. americanum*, and *U. americana* had greater long-term survivorship than did *A. saccharinum* and *R. cathartica*. Survivorship within a species also varied according to forest community. *Fraxinus pennsylvanica* had a greater chance of surviving on dry forests than wet (Chi-square=32.74, df=1, $p<0.001$) whereas *A. saccharinum* had a greater chance of survivorship on wet forests (Chi-square=41.76, df=1, $p<0.0001$). All river reaches other than Reach 4 and the La Grange Reach showed significant differences in seedling survivorship curves. Likewise, there were significant differences in survival curves between forest

communities. Dry forests had greater seedling survivorship than wet forests. Chance of survivorship increased as seedling age increased.

The ability of *Fraxinus pennsylvanica* to survive long-term on the floodplains of the UMRS, coupled with abundant conspecific adults, adequate seed production, and adequate germination rates, indicate that this species will dominate the dry forests and be a major component of the wet forests. For the same reasons, *A. saccharinum* will dominate the wet forests. *Quercus* and *Carya spp*. need special attention as these species are failing to regenerate into the seedling and sapling cohorts. Planting might be the only solution to preserving *Quercus-Carya* forests long-term.

Keywords: floodplain forest, seed dynamics, seedling dynamics, Upper Mississippi River System

DETECTING AND PROTECTING WILD RICE (*ZIZANIA AQUATICA* L.) IN THE UPPER MISSISSIPPI SYSTEM (UMRS) –1975, 1989-2001.

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Wild rice (*Zizania* spp.), the sentinel plant of the deep marsh annual community, is an annual emergent that is protected throughout the Mississippi River Fish and Wildlife Refuge System for its food and cover value to wildlife. To adequately protect a plant species, it must first be detected, and up until the mid-1990's, available data documenting wild rice stands on the upper Mississippi River System was localized, fragmented, or lacking. Systemic CIR aerial photography mapped by LTRMP (1975, 1989, 2000) has detected polygons where wild rice is dominant in all Navigation Pools from 2—13, and in small patches in the Open River Reach and the Alton Reach of the Illinois River. No wild rice has been detected in Pools 14-26 of the Mississippi River nor on any of the remaining portions mapped on the Illinois River (Brandon, Dresden, LaGrange, Lockport, and Marseilles Reaches). Annual LTRMP field monitoring of aquatic vegetation employed a stratified random sampling (SRS) design in Pools 4, 8, 13, 26 of the Mississippi River and the La Grange Reach of the Illinois River from 1998-2002. Additionally, SRS was done on a more limited basis in Pools 5, 7, 12, and the Alton Reach of the Illinois River in 2002.This field method detected wild rice in Pools 4, 7, and 8 in areas that generally overlap distributions detected by CIR photography. However, stratified random sampling (Goose Island area in Pool 8, and some areas of Pool 4) and field observations (La Grange Reach, Illinois River) have also documented some patches of wild rice which so far have been undetected on maps derived from CIR photos. UMRS coverages indicate wild rice typically grows in isolated backwaters, areas of contiguous backwaters that are relatively sheltered from prevailing winds, speedboat traffic, and strong currents, or sheltered sloughs near the confluences of tributaries. Wild rice most consistently occurs in reaches where these types of deep marsh habitat are available or where managers artificially create these conditions with levies and pumps (Trempealeau Wildlife Refuge in Pool 6, and certain managed areas in Pool 13 and on the Illinois River). Wild rice appears to cycle over time in a manner typical of an opportunistic, likely density-dependent annual responding to hydrological and climactic events. In Pool 8, coverages of wild rice in stands where it is the dominant plant appear to increase dramatically following unusually high or protracted spring flood events that occur early in the same growing season or following summer flood events that occurred the previous growing season. Coverages in years immediately following these increases show substantial decreases, indicating a possible density effect. Wild rice might nearly disappear for years and then "miraculously" reappear as it did in Pool 8 in 1994, which can present challenges to managing for this plant and its associated deep marsh annual habitat. Management techniques used thus far on the UMRS to create or preserve deep marsh annual habitat include planting wild rice in promising areas, drawdowns, artificial levying and pumping, and resisting public pressure to increase boating accessibility to the relatively isolated areas where wild rice occurs.

Key words: *Zizania aquatica*, wild rice, Mississippi River, aquatic vegetation, protect

SIMPLE STOCHASTIC MODELS TO EXPLAIN POPULATIONS OF THE FINGERNAIL CLAM, *MUSCULIUM TRANSVERSUM.*

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The populations of *Musculium transversum* from 8 backwater lakes have been studied over a 29-year period based upon over 432 grab samples. These lakes in Pool 9 of the Upper Mississippi River range in size from 2 to 255 hectare surface area, mean depths from 0.2 to 0.9 meters, with mean water exchange times from 0.5 to almost 57 hours. Samples from the 1989-91 period suggested that summer *Musculium* populations had declined to about 9 percent of their mid-1970 levels. Deterministic models have attempted to explain this decline. More recent sampling suggests a substantial recovery of *Musculium* populations (mid-summer mean of 560 per square meter in 2002). Simple stochastic models, with realistic levels of POISSON and NORMAL variables, may provide a better explanation of population fluctuations than previously used deterministic models.

Keywords: fingernail clam, *Musculium transversum*, Mississippi River, stochastic models

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AQUATIC MACROINVERTEBRATE RESPONSES TO ENVIRONMENTAL POOL MANAGEMENT AND EMERGENT VEGETATION IN BACKWATERS OF MISSISSIPPI RIVER POOL 25.

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The St. Louis District of the Army Corps of Engineers implemented Environmental Pool Management (EPM) on Mississippi River Pools 24, 25, and 26 in 1994. The operational goal of EPM is to maintain relatively low, stable water levels in the lower portion of the pools following maximum drawdown in the spring to better simulate a natural hydrograph without inhibiting commercial navigation. When possible, water levels are held up to 2.0 feet below the target pool elevation at the lock and dam for at least 30 days. Previous investigations of mudflats exposed via EPM showed substantial production of emergent vegetation consisting primarily of millet, chufa, and smartweeds. However, little is known about the response of other biota to EPM. From 2000-2002, we studied macroinvertebrate responses to EPM by examining communities in recently flooded vegetation in the fall. Six paired (400 m^2) vegetated and experimentally de-vegetated plots were established to examine benthic organic matter and macroinvertebrate responses. Sites represented a range of backwater types (e.g., island slough, island tip, and shallow bay). Invertebrates were sampled using a stove pipe coring device (312cm^2) during fall of each year.

In 2000, there was no vegetation response because a water level drawdown could not be sustained, whereas in 2001 there was a strong vegetation response. In 2001 there was marginally higher total organic matter in vegetated plots ($p<0.06$), primarily because of differences in coarse material. During both years, there were no significant differences in total macroinvertebrate abundances between plot types. Total biomass was significantly higher in the vegetated plots in 2001 ($p<0.001$). Taxonomic differences were evident, for example, *Dicrotendipes* ($p<0.01$) and *Physa*/*Physella* ($p<0.03$) abundances were significantly higher in the vegetated plots in 2001, whereas abundances of total Chironomidae ($p<0.003$), *Chironomus* ($p<0.04$), *Cryptochironomus* ($p<0.02$), *Polypedilum* ($p<0.01$) and the leech *Helobdella* ($p<0.05$) were significantly higher in de-vegetated plots. Total Chironomidae biomass was significantly higher in the devegetated plots ($p<0.01$). Results show that EPM and the associated vegetation responses influence the distribution of benthic organic matter and macroinvertebrate communities. Although total macroinvertebrate abundance and biomass did not differ between vegetated and devegetated plots, individual taxa exhibited differential responses to these treatments.

Key Words: Mississippi River, Environmental Pool Management, macroinvertebrates, vegetation, wetlands

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COMPARING COMMERCIAL HARVEST AND LONG-TERM MONITORING TRENDS OF FISHES IN POOL 26 OF THE MISSISSIPPI RIVER.

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The Great Rivers Field Station has been monitoring fish populations in Pool 26 of the Mississippi River for the Long Term Resources Monitoring Program (LTRMP) since 1989. Pool 26 is a unique part of the Upper Mississippi River System, housing the last in a series of 26 dams starting in Minnesota and ending in Alton, IL. Pool 26 is just upstream from the confluence of the Missouri River, where river dynamics change dramatically, and within Pool 26 is the confluence of the Illinois River. The Mississippi River provides income for 170-200 Illinois commercial fishers worth over $1 million annually. The Mississippi River has accounted for over 65% of the total earnings in the state of Illinois in recent years, with Pool 26 accounting for 15-25% of the total catch for the Mississippi River. We compared LTRMP data to commercial fisheries data for the most frequently harvested fishes in Pool 26 of the Mississippi River to detect year class strength and overall population trends. Both sets of data display similar trends in fish populations with no clear sign of over harvest, however, buffalo (*Ictiobus*) populations should be carefully watched over the next few years because the commercial harvest has continued to increase whereas CPUE from LTRM sampling has declined in recent years.

Keywords: Mississippi River, Pool 26, Commercial fisheries, LTRMP, population trends

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SPATIAL AND TEMPORAL DIFFERENCES IN TRANSPORT OF MACRO AND MICROZOOPLANKTON IN THE SCHOOLCRAFT LAKE-RIVER SYSTEM.

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During the summer and fall of 2002, macro and microzooplankton were collected at both river and lake sites along the Schoolcraft River, a tributary of the Mississippi River in northern Minnesota. Sites included the inlet and outlet of lakes Plantagenet, Marquette, Irvine and Bemidji. Species diversity was much higher at all sites during the fall sampling period with calanoid and cyclopoid copepods, *Daphnia retrocurva* and the rotifer *Keratella cochlearis* being the dominant species present. Total zooplankton density was highest (31.6 ind L^{-1}) in the spring when diversity was lowest. Spring communities were dominated by *Bosmina* and *K. cochlearis*. At all sites and times zooplankton density increased between lake input (11.5 ind L^{-1}) and output (27 ind L^{-1}) suggesting that in-lake production was high enough to offset predation. Zooplankton densities decreased during riverine transport (net loss of 19 ind L^{-1}) suggesting that production was low due to decreased food availability, greater predation or physical stress. The Schoolcraft River serves as a source of zooplankton to the Mississippi River (16.3 ind L^{-1}), although species diversity of exports remains low.

Keywords: Zooplankton, River, Lake, Budget, Transport

BALD EAGLE NEST SITE SELECTION AND PRODUCTIVITY RELATED TO HABITAT FEAUTURES.

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Bald eagle (*Haliaeetus leucocephalus*) populations declined dramatically between 1930 and 1970 due to several reasons. One of the causes often cited is habitat loss. However, essential habitat requirements of nesting bald eagles are not well understood. Furthermore, recent gains in the number of eagles have not been associated with a large-scale recovery of "typical" eagle habitat. The goal of this project was to determine the relationship between bald eagle nesting habitat features and productivity. A large sample of nests across several different habitat zones was used to reduce the amount of variation seen in past studies. Minnesota has a large breeding bald eagle population, four distinct ecoregions, and a history of bald eagle nest monitoring, providing an ideal location for this project. The primary objectives of the study were to 1) examine habitat characteristics at nest sites and an equal number of random sites and 2) obtain at least two years of productivity for each nest.

A sample of 116 nests was chosen along with 166 random habitat sites, each stratified according to the four ecoregions of the state. Habitat evaluation at each site consisted of 1) physical examination of trees within 100 m of the nest and 2) evaluation of aerial photographs and land use maps to determine habitat types within 1 km of the nest. Productivity data for each nest was obtained via two groups of aerial surveys to determine the number of nestlings prior to fledging.

Trees associated with nest sites were larger in diameter than trees at random sites. Nest trees were among the tallest trees at the nest site, but usually were not "supercanopy" trees. Nest tree species varied according to the available trees in the area. The most frequently chosen nest trees were cottonwoods, white pines, red pines and quaking aspen. Land use within 1 km of the nest varied greatly between nest sites. Mean distance to shoreline was similar to those reported for eagle nests in other studies. Bald eagle habitat may not be as limited as once thought. Eagles in Minnesota use a large variety of habitats with different land use types within 1 km of their nest. Eagles have shown the ability to reproduce successfully in areas once considered sub-optimal nesting habitat. Protection of shoreline habitat for nesting and foraging purposes continues to be a concern.

Keywords: Bald Eagle, Nest Site Selection, Shoreline Ecology, Endangered Species, *Haliaeetus leucocephalus*

WHY IS THE MUSSEL FAUNA DIFFERENT AROUND THE CORNER FROM THE ST. CROIX? RECOVERY OF THE UNIONID FAUNA IN MISSISSIPPI RIVER MARGINAL HABITAT, LOWER POOL 2, MINNESOTA.

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A widely accepted fact has been that the Mississippi River unionid fauna, between the Twin Cities, MN, and the St. Croix River, was greatly impacted over time by various types of pollution from the Twin Cities. In June and July 2002, 19,680 unionids representing 23 living species were recovered from 52,250 m2 of marginal habitat in the impounded area of lower Pool 2, Mississippi R.M. 818.9, prior to the construction of a new wastewater outfall pipe. Seven species found are on the Minnesota Endangered, Threatened, or Special Concern list. The Endangered *Quadrula nodulata* (Rafinesque 1820) represented 7.37 % (1451) of the total, and was the 3rd most abundant species. The Endangered *Arcidens confragosus* (Say 1829) represented 0.99% (194) of the fauna, and was the 10th most abundant species. Other living Special Status species, each represented by 1-7 specimens, included *Megalonaias nervosa* (Rafinesque 1820), *Tritogonia verrucosa* (Rafinesque 1820), *Actinonaias ligamentina* (Rafinesque 1820), *Obovaria olivaria* (Rafinesque 1820), and *Ligumia recta* (Lamarck 1817). The most common species were *Obliquaria reflexa* Rafinesque 1820 (46.8%) and *Quadrula quadrula* (Rafinesque 1820) (23.9%). *Amblema plicata* (Say 1817) was only 3.2% of the fauna. Living mussels were translocated to a nearby upstream area. Nearly 600 of 1657 special status mussels were measured, aged, and uniquely numbered. The special status mussel species were widely distributed throughout the area, in all types of habitat. Although the mean density was very low (0.38/m2), there was good reproduction by most species. The substrata was mostly of marginal quality (mud) in depths from <1 m to 6m. Most of the project area was quite shallow since the site was in the impounded area upstream of Lock and Dam 2, Hastings, MN. The large old (main) Ninninger channel, adjacent to the north shoreline, ranged from 125-300 m wide, and was up to 6 m deep, but with little to moderate current. There was a great deal of wind fetch in the area; almost no submerged aquatic vegetation was observed. The only areas of moderate mussel concentrations were near the main navigation channel, where the substratum became coarser, and thus more suitable mussel habitat. There was evidence of damage to a number of mussels near the navigation channel, apparently from commercial barge traffic. Several mussel species had never been reported from Pool 2, dead or alive.

CONCLUSIONS: A 1980's lawsuit improved the Twin Cities water quality, which in turn has improved the Pool 2 unionid fauna. But, some species doing well in lower Pool 2 are not in the nearby St. Croix, and vice versa. We have no idea why the mussel fauna differs around the corner from the St. Croix, but *Q. nodulata* and *A. confragosus* are almost nonexistent in the St. Croix River.

Keywords: Mississippi River Pool 2, unionid translocations, unionid species, mussels, St. Croix River mussel species.

EMP BIORESPONSE MONITORING SUMMARY: LAKE CHAUTAUQUA 1991-2002.

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Lake Chautauqua is roughly a 1,400 ha floodplain lake just north of Havana, Illinois on the Illinois River. Lake Chautauqua has a long history of serving as a waterfowl resting area and habitat for floodplain fishes. Prior to construction, the two existing pools were connected through an incomplete cross-levee and water management was minimal due to inadequate levees and control structures much of the year that allowed river level fluctuations to impact the lake. Beginning in 1991, the Illinois Natural History Survey (INHS), Illinois River Biological Station (IRBS) began monitoring various parameters on this lake to gauge the success of improvements to levees and other physical structures on this U.S. Fish and Wildlife Refuge. Lake Chautauqua was drained during construction of levees and control structures and allowed to refill. After refilling the north pool of the lake, water levels will be held steady to promote submersed aquatic plants, provide good fish habitat, and provide habitat for migrating diving ducks. This management strategy contrasts that of the south pool which is now drained in the summer for moist soil plant production used by migrating waterfowl and shorebirds. Therefore, monitoring of fish on the north pool continued to assess pre- and post- construction fish population dynamics. Prior to construction (1991-1993), 57 species were collected by INHS surveys. The most abundant species in these collections were emerald shiner, gizzard shad, common carp, freshwater drum, and bluegill, with channel catfish ranking 8th. Stocking of largemouth bass, black crappie, bluegill, channel catfish, and fathead minnows took place to mold the fishery of Lake Chautauqua in 1997. After construction (2000-2002), 54 species were collected by INHS surveys. The most abundant in these collections were gizzard shad, white crappie, bluegill, freshwater drum, and black crappie. Largemouth bass and channel catfish ranked 8th and 15th respectively. Pre- and post-construction fishery data will be compared to assess whether the fisheries goals of the north pool have met project expectations.

Keywords: Illinois River, Environmental Management Program (EMP), Long Term Resource Monitoring Program (LTRMP), Habitat Rehabilitation and Enhancement (HREP)

BREEDING BIRDS OF YOUNG FLOODPLAIN FORESTS GROWING ON ABANDONED AGRICULTURAL LAND.

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The floodplain forests of the Upper Mississippi River are less diverse in tree species and age structure than they were prior to European settlement. Land managers are concerned about habitat quality for migratory birds and other wildlife that depend on the forests. Management agencies responsible for the Upper Mississippi River floodplain are particularly interested in the habitat values of young floodplain forests because cottonwood (*Populus deltoides*) and willow (*Salix* spp.)-dominated floodplain forests are currently scarce. In 2001 we studied stands of young cottonwood (*Populus deltoides*) and willow (*Salix* spp.) forest growing on abandoned agricultural land along the Mississippi River. The study sites were Harlow and Wilkinson Islands, both owned by the U.S. Fish and Wildlife Service, Mark Twain National Wildlife Refuge Complex. Our objectives were to 1) compare the breeding bird community of young cottonwood and willow forests with that of adjacent scrub/shrub and mature forest habitats, 2) describe vegetation characteristics associated with these habitats and, 3) place these communities in context with the surrounding landscape. Forests, followed by pasture or grasslands, and row crops are the dominant land uses in the region surrounding the study area. We recorded a total of 69 bird species in 2001; the most frequently observed species were the Indigo Bunting (*Passerina cyanea)*, Red-winged Blackbird (*Agelaius phoeniceus*) and Yellow-billed Cuckoo (*Coccyzus americanus*). Bird species richness differed among the habitat classes, with mature forests supporting the largest number of species. Ordination plots showed that both the vegetation and bird community differed among habitat classes. The Indigo Bunting, Common Yellowthroat (*Geothlypis trichas*), and Yellow-breasted Chat (*Icteria virens*) were most indicative of scrub/shrub habitats and the Dickcissel (*Spiza americana*) and Wood Duck (*Aix sponsa*) were of high management concern to the U.S. Fish and Wildlife Service in this habitat type. The Yellow-billed Cuckoo and Orchard Oriole (*Icterus spurius*) were most indicative of young forests; the Field Sparrow and Orchard Oriole were of management concern. The Northern Cardinal (*Cardinalis cardinalis*), Gray Catbird (*Dumetella carolinensis*), Downy Woodpecker (*Picoides pubescens*), Red-eyed Vireo (*Vireo olivaceus*), and Tufted Titmouse (*Baeolophus bicolor*) were most indicative of mature forests and the Red-headed Woodpecker (*Melanerpes erythrocephalus*), Northern Flicker (*Colaptes auratus)*, Kentucky Warbler (*Oporornis formosus)*, Prothonotary Warbler (*Protonotaria citrea*), Acadian Flycatcher (*Empidonax virescens)*, and Wood Thrush (*Hylocichla mustelina*) were of high management concern in mature forests. Mature floodplain forests provided habitat for many cavity-nesting species because of the abundance of standing dead snags. The mosaic of habitat types that developed on these sites post-flooding supported a diverse bird community. Long-term management that speeds the establishment of mature woody wetlands is most compatible with patterns of natural vegetation succession and regional bird conservation objectives.

Keywords: Mississippi River, young forest, bottomland forest, cottonwood, willow, bird community, floodplain forest, Missouri, Illinois.

PHYSICAL AND CHEMICAL INFLUENCES ON THE DISTRIBUTION AND ABUNDANCE OF *VALLISNERIA AMERICANA* MICHX.

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Vallisneria americana Michx. (hereafter *Vallisneria*) is an ecologically important plant of submersed aquatic communities in the upper Mississippi River (UMR). *Vallisneria* foliage, rhizomes, tubers and fruit are important food sources for migrating waterfowl. Most of the research done to determine the optimal physical and chemical characteristics for *Vallisneria* growth has been done in lake environments. Most research on *Vallisneria* in riparian systems has been done experimentally in laboratory microcosms. Our primary objective was to determine the optimal conditions of *Vallisneria* growth in the UMR. We did a season-long study in the bottom half of Pool 8 measuring seven water variables (e.g. turbidity, % light absorbance, and pH) that have been known to affect *Vallisneria*. We collected sediment and aboveground biomass samples during peak *Vallisneria* biomass. Sediment samples were analyzed for porewater and extracted dissolved inorganic nitrogen, organic content and particle size. The information collected was used to construct a model that used the significant variables to express the changes in aboveground biomass. Although we investigated 14 variables, only turbidity, velocity, depth and % light absorbance were found to have a significant correlation with biomass. The other ten variables were not significantly correlated with biomass in our study, despite that they have experimentally been shown to affect biomass in lentic systems. However, the variability of the UMR and the high amount of dissolved inorganic nitrogen in the system may have affected the significant findings in our study. Also, the sampling was conducted during a year when the lower pool was being drawn down to enhance emergent plant growth. Thus, the fluctuation in water level may have affected our water variables. Further research needs to be done to determine how these variables interact in the river system and the effects these interactions have on submersed plant growth.

Keywords: *Vallisneria americana*, Upper Mississippi River, macrophyte abundance, water and sediment chemistry, modeling

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THREE-DIMENSIONAL HYDRODYNAMIC SIMULATIONS OF THE MISSISSIPPI RIVER – POOL 16.

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Over a quarter of the world's approximately 1,000 freshwater mussel species live in the waters of North America. Approximately 50 of those species have been reported in the Upper Mississippi River (UMR), but only around 30 are present there today. The American Fisheries Society considers 72-percent of the species to be extinct, endangered, or threatened. Freshwater mussels provide food for small mammals, bottom feeding fish, and birds in a riverine environment. They provide improved water quality by filtering nutrients and contaminants from the river water. In an effort to develop conservation strategies and understand how population dynamics are impacted by subsequent changes in water quality and hydrodynamic parameters, an individual based model of the freshwater mussel is under development (Mussel Dynamics Tool) at IIHR. The mussel dynamics tool will rely on the assertion that mussel distribution is the consequence of various physical, measurable environmental parameters. The mussel dynamics tool will rely upon hydrodynamic and water quality conditions and simulated life processes such as competition for food, growth, reproduction, mortality, motion, spreading, and settlement. The mussel dynamics tool will be applied to Mississippi River Pool 16 as a case study. In support of this work, a fully three-dimensional hydrodynamic model of Pool 16 will be developed. The hydrodynamic simulations will be performed using U^2RANS, a computational fluid dynamics model developed at IIHR, intended for use in solution of unsteady, two or three-dimensional, turbulent flow problems. It uses the pressure-based finite volume technique, with cell-centered storage and collocated grid arrangement. High-resolution bathymetric survey data of Pool 16 have been taken and will be utilized in the development of the computational mesh. To evaluate the habitat suitability, the mussel dynamics tool requires complete hydrodynamic information in the local vicinity of the mussel bed, including velocity flow field, water depth, bed shear stress, and turbulence intensity.

Keywords: freshwater mussels, Upper Mississippi River, habitat, numerical modeling, hydrodynamics

HABITAT SUITABILITY ANALYSIS FOR MUSSELS IN THE MISSISSIPPI RIVER.

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Freshwater mussels of the Family *Unionidae* are found all over the world, but nowhere are they as abundant as in North America. Nevertheless, the combined effect of habitat alteration and the introduction of the invasive species *Dreissena polymorpha* have caused a dramatic depletion on *Unionids* populations and at the moment approximately 70% are considered threatened, endangered or extinct. In this paper we present a summary of previous reported tolerances of freshwater mussels to various water quality indicators and we describe a general approach for assessing the suitability of a given habitat for *Unionids* survival. As an example, the habitat suitability of Pool 16 of the Mississippi River for the threeridge mussel (*Amblema plicata*) is estimated and a mussel dynamics model for predicting mussel populations is presented.

Keywords: Freshwater mussels, Unionids, Mississippi River, habitat suitability analysis, water quality indicators.

SUSTAINED HIGH WATER ON THE MISSISSIPPI RIVER: INFUENCES ON FISH ASSEMBLAGES IN COLDWATER TRIBUTARIES.

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The Mississippi River at Winona, MN, remained at flood stage for one month (12 April-13 May) during 2001, but high water levels were sustained for three months (7 April-5 July). High waters flooded low islands and inundated the lower reaches of many coldwater tributaries. This study examined the influence of this inundation on the fish assemblages normally found in these coldwater streams. Five coldwater tributaries with survey data from previous years were electrofished after water levels returned to normal in late-summer 2001, and four of these sites were sampled again in 2002. Twelve species of river fish (one to four per stream) not normally found in these streams remained after waters receded in 2001. These "new" fish comprised 10.6-51.6% of the total fish collected from each stream. Northern pike (especially YOY fish) was the most common invader, present in four of the streams. Other new species included golden redhorse, quillback, sauger, crystal darter, spotted sucker, and goldfish. The presence of these fish in the coldwater streams in 2001 slightly reduced the biotic integrity scores of these streams relative to pre-inundation surveys. Fish assemblages had returned to normal during 2002 surveys, with only a few token individual river fish remaining in two of the streams. Although inundation by Mississippi River floodwaters may temporarily alter the fish assemblages in coldwater tributaries, the effects appear to be minimal and the recovery rapid.

Key words: flooding, tributary streams, fish assemblages, coldwater streams, biotic integrity

SPATIAL AND TEMPORAL DYNAMICS BETWEEN OVERSTORY STRUCTURE AND GROUND FLORA DIVERSITY OF TWO LIMESTONE GLADES IN PIKE COUNTY, ILLINOIS.

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Tallgrass prairie and associated communities once dominated Illinois and much of the Midwest. Today, these communities are considered critically endangered, occupying less than two percent of their original area. Highly fragmented remnants are currently disappearing, converting to closed canopy conditions after decades of fire suppression. Consequently, a greater understanding of successional processes and their effects on grassland communities is necessary in order to enhance preservation efforts. During the summer of 2001, study areas were established on two, limestone glade grassland communities on the bluffs of the Illinois River, in Pike County, Illinois – representing minimal, and high disturbance. To assess patterns and effects of succession in these communities, tree and sapling age structure, distribution and composition were determined, spatial relationships analyzed, and ground flora diversity/distribution examined in relation to these overstory parameters. The glades were found to have very different stem age distributions with markedly different ground flora compositions. Stem compositions and densities within age classes between glades, also differed significantly. Age histograms revealed recent periods of strong stem recruitment, with the highest stem densities occurring in younger age classes. Preliminary analyses indicate strong spatial aggregation of stems occurring within multi-species age classes and within age classes comprised of specific species. Preliminary analyses also indicate negative correlations between ground flora diversity/distribution and overstory stem density and species composition. Analyses examining spatial attraction/repulsion between age classes, species, and age classes within species are currently underway.

Key words: limestone glades, spatial temporal dynamics, grassland communities, succession, habitat loss

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GENE FLOW IN THE ILLINOIS POPULATION OF WILD TURKEY, AN INVESTIGATION USING MTDNA.

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The eastern wild turkey, *Meleagris gallopavo silvestris,* was eliminated from Illinois in 1903. Reintroduction of over 2,700 wild-caught turkeys from 1959-1993 has resulted in a population of over 120,000 individuals in Illinois as of 1999. Protein, starch-gel electrophoretic studies of wild turkey samples collected from 1988-1996 suggested that large river systems, in particular the Mississippi River, facilitate dispersal, and thus gene flow of these birds. This investigation involved PCR-RFLP and DNA sequencing of the control region of mtDNA of Illinois wild turkey samples from four inland counties and four counties bordering the Mississippi River. Newly gathered data from mtDNA were analyzed in conjunction with results from previous allozyme studies, Illinois restocking history, and land cover data from the study counties. PCR-RFLP of 1800 bp of the mtDNA control region was unable to distinguish any haplotypes within the study populations. However, F_{ST} values calculated from mtDNA sequence data support the previous conclusion that the Mississippi River does facilitate gene flow within the Illinois population of wild turkeys (F_{ST} river counties = 0.054, F_{ST} inland counties = 0.151). In addition, comparison of nuclear (allozyme) and mtDNA data support reports of female dominated dispersal within this species. The information uncovered about the role of the Mississippi River in dispersal and gene flow of the wild turkey can be utilized if further restocking or restructuring of the population is necessary.

Keywords: Eastern wild turkey, *Meleagris gallopavo silvestris,* gene flow, dispersal, mtDNA

HIGHLIGHTS FROM 14 YEARS OF FISH MONITORING ON POOL 26 OF THE MISSISSIPPI RIVER.

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Staff of the Great Rivers Field Station have been collecting fish data on Pool 26 of the Mississippi River as part of the Long Term Resource Monitoring Program (LTRMP) since 1989. We analyzed Pool 26 fish data to determine the major population trends for the period of 1989-2002. A major event during this time period was the Great Flood of 1993. This flood allowed several fishes to produce exceptionally strong year classes, including common carp (*Cyprinus carpio)*, largemouth bass *(Micropterus salmoides*), and black crappie (*Pomoxis nigromaculatus*). The flood of 1993 also eliminated most aquatic vegetation in our pool, and populations of most Centrarchids declined following 1993. In recent years, these species have started to rebound, and other species have become established in our pool. Bighead (*Aristichthys nobilis*) and silver (*Hypophthalmichthys molitrix*) carp appeared in our data in low numbers until 1998 when production of young of the year fish indicated they became established. Since the mid 1990's, populations of these two invasive species have increased exponentially. Blue catfish (*Ictalurus furcatus*) were a very minor portion of the LTRMP catch in Pool 26 throughout the 1990's, but began increasing in 2000 and had strong year classes in 2001 and 2002. Channel catfish (*Ictalurus punctatus*) also produced a strong year class in 2001. Our fish monitoring data suggest that we are in a particularly dynamic period of time, and the continuation of our LTRMP sampling will be important for tracking changes in the fish community.

Keywords: Mississippi River, LTRMP, Pool 26, Great Flood of 1993, population trends.

FOREST COMMUNITIES OF A HYDROLOGICALLY MODIFIED FLOODPLAIN ALONG THE LOWER KASKASKIA RIVER.

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Alterations of floodplain hydrology in the lower reaches of the Kaskaskia River have caused concern among landowners and resource managers for the health of the associated riparian forest communities. A dam was completed upstream in 1967 at Carlyle, Illinois on the Kaskaskia River to control flooding and improve downstream navigation. This study was initiated to determine if there is a relationship of forest tree composition and growth to the altered flooding regime. Three study sites were chosen, Posey, Venedy, and Fayetteville, with distance from the dam and proximity to river gauging stations as selection criteria. Overstory and midstory strata were sampled with circular plots, 0.04 hectares and 0.0025 ha plots, respectively. The Posey site is located 6.4 km below the dam. Forest overstory stratum at this site was primarily composed of high densities of *Acer saccharinum, Celtis occidentalis*, and *Fraxinus pennsylvanica*. More *Ulmus americana* is found in the overstory at this site than at the two sites downstream. Very little *Quercus bicolor* and only scattered *Quercus palustris* were present in the overstory. Midstory species were predominately *C. occidentalis*, *U. americana*, *Acer negundo*, and *A. saccharinum*. Some scattered *Q. palustris* were also in the midstory. The floodplain forest at this site had few *Quercus* sp. in the overstory and midstory forest strata. Venedy is 32 km below the Carlyle dam. The Venedy floodplain overstory stratum was composed mostly of *C. occidentalis, U. americana, A. saccharinum,* and *A. negundo*. The *Quercus* overstory component was sparse at this site, with several canopy *Quercus* scattered in throughout the floodplain area. There were very few *Quercus* in the midstory; none were present in our midstory plot sampling. Midstory forest species at Venedy included *C. occidentalis, U. americana, A. negundo* and *Carya ovata*. There was less *A. saccharinum* in the midstory at this site than at the Posey and Fayetteville sites. The Fayetteville site is 56 km below the dam. The Fayetteville overstory stratum was mostly *A. saccharinum, C. occidentalis,* and *F. pennsylvanica*. Midstory regeneration was primarily *U. Americana, C. occidentalis, F. pennsylvanica, A. saccharinum,* and *A. negundo*. *Quercus bicolor* and *Q. palustris* were present in the midstory, unlike the other sites. Relationships of species composition and site factors of soil texture, elevation, and flood inundation period will be determined with further data collection and analyses. Upon completion, this research will provide insight into floodplain forest communities and recommendations for better management and understanding of these areas.

Keywords: floodplain, Kaskaskia River, forest, riparian, hydrology

TWELVE YEARS OF WATER QUALITY TRENDS IN POOL 26 OF THE UPPER MISSISSIPPI RIVER.

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The upper Mississippi River is a major resource for multiple uses, including navigation, water supply, habitat for fish and wildlife, and recreation. In order to effectively manage this resource, the Long Term Resource Monitoring Program (LTRMP) was established to enhance understanding of this ecosystem and provide information needed for sound management. The LTRMP has accumulated over 10 years of limnological data, providing a comprehensive and unequalled view of the water quality of the upper Mississippi River. The Great Rivers Field Station, as part of the LTRMP, has performed basic field and laboratory water quality measurements on Pool 26 of the Missisippi River, along with its tributaries and backwater areas. One of the benefits of such a long-term database is the ability to detect trends or change over time. We used time-series analysis on a number of important water quality measurements (e.g. dissolved oxygen, nitrogen, phosphorous, etc.) to determine whether there were any detectable trends, either poolwide or habitat-specific, over the past 12 years. We found a number of distinct trends: total nitrogen, soluble reactive phosphorous and chlorophyll-a showed distinct downward trends poolwide over the past 12 years. Habitat-wise, dissolved oxygen showed a distinct upward trend in backwaters over the past 12 years. Several water quality parameters also showed distinct seasonality, some of which varied among habitats. We believe the ability to detect trends attests to the value of the LTRMP water quality database. Whether these trends will continue can only be determined through continued monitoring of this important resource.

Keywords: water quality, Mississippi River, time-series analysis, nitrogen, phosphorous

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REPRODUCTIVE SUCCESS AND TERRITORY RE-OCCUPATION RATES FOR RED-SHOULDERED HAWK (*BUTEO LINEATUS*) WITHIN THE MILAN BOTTOMS.

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Between 1992 and 2002, we collected information on Red-shouldered Hawk (*Buteo lineatus*) nesting within the Milan Bottoms study area which includes approximately 1300 acres of bottomland forest and wetland habitat along the Mississippi River just below the confluence of the Rock River in Rock Island County, Illinois. The study area is managed by the U.S. Corps of Engineers Natural Resources Management Section, although some of the perimeter habitats are in private ownership.

The number of nesting attempts we confirmed varied from year to year. We confirmed three attempts in 1998, 1999 and 2000, and two attempts in 2001 and 2002. We confirmed a total of 26 Red-shouldered Hawk nesting attempts between 1992 and 2002, and we were able to determine the outcome of 22 attempts. Of these, 12 were successful (57.1%), and 21 nestlings reached fledging age (1.75 per successful nest and 0.95 per nesting attempt). This success rate is slightly lower than the average rate we found at the other known Red-shouldered Hawk nesting sites along the Mississippi River between 1983 and 2002. During that period, we determined the outcome of 106 Red-shouldered Hawk nesting attempts (average of 5.3 per year). Of these, 69 were successful (65.1%) and 153 nestlings reached fledging age (average of 2.22 per successful nest, or 1.44 per nesting attempt). Success rates varied from year to year, with a high of 88% to a low of 33% during the flood years of 1993 and 2001.

Red-shouldered Hawk nesting sites were usually located in mature or medium aged forests and most of the nests were situated within 100 meters of a waterway or slough. Most nests were placed in areas where the overhead forest canopy was well developed. Active nests were placed in Silver Maples (*Acer saccharinum*) (78%), Eastern Cottonwood (*Populus deltoides*) (14%), and in Green Ash (*Fraxinus pennsylvanicus*) (8%). The diameter at breast height of the nest trees ranged from 16.9" to 32.6".

During the course of this study we have found that 89% of Red-shouldered Hawks breeding territories that we monitored along the Mississippi River were active in subsequent years. Because of this nest-site tenacity, we feel this species is an excellent “Umbrella Species” - an indicator of high quality habitat. Management practices that favor Red-shouldered Hawks are likely to benefit several species of concern that require large unfragmented forest tracts, especially some of the neotropical migrant passerines which may be more difficult to monitor.

Keywords: Red-shouldered Hawk, *Buteo lineatus*, Upper Mississippi River, raptor monitoring, floodplain forests.

SPATIALLY-EXPLICIT HIERARCHICAL MODELS OF ANIMAL COUNTS.

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Most wildlife researchers do not employ Bayesian approaches to wildlife problems because they are unfamiliar with Markov Chain Monte Carlo (MCMC) methods. This is unfortunate because MCMC can fit more complex models than is feasible through conventional methods. We utilized an MCMC approach to spatially predict abundance of 11 rare avian species in the Upper Midwestern US. The model is an overdispersed Poisson regression with fixed and random effects; 21 years of North American Breeding Bird Survey counts occur as a loglinear function of explanatory variables describing habitat, spatial relatedness, and nuisance effects (differences between observers). We also included a year effect to control for trends in counts over time. The model includes a conditional autoregressive term representing the correlation between adjacent routes. Explanatory habitat variables in the model included land cover composition and configuration, climate, terrain heterogeneity, and human influence. The model is hierarchical in that distributions of the data and parameters are described conditionally on realized values of parameters that are also random variables. Because there is no closed-form expression for such an approach, the model must be fitted by iterative simulation. The program WinBUGS conducts these MCMC iterative simulations. As an example of our work with this model, we mapped regional patterns in Cerulean Warbler (*Dendroica cerulea*) abundance based on a model containing the percentage of woody wetlands, an index of wetness potential, and the interaction of annual precipitation and deciduous forest patch size. We conclude that Cerulean Warblers are most abundant in dry areas within moist forested landscapes, with their sensitivity to forest patch size modified by regional gradients in precipitation. This species is most abundant in the largest forests where precipitation is greatest. This model explained 32% of the variation in Cerulean counts, a sizable portion given that specific site-level habitat information (e.g., canopy cover, understory stem density) was not represented in the model. This Bayesian approach is not limited to spatial models of avian abundance; furthermore, this family of hierarchical models is extensible to a wide range of natural resource questions.

Keywords: Bayesian analysis, Breeding Bird Survey, Markov Chain Monte Carlo, Poisson, WinBUGS

INTERACTIONS BETWEEN THE HYDROID *CORDYLOPHORA SP.* AND THE ZEBRA MUSSEL *DREISSENA POLYMORPHA* IN TWO MIDWEST RIVERS.

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The freshwater-brackish hydroid *Cordylophora sp.* (Phylum Cnidaria) and the zebra mussel *Dreissena polymorpha* (Phylum Mollusca) are invasive species found to coexist in many waterways worldwide. Both are epibenthic organisms that foul ship hulls, dock pilings, and power plant intake pipes, and disrupt native ecosystems. It has been proposed that *Cordylophora* may enhance zebra mussel larval settlement by providing an appropriate filamentous substrate or may inhibit larval settlement by eating zebra mussel larvae. The purpose of this study was to clarify the relationship between hydroid filaments and mussel larvae as these two Ponto-Caspian organisms co-exist within the Mississippi River system. Field experiments in the Des Plaines River, IL, where both zebra mussels and hydroids co-exist, were conducted to determine the effects of the hydroid on mussel settlement. Settlement plates with live, dead, and no *Cordylophora* were deployed. In addition, settling plates with hydroid "mimic" polypropylene filaments attached were placed in the Bark River, Wisconsin, in a location where *Cordylophora* has not yet been found but *Dreissena* is abundant. Larval samples were taken weekly at both sites to document the supply of zebra mussel larvae of settlement size. Preliminary results indicate that artificial filaments enhance mussel settlement while live and dead colonies at the Des Plaines location enhance settlement of a variety of invertebrate fauna. Zebra mussel larvae presented to *Cordylophora* in the laboratory were consistently rejected or failed to be ingested, suggesting that *Cordylophora* rarely consumes zebra mussel larvae. These data will help clarify the effects of the filamentous *Cordylophora sp.* on larval settlement of *Dreissena polymorpha* and their combined effects on native communities.

Keywords: Invasive species, *Cordylophora sp.*, *Dreissena polymorpha*, fouling organisms, Ponto-Caspian

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HYDRODYNAMIC CHARACTERIZATION OF FRESHWATER MUSSEL HABITATS IN THE UPPER MISSISSIPPI RIVER.

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Human activities in the Upper Mississippi River Basin have caused a significant decline in freshwater mussel populations. One contributing factor is the construction of navigation dams and river training structures on the main stem of the Upper Mississippi River (UMR). These structures have resulted in the slowing and redirection of flow through the braided channel system, severely impacting mussel habitats. The goal of the research described is to develop a more complete understanding of hydrodynamics within mussel habitats in hopes of providing information useful in the preservation and restoration of mussel populations in the UMR. Research efforts will involve a comprehensive data collection program in Pool 16 of the UMR, characterizing hydraulics, water quality, and substrate in the reach. Statistical treatment of the data will be used to correlate measured parameters with mussel density and habitat quality.

Methods will include collection and analysis of data describing the bathymetry, flow fields, water chemistry, sediment gradation and chemistry, and mussel location and density. A bathymetric survey, begun in 2002, will define the geometry of the riverbed at reach and habitat scales. Velocity data will be collected using acoustic Doppler velocimetry (ADV). ADV measures time series of fine-scale three-dimensional velocities, allowing for a detailed description of velocity fields and useful in characterizing shear stress and turbulence. Water quality, sediment, and mussel data will be collected using conventional methods. The use of side-scanning sonar is currently being investigated as a supplemental means of measuring substrate composition, locating mussel beds, and quantifying mussel density.

Bathymetric and velocity data will also be used to develop numerical simulations using computational fluid dynamics (CFD). Numerical simulation will provide a means of studying hydrodynamics under the wide range of flow conditions experienced by UMR species, as well as the relationship between scale and the influence of individual hydrodynamic parameters on habitat quality.

Keywords: Upper Mississippi River; bathymetric survey; freshwater mussels; hydrodynamics; habitat

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RELATIONSHIPS BETWEEN FISH COMMUNITIES, HABITAT TYPES, AND ENVIRONMENTAL GRADIENTS IN THE UNIMPOUNDED MISSISSIPPI RIVER.

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Spatial variation of fish communities was investigated in response to environmental gradients within five habitat types in the unimpounded Mississippi River. These habitats included main channel border, wing dike, open-side channel, closed-side channel, and tributary. Data on fish communities, environmental measurements, and habitat measurements were collected between Upper Mississippi River (UMR) miles 30 and 80 from 1993-2000 during three annual sampling periods. Partial Canonical Correspondence Analyses revealed variation within the habitat types and between the sampling gears, years, periods, and age groups (i.e., young-of-the-year and adults). Habitat use was different for many young-of-the-year fish when compared to adults of the same species. Sampling gears employed in this study did not sample the fish community equally and no gear type was effective in sampling all subsets of the community. The fish assemblage in this river reach differed the most in 1994. Many of the adults were associated with all three annual sampling periods while young-of-the-year fish were often associated with specific sampling periods. The three main environmental gradients influencing community structure for both age groups included river stage height, surface water velocity, and conductivity. Young-of-the-year goldeye (Hiodon alosoides) and adult blue catfish (Ictalurus furcatus) were associated with increased surface water velocity. Young-of-the-year common carp (Cyprinus carpio) and freshwater drum (Aplodinotus grunniens) were associated with high river stage height. High river stage height, flooded terrestrial habitat, and increased surface water velocity corresponded with the first sampling period (June 15-July 30), while increased visibility, decreased surface water velocity, and low river stage height corresponded with the third sampling period (September 16-October 30). The results of this study are instrumental in better understanding the ecological relationships that exist within the unimpounded Mississippi River.

KEYWORDS: Mississippi River, environmental gradients, habitat, fish community, multivariate analysis, ordination.

QUANTITATIVE SELECTION OF A SPECIES LIST FOR REVEGETATION OF REED CANARYGRASS COMMUNITIES.

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Reed canarygrass (*Phalaris arundinacea* L.) is an aggressive cool-season grass that invades wet meadows, sedge meadows, and wet prairies. Though various management strategies have been proposed to control this species, habitat restoration may ultimately require reintroduction of appropriate native species. The objective of this study was to develop a list of native species such purposes. We surveyed 11 sites along the upper Mississippi River and several of its tributaries, 10 of which were dominated by reed canarygrass and a reference site that was dominated by native species. We recorded the presence of all herbaceous species within a 1-hectare plot at each site and calculated coefficients of conservatism and indices of floristic quality. Of the 88 species recorded in the reed canarygrass sites, 54 were native (mean number of native species per site = 17). Based on their presence in $\geq$ 30% of the sites, we complied a planting list of 21 native species (8 graminoids and 13 forbs) for use in areas after reduction of reed canarygrass has been achieved.

Key words: Reed canarygrass, *Phalaris arundinacea*, Mississippi River, revegetation, species list

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RAREFACTION ANALYSIS TO DETERMINE SUB-SAMPLING EFFORT FOR ESTIMATING CHIRONOMID DIVERSITY IN MINNESOTA FARM PONDS.

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Farm ponds experience a variety of disturbances from agricultural practices. Sediments, pesticides, herbicides, and fertilizers are transported by run-off from surrounding-agricultural watersheds and deposited into receiving ponds. Non-biting midges (Chironomidae: Diptera) are one of the largest families of aquatic insects, with representatives found in almost every aquatic habitat. The wide geographical range and diverse composition of chironomid assemblages makes this group very useful for assessing ecological change in a variety of aquatic habitats. Chironomid larvae have been used as biological indicators for lakes and rivers, but little work has focused on ponds. The objective of this study is to determine how patterns in chironomid richness, relative abundance, and instantaneous growth vary across farm ponds under different land uses. Larvae were collected from four types of farm ponds, based on wetland type and adjacent land uses: (1) natural wetlands, and constructed agricultural ponds adjacent to (2) row crop agriculture, (3) grazed grassland, and (4) non-grazed grassland. Constructed ponds were classified based on the land-use practices within the first 100 m of their surrounding drainage basin. The epi- and in-faunal chironomid assemblages were sampled in each pond over a three-month period during the summer of 2001. A pilot study was conducted with samples collected from the summer of 2000 in order to determine sub-sampling effort. Rarefaction was used to determine the minimum number of larvae needed to adequately estimate chironomid diversity across pond type. The rarefaction plot showed a horizontal asymptote around 14 genera that corresponded with 70 larvae per sample whereas at 100 larvae per sample, only one additional genus was represented. Thus, it proved more efficient to measure, mount and, identify up to 70 larvae from each sample. Taxonomic richness, relative abundance, and instantaneous growth within the chironomid assemblages will be compared to develop an index for monitoring disturbances in farm ponds.

Key words: chironomids, farm ponds, southeastern Minnesota, rarefaction, taxonomic richness

NITROGEN CYCLING DURING SEDIMENT DESICCATION AND REWETTING IN THE UPPER MISSISSIPPI RIVER, NAVIGATION POOL 8.

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In summer 2002, a 14-week water level drawdown was conducted in Navigation Pool 8 of the Upper Mississippi River for the primary purpose of consolidating sediments and stimulating vegetation growth along the river margins. We used this opportunity to investigate the effect of water level manipulations on nitrogen cycling processes. Nitrogen concentrations and nitrogen cycle processes were measured bi-weekly before, during, and after the drawdown from a 10-site experimental transect that dried during the drawdown and from another 10-site reference transect that remained inundated. During the dry period, porewater nitrate (NO_3^-) concentrations and rates of nitrification and denitrification increased in the experimental transect whereas denitrification enzyme activity (DEA) rates and exchangeable ammonium (NH_4^+) concentrations decreased ($p < 0.05$, RM ANOVA), compared to those in the reference transect. The increase in nitrification in the experimental transect was likely in response to increased aeration in the sediments. This resulted in higher levels of available NO_3^-, which subsequently enhanced denitrification. The inverse relationship between denitrification and DEA rates could be attributed to concurrent desiccation-induced degradation of denitrification enzymes and enhanced enzyme efficiency from an increase in denitrification. The decrease in NH_4^+ likely resulted from increases in nitrification and plant uptake. After rewetting, nitrification, denitrification and pore water NO_3^- returned to levels similar to the reference sites, although DEA rates and NH_4^+ remained lower in the sediments that previously dried. Overall, there was an apparent, but not significant reduction in total nitrogen in the sediments of the experimental transect. Although nitrification and denitrification rates increased, indicating a net nitrogen loss, it was not sufficient to show a significant affect in the high total nitrogen levels in the sediment (near 2000 mg/L). Our results demonstrate that water level manipulations do promote some nitrogen loss from the sediment by stimulating nitrogen cycling processes, however a pronounced reduction in total sediment nitrogen may require extended dry periods or multiple manipulations.

Keywords: drawdown, desiccation, nitrification, denitrification, Mississippi River

LONG-TERM WATER TEMPERATURE MONITORING ON THE ST. CROIX NATIONAL SCENIC RIVERWAY.

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The St. Croix National Scenic Riverway (Riverway), one of the original components of the National Wild and Scenic River System, hosts an incredible diversity of aquatic life. Protecting and enhancing that diversity is an important goal of the National Park Service and our cooperating state and federal agencies. The Riverway's biodiversity is a reflection of the good water quality and habitat found within the river. A key abiotic characteristic of the Riverway is its water temperature. The influence of water temperature on aquatic life and ecosystem processes is well documented. With the mounting evidence of global warming, and concern about local influences on water temperature (such as loss of riparian vegetation, changes in runoff patterns, loss of groundwater contribution, and increasing development and impervious surfaces in its watershed), Riverway managers felt the need to establish a long-term water temperature monitoring network. This information will aid river management partners in future decision-making regarding land use planning and river management, determine if remedial actions are needed, and provide important baseline data for aquatic research.

To implement this program, a series of HOBO® recording thermometers have been placed in the St. Croix and Namekagon Rivers, from the headwaters to Stillwater, MN. A standard protocol is used for the placement of each thermometer. For over three years these HOBOs ® have recorded temperature every 15 minutes from May through October. The data is analyzed annually (and graphically highlighted) to note changes and trends. Comparison is made with ambient air temperatures. This long-term monitoring activity will be used to help pinpoint possible changes and threats to Riverway habitat and sensitive species.

Keywords: water temperature, St. Croix River, HOBO, development, runoff

A REGIONAL WETNESS INDEX MODEL, WITH APPLICATION TO MAPPING AVIAN HABITAT ASSOCIATIONS.

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Vernal pools, ephemeral wetlands, sedge and fresh meadows, and wet prairies contain water for only part of the year, and are among the most threatened wetlands. These wetlands were once common in the prairie biome, but many have now been drained for farmland or filled for development. They support a wide variety of flowering plants, crustaceans, insects, reptiles, amphibians, and mammals, and are important food- and rest-stops for migrating birds. Regional maps of ephemeral wetlands are not available primarily because they are difficult to identify using standard remote sensing technology. While wetlands maps are available by state, each state uses somewhat different approaches to mapping wetlands. To provide a consistent and seamless surrogate to ephemeral wetlands at the regional geographic scale, we mapped a static wetness index for the Upper Midwest. Topographic indices such as the static wetness index have been widely applied in hydrology and were originally developed to predict zones of surface saturation, patterns of soil moisture, and saturation deficit. There are various measures of static wetness, but the measure we used is ln(Catchment Area/tangent of the slope angle). The catchment area is the upslope area draining into the location of interest. Shallow areas are more likely to catch water than steep areas, and ridge tops have less upslope contributing area than valley bottoms. We provide the hierarchy of geographic information system processes we used to produce this index using only digital elevation models and hydrological units as boundings. We show how the location of wet meadows and seasonally-inundated woodlands can be predicted with our model. We applied the wetness index in a habitat model for the Cerulean Warbler (*Dendroica cerulea*). We found that the wetness index was an important predictor of Cerulean Warbler abundance within the Prairie-Hardwood Transition Ecoregion (BCR 23). Because ephemeral wetlands are important habitats for a wide variety of wildlife, further model development of wetness potential will have wide application.

Keywords: static wetness index, hydrological units, digital elevation models, National Wetland Inventory, bird habitat model

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EFFECTS OF ZEBRA MUSSEL INFESTATION ON GENETIC DIVERSITY OF NATIVE MUSSEL SPECIES.

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Two species of native unionids, *Amblema plicata* and *Pyganodon grandis*, were collected to determine if variation in zebra mussel (*Dreissena polymorpha*) surface area infestation effects genetic structure among host populations found in Pool 19 of the Mississippi River. Foot muscle tissue taken from frozen samples was the source of soluble enzymes. From these tissue preparations, allozyme variation was quantified using starch gel electrophoresis to separate enzymes encoded by 11 presumptive structural loci. Deviations from Hardy-Weinberg expectations, mean heterozygosity values and similarity phenograms were constructed using BIOSYS1 (Swofford and Selander 1981). Initial investigations into *A. plicata* suggest that low average zebra mussel infestation (.55 zebra mussels/host) results in heterozygote deficiency (-0.027). In other *A. plicata* populations where infestation is higher, ranging from 8.8 zm/host to 104.8 zm/host, the heterozygote deficiency is smaller -.008 to +.005. This may be a result of the longer life expectancy of *A. plicata* where a pre-selection population (low zm) contrasts with a population that is currently undergoing selection. In *P. grandis*, the heterozygote deficiency ranges from -.054 in a population with 6.7 zm/host to a population with -.026 heterozygote deficiency with 177.7 zm/host. The variation in *P. grandis* may be the result of populations that occur at least one generation after initial infestation. However, because of the shorter life expectancy and subsequent generation time of P. grandis, it may be there is a completely different frequency of alleles in founder populations before infestation resulting in a different process from the other species. Further investigations will be required to determine the full genetic impact zebra mussels have on native unionid populations, both in areas where infestation has existed for several years versus areas where the zebra mussels have not yet invaded.

Keywords: *Dreissena polymorpha*, mussels, Mississippi River, electrophoresis, parasitism.

A COMPARISON OF MACROINVERTEBRATES AS FACTORS IN DETERMINING BIOLOGICAL INTEGRITY: AN INDEX OF WATER QUALITY FOR MULTIPLE STREAMS.

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We are participating in an assessment of groundwater-dependent water resources flowing into the Saint Croix River from Washington County, Minnesota. The quality of groundwater reaching the land surface represents an amalgamation of physical, chemical and biological processes along its entire underground course. Traditional groundwater assessments relying on well-testing reflect single samples in time and space, and may not reflect water quality conditions when groundwaters re-emerge at springs. Our goal is to judge the feasibility of using macroinvertebrate communities in spring runs, located near terminal springs, as indicators for overall groundwater quality. We used the following physical components of 21 spring-fed streams to develop alternative classifications of the springs: geomorphologic setting, surface watershed size, riparian vegetation structure, discharge, water chemistry, and substrate attributes. Community-level data from kick net samples of macroinvertebrates, collected seasonally over one year, were analyzed using Mean Similarity Analysis to determine which of the alternative classifications based on physical components was best supported by invertebrate community data. Our results suggest classifications based on water chemistry and substrate attributes are more strongly supported than classifications based on discharge and size of surface watershed. A classification based on riparian vegetation structure was not strongly supported. For this presentation, the January macroinvertebrate data will be highlighted.

Keywords: biological index, macroinvertebrates, groundwater, streams, St. Croix River

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TUNDRA SWAN RESEARCH NEEDS ON THE UPPER MISSISSIPPI RIVER.

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The Upper Mississippi River (UMR) has become an important stopover area for the Eastern Population of Tundra Swans (*Cygnus columbianus columbianus*) during fall migration in recent years. During 1997 through 2002, annual fall swan use averaged more than 760,000 use-days. This represents a 700% increase in river-wide swan use from the early 1980s based on use-day estimates. Swan numbers on the UMR peaked in excess of 31,000 during late-November 2002 and represented a substantial portion of the Eastern Population (2001/02 Midwinter Index was 104,100). Because of the increased public interest in swans and the responsibility for management of the UMR for this trust species, river managers and biologists have identified and prioritized research needs that would provide important information to support the wise management of Tundra Swans. Among the research needs identified were (1) determine the importance of the UMR to the Eastern Population of Tundra Swans, (2) assess the availability of food resources and the impacts of Tundra Swans on those resources on the UMR, (3) determine local movements and the distribution of Tundra Swans on the UMR, (4) determine the impact of waterfowl hunting and the Closed Area program on swan movements and distribution, (5) evaluate public interest in swans, and (6) determine the amount and distribution of Trumpeter Swan (*Cygnus buccinator*) use of the UMR. Federal and state partners are working to expand efforts to address these research areas. The accrued information should guide river resource managers in development and implementation of management strategies for enhancement of the UMR as an important resource for swans.

Keywords: *Cygnus columbianus*, management, research needs, tundra swan, Upper Mississippi River

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VEGETATION RESPONSE TO A DEMONSTRATION DRAWDOWN ON POOL 8 OF THE UPPER MISSISSIPPI RIVER.

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In an effort to enhance aquatic plant production and habitat diversity on the Upper Mississippi River (UMR), the U.S. Army Corps of Engineers St. Paul District conducted a pilot water level reduction on Navigation Pool 8 of the UMR during summer 2001 and again in 2002. The water level reduction was expected to dry and consolidate bottom sediments and, thereby, increase the area of emergent and submersed aquatic vegetation by natural seed germination. We assessed vegetation response to the water level reduction during the drawdown through (1) use of high-resolution aerial photography and land cover data generated from that photography, (2) field measures of the distribution and biomass of submersed aquatic vegetation (SAV), and (3) field measures of the composition and productivity of moist soil and emergent perennial vegetation on exposed substrates. The drawdown and/or spring flooding in 2001 likely contributed to an increase in deep marsh annual, shallow marsh perennial, wet meadow, sand bar, submersed aquatic vegetation, wet meadow shrub, shallow marsh annual, and mud communities in Pool 8. Plant communities that developed on exposed substrates in response to the Pool 8 drawdown in 2001 were dominated by arrowhead (*Sagittaria spp*.), false pimpernel *(Lindernia dubia*), water stargrass *(Zosterella dubia*), teal love grass (*Eragrosits hypnoides*), rice cutgrass *(Leersia oryzoides),* and flatsedge (*Cyperus spp*.). We observed a shift from a plant community dominated by annuals to one dominated by perennials in 2002. Arrowhead tuber production increased 16-fold (0 = 3.4 g/m^2 in 2001 vs. 55.3 g/m^2 in 2002) across transects we examined during the two years. In general, submersed aquatic vegetation did not appear to be negatively effected by the drawdown. Submersed aquatic vegetation standing crop biomass was significantly lower in 2000 and 2001 (0 <20 g/m^2) from 1999 levels (35 g/m^2) and rebounded to 32 g/m^2 in 2002. In the near future, we will determine the persistence of emergent perennial plant beds that were reestablished as a result of the drawdown and continue to assess the distribution and abundance of submersed aquatic vegetation.

Keywords: drawdown, moist soil, Navigation Pool 8, vegetation response, water level management

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COMMUNICATING SCIENTIFIC RESULTS USING MULTIMEDIA VIDEOS.

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With recent technological advances, high-powered computers and digital cameras are widely available and can now be used to create multimedia videos. Researchers can use these tools to communicate scientific results in a way that appeals to a general audience. During the fall of 2002, we created a video for a research project on amphibians. The study used radio telemetry to track movements of northern leopard frogs (*Rana pipiens*) in an agricultural landscape. Video production requires the use of digital video cameras, computers, and editing software. We recorded and captured digital video of field workers tracking frogs, scientists describing results, and the comments of a landowner. We transferred the video to a computer, and edited and produced a five-minute video summarizing the project. The public will view the video from the project web page and we plan to show the video during the poster session. We used a Sony digital video camera to record footage. The video capturing process used editing software to upload the recorded tape; we used Pinnacle Studio version 8 software for capturing, editing, and production. The final product, including video, audio, and pictures, will be produced and made available through the project page on the USGS Upper Midwest Environmental Sciences Center website (http://www.umesc.usgs.gov/). Videos created for websites are necessarily of lower quality than professional videos because the file must be compressed to accommodate Internet limitations. Even though the equipment to produce such a video is fairly inexpensive and relatively easy to use, the process of learning to tape, edit, and produce video can be time consuming. However, the educational benefits of using video to convey science information may outweigh the costs. A short video communicates many aspects of science that an article cannot. For instance, video can illustrate the sights and sounds of different habitats and animal behaviors, and can demonstrate study methods. Internet technology has increased the utility of short informational videos for communicating science information to the public. Videos can also enhance presentations to other scientists at conferences and meetings. Scientists and the general public can benefit from the use of videos to communicate science.

Keywords: video camera, Pinnacle Studio, internet, *Rana pipiens*, science communication.

CHANGES IN AQUATIC VEGETATION BETWEEN 1975, 1991, AND 2002 NEAR STODDARD, WI, POOL 8, UPPER MISSISSIPPI RIVER SYSTEM.

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Aquatic vegetation surveys were conducted near Stoddard, WI in Pool 8, Upper Mississippi River System (UMRS), in 1975, 1991, and 1998 through 2002. Percent frequency of aquatic vegetation detected along fixed transects decreased dramatically from 1975 to 1991. By the 1998-2002 period, data from stratified random samples taken in the same areas as the transects suggested aquatic vegetation had rebounded to near 1975 levels. In his study in 1991, Fischer hypothesized that increased exposure to wind fetch due to loss of small islands in the area, along with other factors, may have contributed to the decline in aquatic vegetation between 1975 and 1991. In 1997, a habitat rehabilitation and enhancement project was begun in the Stoddard area of Pool 8. This project provided a sheltered area that likely helped promote aquatic vegetation growth after 1998.

Eleven species were recorded in 1975, four species in 1991, and 14 species in 1998-2002. All 11 species recorded in 1975 were found in the 1998-2002 sampling period. *Vallisneria americana* Michx. was the dominant species in 1975 and was co-dominant with *Heteranthera dubia* (Jacq.) MacM. in the 1998-2002 sampling period. *Myriophyllum spicatum* L., an exotic species not recorded in 1975, was the fifth most dominant species in 1998-2002. Overall, community structure and species dominance was very similar between 1975 and 1998-2002. Between 1975 and 2002, aquatic vegetation in the area near Stoddard, WI, Pool 8, UMRS declined drastically and then rebounded.

Keywords: aquatic vegetation, Mississippi River, Pool 8, trends

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FACTORS INFLUENCING SPATIAL VARIATION IN NITROGEN FIXATION.

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The Upper Mississippi River (UMR) transports a substantial load of nitrogen (N) through its mainstem. Nitrogen is not considered to be a limiting nutrient within the system. However, summer blooms of the cyanobacterium *Aphanizomenon* sp., a genus capable of fixing atmospheric nitrogen (N_2), when limited by nitrogen, are common in many areas of the river. Microscopic examinations of *Aphanizomenon* sp. indicate the presence of N-fixing heterocyst cells. We investigated the relationship among nutrient levels and spatial variability of nitrogen fixation by *Aphanizomenon* at the Trempealeau National Wildlife Refuge, Trempealeau, WI, and the nearby Trempealeau and Mississippi Rivers. Elevated nitrogenase activity (652.0 ug-$N/m^3/h$) was observed within the refuge pools compared to that in the rivers (44.7 ug-$N/m^3/h$). The refuge pools are not directly connected to the adjacent rivers during summer periods and total nitrogen levels are lower than in areas connected to the Mississippi main channel. In our study, N:P ratios were generally lower where nitrogen fixation rates were higher suggesting that an imbalance in the Redfield ratio (C:N:P=106:16:1) plays a part in nitrogen fixation regulation, but other factors may also be involved. In nutrient addition experiments, control and phosphate treatments showed an increase in nitrogen fixation between days four and seven, whereas, the addition of nitrate yielded no nitrogen fixation over the 11 day period. These results further suggest that nitrogen limitations may be the primary regulator of nitrogen fixation in the system. Given the load of nitrogen transported through the UMR system it is interesting that some isolated areas during the summer exhibit nitrogen limitations to the degree that nitrogen fixation is promoted.

Keywords: nitrogen fixation, acetylene reduction, Aphanizomomenon sp., Mississippi River.

EFFECTS OF REED CANARY GRASS (*PHALARIS ARUNDINACEA*) ON TERRESTRIAL ARTHROPOD ABUNDANCE, BIOMASS, AND DIVERSITY IN UPPER MIDWESTERN RIPARIAN WET MEADOWS.

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Reed canary grass occurs in temperate regions of the northern hemisphere and is native to North America. However, cultivated Eurasian strains, introduced to the United States by European settlers, blended with the native varieties and made reed canary grass more aggressive. Reed canary grass tolerates a wide range of growing conditions, and is considered invasive because it can quickly develop into dense, monotypic stands that displace native vegetation. Invasive plant species, such as reed canary grass, have altered grasslands and wetlands by reducing plant diversity and structure. Studies have shown that plant diversity and arthropod diversity are positively correlated. Arthropods are abundant in terrestrial habitats and are critical components of ecosystems. However, little is known about how arthropods respond to the presence of reed canary grass. The purpose of this research was to determine if abundance, biomass, and diversity of arthropods were higher in areas dominated by diverse, native vegetation compared to areas dominated by reed canary grass. Arthropod sampling was conducted in July 2001 and July 2002 at 12 and 13 wet-meadow/grassland plots, respectively, in southeastern Minnesota and southwestern Wisconsin. The plots varied in size from 4.5 ha to 16.5 ha and ranged from low to high reed canary grass abundance. Arthropods were sampled with sweep-nets at randomly selected points on each plot, which represented one sweep-net sample per 1.5 ha of plot (n=73 in 2001, and n=80 in 2002). For each sample, the number of arthropods, the wet weight (g) of the total sample, and the number of individuals in each Order were recorded. Preliminary results suggested that average arthropod numbers were similar among the plots, but average sample biomass tended to be slightly higher in plots with low and intermediate levels of reed canary grass. Also, the average number of Orders represented in samples for each plot were similar, but there may be differences in the average number of individuals per Order related to reed canary grass abundance on the plots. Additional analysis of the 2001 data and analysis of the 2002 data are currently in progress.

Keywords: invasive species, *Phalaris arundinacea*, reed canary grass, terrestrial arthropods, wet meadows

STABLE ISOTOPES AS A SEDIMENT FINGERPRINTING TECHNIQUE.

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The United States Geological Survey (USGS) and the National Institutes for Water Resources (NIWR) have highlighted non-point source sediment-bound pollutants, their source and fate, as Research Priority Area A in the request for proposals. One goal in the second decade of the National Water-Quality Assessment (NAWQA) program is to improve explanation and understanding of the sources of contaminants and their transport through the hydrologic system. Basin and subbasin scale data in Iowa State, such as those collected for the mainstem Mississippi River (e.g., Mississippi River at Clinton) and Lower Cedar River Watershed in Eastern Iowa as part of NAWQA, demonstrate that soil erosion is a substantial problem. During intense runoff, large quantities of soil originated from multiple land uses (e.g. agriculture, deforestation, cattle grazing, urban) are transported to streams causing increased turbidity and siltation and thus degrading the aquatic habitat and aesthetic quality of the streams.

There is, therefore, a clear need to develop an effective tracing technique to identify the source of sediment within a basin that is essential for developing appropriate strategies to control sediment mobilization and associated offside effects, such as the siltation of river channels and reservoir sedimentation. The research that is proposed here explores the potential of geochemical techniques such as carbon and nitrogen stable isotopes (i.e., isotopes that do not decay with geological time) for identifying sediment sources in a case study for the Lower Cedar River Watershed. The multiple land uses that exist within the Lower Cedar River Watershed include the production of row crops, such as corn, the production of cover crops, such as alfalfa and small grains, deciduous forest cover, and industrial facilities and urban housing. Erosion prone areas of the watershed are comprised of nearly 60 percent agricultural/urban riparian systems and 40 percent riparian. These vegetative differences allow the use of C/N atomic ratios and C and N isotopic signatures for source identification.

Carbon isotopes can be used to distinguish between organic matter derived from different plants, particularly between plants that use C3 (trees, shrubs and some grasses) vs. C4 (bamboo, corn, and many grasses) photosynthetic pathways because the two pathways impart very distinct isotopic signatures on the plant tissue (Stevenson 1997). The nitrogen isotopic composition of sediments will reflect the isotopic composition of their source sediment. Importantly, introduction of fertilizers and microbial activity associated with agriculture can either lower or increase the nitrogen composition of a soil, depending on the type of fertilizer used. Therefore cultivated soils are often isotopically distinct with respect to nitrogen from their uncultivated equivalent (e.g. Broadbent et al., 1980). The C/N ratios will reflect the presence of an active biological milieu altering the elemental composition of soils.

Keywords: Stable isotopes, geochemical tracers, sediment sources, Palouse watershed

BOOTSTRAPPING TO CREATE NON-PARAMETRIC CONFIDENCE INTERVALS FOR SELECTION RATIOS OF FEEDING SITES OF GREAT BLUE HERONS ON THE UPPER MISSISSIPPI RIVER SYSTEM.

Sarah Timm[1], Christine Custer[1,2], Douglas Olsen[1].
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Selection ratios are often used in resource selection studies to give an indication as to whether or not a particular resource (often a habitat) is being selected, avoided, or used in proportion to availability. Selection ratios are advantageous because they do not depend on what types of habitats are deemed available (unlike chi-squared tests). Confidence intervals do, however, depend on the assumption that selection ratios are normally distributed, something that appears to be true only if each category (selected and available sites has a 'moderately large' (e.g. $n \geq 5$) sample size. When these assumptions do not hold, bootstrapping can be used to create confidence intervals free of distributional assumptions. Data from a study of Great Blue Heron *(Ardea herodias)* feeding sites in the Upper Mississippi River System are used as an example.

Keywords: Resource Selection, Selection Ratios, Bootstrap Confidence Intervals, *(Ardea herodias)*

HABITAT PREFERENCE AND GROWTH OF THE GLASS SHRIMP (*PALAEMONETES KADIAKENSIS*) IN THE UPPER MISSISSIPPI RIVER, DUBUQUE COUNTY, IOWA, AND VERNON COUNTY, WISCONSIN.

Amy Waterman, Shelly Klein, Rebecca Rogis, and Daniel Call.
Environmental Science Program, University of Dubuque, Dubuque, IA 52001.

During the months of April through September 2002, a study was conducted on the Mississippi River on a somewhat overlooked species, *Palaemonetes kadiakensis*, otherwise known as the glass or ghost shrimp. This study evaluated the type of habitat the shrimp preferred, and measured growth over the spring and summer months. Measurements of body weight, body length, and antenna length were made of collected animals. Various local sites on the Mississippi River and tributary streams in Dubuque County, Iowa, were sampled to provide a variety of habitat types. The shrimp was only found at one of these sample sites, where it was collected repeatedly. Glass shrimp were also collected in the Mississippi River at Vernon County, Wisconsin, in comparable habitat. Shrimp were collected by means of seines and mini fyke nets. Some of the habitat observations and measurements that were made included a listing of dominant plant species, dissolved oxygen, turbidity, and water temperature. This preliminary study suggests that most glass shrimp in this area have a single breeding season, likely in late May or early June, and a one-year life span. Additional sampling will be required during this period to obtain gravid females and early juvenile animals. One exceptionally large individual in our samples that was collected in September may have been from the previous year-class.

Keywords: glass shrimp, invertebrates, macroinvertebrates, *Palaemonetes kadiakensis*, Mississippi River, freshwater shrimp

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WEB-BASED APPLICATIONS SUPPORT BIRD CONSERVATION PLANNING.

Shawn E. Weick[1], Timothy J. Fox[1], J.C. Nelson[1,3], John C. Sauer[2], Wayne E. Thogmartin[1], Melinda G. Knutson[1].
[1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.
[2]U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, Maryland 20708-4039.
[3]University of Wisconsin-La Crosse, River Studies Center, La Crosse, WI 54601.

Conservation planning to meet the needs of migratory birds is one of the biggest challenges facing many federal agencies. The North American Bird Conservation Initiative (NABCI) calls for on-the-ground initiatives designed to support populations of all bird species. To implement these initiatives, high priority species and potentially important bird habitats must be located. A wealth of information that could be applied to conservation planning exists, but is not generally available to managers. For example, 37 years of data describing bird populations exists in the Breeding Bird Survey (BBS) database. Information about landscapes and human use patterns is available in GIS databases such as the National Land Cover Database (NLCD) and the U.S. Census. At present, managers and planners at state and federal levels do not have simple ways to access, summarize, or synthesize spatially explicit data from these diverse data sources. We are currently developing maps that summarize bird, land use, and human census information at scales relevant to planners. We anticipate that these maps will be useful for developing location-specific bird conservation plans. We are developing applications using an ArcIMS platform that will allow managers to access maps and run analyses via the Internet. In addition, managers will be able to download the results as GIS coverages for local use. We are working to incorporate these applications into a node in U.S. Geological Survey's (USGS) National Biological Information Infrastructure (NBII; www.nbii.gov). NBII provides online analytical tools to help people utilize, explore, understand, and better manage our nation's natural resources. The NBII Bird Conservation node provides access to data and information in support of bird conservation across North America.

Keywords: NBII, Bird Conservation, North American Bird Conservation Initiative, Bird, Breeding Bird Survey

DECISION SUPPORT SYSTEM FOR AQUATIC RESOURCES IN THE MIDDLE MISSISSIPPI RIVER.

Steven J. Zigler[1], Jason Rohweder[2], and Robert A. Hrabik[3].
[1] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, Wisconsin 54603, [2] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 575 Lester Ave, Onalaska, Wisconsin 54650, [3] Missouri Department of Conservation, Fisheries Research, Assessment, and Monitoring Section, Open River Field Station, 3815 East Jackson Boulevard, Jackson, Missouri.

The Middle Mississippi River and its floodplain have been substantially modified to accommodate multiple human uses that include urban development, navigation, and agriculture. There is growing need for a framework to synthesize biological and physicochemical data layers to guide decisions about aquatic resources made by managers and policymakers in state and federal agencies. In particular, fisheries resource issues including endangered species (e.g., pallid sturgeon), habitat availability and modification, and navigation effects have become significant topics of discussion. We are developing a GIS-based decision support system (DSS) to provide decision-makers with a spatially explicit tool for inventorying existing knowledge, developing models to investigate potential effects of management decisions, and developing scientifically defensible studies and monitoring. To facilitate development of the DSS, an interagency workshop focusing on hydrologic and other potential system drivers of aquatic habitats was held during winter 2002. We discuss the results of the workshop, and the process of constructing the DSS for the Middle Mississippi River.

Keywords: Middle Mississippi River, decision support, GIS, aquatic resources

MINUTES OF THE 2002 BUSINESS MEETING
ANNUAL MEETING OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

26 April 2002
The meeting was called to order at 12:49 by Brent Knights (President), Jeff Arnold (Vice-President), Mike Romano (Secretary), and about 60 other members were present. Neal Mundahl (Treasurer) was not present at the meeting.

Minutes
A motion to accept the Minutes from 27 April 2001 Business Meeting was seconded and approved by acclimation.

President's Report
President Knights announced that the number of 128 participants at this year's meeting was roughly equal to the number who attended last year (132).

President Knights acknowledged the efforts of the Executive Committee (Neal Mundahl, Mike Romano, and Jeff Arnold). He singled out Georginia Ardinger and Mike Dewey for their outstanding efforts on registration. President Knights also thanked Heidi Imker (t-shirt design), Ginny Stefanez and her folks (computer and AV equipment), John Kalas (poster boards), Bill Meyer (setup and teardown), and Mike Caucutt (maintenance of the website). Brent also thanked all judges and moderators for their contributions to this year's meeting. Terry Dukerschein and Randy Hines were recognized for photography and Mike Dewey was again acknowledged for his contributions on the raffle and the organization of the high school poster session.

Treasurer's Report
Treasurer Neal Mundahl was not present at the Annual Meeting, so President Knights gave the report on his behalf. The report was published on page 75 of the Proceedings. Brent indicated that there is approximately $11,000 currently on account with $8,500 brought in this year. This is approximately equal to last year's financial status. A motion to accept the Treasurer's Report was made by Barry Johnson and seconded by Theresa Naimo and approved by acclimation.

Old Business
Joint MRRC-UMRCC. President Knight pursued the possibility of a joint MRRC-UMRCC meeting and found little consensus on this issue. The discussion focused on the different objectives of the two organizations and many felt it would be difficult to reconcile those objectives and would not be helpful to either. A few felt differently indicating that a meeting that focused on both management and research would be complementary. It was pointed out that management presentations and research presentations would be educational for individuals who were not involved in one of the two areas. It was also pointed out that such a meeting would require concurrent sessions and some felt this would detach from the character of MRRC meetings. Further discussion during the course of the Business Meeting provided some support but not enough to reach a conclusive mandate to pursue it at this time.

USACOE Recruitment. Recruitment of USACOE people was briefly discussed. Recruitment attempts will continue.

New Business
Nominations. A slate of officers for next year was presented by President Knights that included Jeff Arnold for President, Mike Romano for Vice President and Neal Mundahl for Treasurer. Jim Fischer was nominated for Secretary. Marian Havlik moved that all nominations be closed. The motion was seconded and all positions were approved unanimously. The meeting was turned over to Jeff at 12:56 p.m.

The 2004 Meeting. Suggested dates for the 2004 meeting included March 31st-Aril 1st and April 1st-April 2nd. These dates were available dates at the Radisson Hotel. The membership agreed that the April 1st and 2nd date would be acceptable. Everyone agreed a Wednesday-Thursday meeting would be undesirable. The 2004 meeting is tentatively scheduled for April 1st and 2nd. The 2003 meeting is scheduled for April 24th and 25th.

Other New Business
Meeting Location. Barry Johnson suggested moving the meeting to another city in future years. However it was brought up that the Consortium Constitution would have to be changed and the discussion was dropped.

Discussion of Consortium Mission. Steve Gutreuter suggested broadening the Consortium's mission and dropping Mississippi from the title. Discussion both pro and con ensued. Support at this time was not there; however, discussion is likely to continue.

Meeting adjourned at 1:11 pm.

MISSISSIPPI RIVER RESEARCH CONSORTIUM
TREASURER'S REPORT - SUBMITTED BY NEAL D. MUNDAHL
1 MARCH 2003

Accounts as of 30 June 2000		$11,068.19
Accounts as of 30 June 2001		$11,274.56

Transactions, 1 July 2001 to 30 June 2002

INCOME		
2002 Registration and dues	6829.00	
2002 Raffle proceeds	956.00	
2002 T-shirt sales	321.00	
Interest	44.81	
Total	8150.81	
EXPENSES		
Radisson Hotel - 2002 meeting	6003.66	
2002 Proceedings	761.25	
2002 Raffle prizes	667.17	
2002 Best paper/poster awards	101.00	
T-shirts	561.25	
Postage, mailing, supplies	145.29	
Corporation fee	10.00	
Total	8249.62	
Accounts as of 30 June 2002		$11,175.75

Transactions, 1 July 2002 to 1 March 2003

INCOME		
2002 Registration and dues	175.00	
Interest	11.32	
Total	186.32	
EXPENSES		
Postage, mailing, supplies	239.81	
Corporation fee	10.00	
Total	249.81	
Accounts as of 1 March 2003		$11,112.26
Accounts		
Checking account	6272.71	
Savings account	4839.55	
Total	11112.26	

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.
BUSINESS MEETING AGENDA

25 April 2003, 12:30 PM
Radisson Hotel, La Crosse, Wisconsin

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1. Call to Order
2. President's Report
    - Approval of 2002 minutes
    - Acknowledgments
3. Treasurer's Report
4. Old Business
    - Discussion of Consortium mission
5. New Business
    - Executive board nomination
    - Election of officers
    - Suggested dates for 2005 meeting and meeting reservations at Radisson
6. Adjournment

Business Meeting Notes

CONSTITUTION OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I. NAME AND OBJECT

1. This organization shall be named Mississippi River Research Consortium, Inc.

2. The objective of this organization shall be:

a. To establish and encourage communication between river scientists and between the scientific community and the public.

b. To encourage pure and applied research concerning the water and land resources of the Mississippi River and its valley.

c. To provide an annual meeting where research results can be presented, common problems can be discussed, information can be disseminated, and where river researchers can become acquainted with each other.

d. To encourage cooperation between institutions and to encourage the sharing of facilities.

e. To function as an advisory group to other agencies.

f. To aid in the formation of a concerted and organized research effort on the Mississippi River.

ARTICLE II. ORGANIZATION

1. The organization of the Mississippi River Research Consortium shall be provided for by the enactment of suitable by-laws.

2. The by-laws of this organization shall designate the officers and standing committees, the provisions for the election of officers, the conduct of meetings, and for any other matters which are necessary for the government of this organization.

ARTICLE III. MEMBERSHIP AND DUES

1. The membership of this organization shall consist of any persons who demonstrate an interest in any aspect of the Mississippi River, and who express a desire to join the organization.

ARTICLE IV. AMENDMENTS

1. The constitution or the by-laws of the MRRC may be amended by an affirmative vote of two-thirds of the eligible voting members present at the annual meeting.

BYLAWS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I: NAME, PURPOSES AND DUTIES

1.01 There is hereby established a Board under the name of the Mississippi River Research Consortium, Inc., having the purpose and duties of governing all matters relating to this corporation. These shall be deemed to include the following without limitation:

(a) To have the ultimate decision making authority for any and all affairs of the Mississippi River Research Consortium, Inc. which includes, but is not limited to, the authority to create and terminate the corporation, to determine the budget and expenditure of funds, to manage affairs, to determine the manner, location and extent of services performed by the corporation, to determine the number, of, location and job duties of any employees and to do all other and necessary work for the benefit of the corporation.

(b) To formulate all policies necessary for the effective and continuous operation of the corporation.

(c) To coordinate and make decisions regarding priorities of services.

1.02 The purposes of the organization shall be as follows:

(a) To establish and encourage communication between river scientists and between the scientific community and the public.

(b) To encourage pure and applied research concerning the water and land resources of the Mississippi River and its valley.

(c) To provide an annual meeting where research results can be presented, common problems can be discussed, information can be disseminated, and where river researchers can become acquainted with each other.

(d) To encourage cooperation between institutions and to encourage the sharing of facilities.

(e) To function as an advisory group to other agencies.

(f) To aid in the formation of a concerted and organized research effort on the Mississippi River.

ARTICLE 2: OFFICES

2.01 Principal and Business Offices.

The corporation may have such principal and other offices, either in or out the State of Wisconsin as the Board of Directors may designate or as the business of the corporation may require from time to time.

2.02 Registered Office.

The registered office of the corporation required by the State of Wisconsin corporation law to be maintained in the State of Wisconsin may be, but need not be, identical with the principal office in the State of Wisconsin, and the address of the registered office may be changed from time to time by the Board of Directors or by the Registered Agent. The business office of the registered agent of the corporation shall be identical to such registered office.

ARTICLE 3: OFFICERS AND BOARD OF DIRECTORS

3.01 General Powers, Responsibility, and Number.

The business and affairs of the corporation shall be managed by its Board of Directors. It shall be the responsibility of the Board to carry out the objectives of the organization and to jointly organize, hold and reside over the annual meeting. The Board of Directors of the corporation shall consist of an elected president, vice-president, secretary and treasurer.

3.02 Election and Terms of Officers.

Each Board member will be elected for a two year term after the 1991 election. In odd numbered years a treasurer and vice-president will be elected, with at least one being a representative of either a state or federal agency. In even numbered years a secretary and a vice-president will be elected, with at least one being a representative of an academic institution. After a vice-president serves for one year, he or she shall become president for the next year. In 1991 all four officers will be elected. The term for president and secretary elected in 1991 will be for one year. The term for the treasurer elected in 1991 will be for two years. The vice-president elected in 1991 will become president in 1992. The term of each officer begins at the annual meeting.

3.03 Removal From Office.

Any officer may be removed by the Board of Directors whenever in its judgment the best interests of the corporation shall be served thereby, but such removal shall be made without prejudice to the contract rights of any person so removed. Election or appointment shall not of itself create contract rights. An officer may be removed from office by affirmative vote of a majority of the Board of Directors, taken at a meeting by the Board of Directors for that purpose. A director may resign at any time by filing a written resignation at the registered office. Any officer who is absent from three (3) consecutive meetings of the Board shall, unless excused by action of the Board, cease to be a member of the Board of Directors and shall be removed forthwith.

3.04 Meetings.

The Board of Directors shall meet on the times and dates to be established by them but at least once during the annual meeting. Meetings of the Board of Directors may be called by or at the request of any officer. The president or secretary may fix the place of the meeting and if no other place is designated or fixed the place of the meeting shall be at the principal business office of the corporation in the State of Wisconsin. Telephone conference calls can be used in place of regular meetings except during the annual meeting.

3.05 Notice; Waiver.

Notice of such meetings of the Board of Directors shall be given by written or verbal notice delivered personally, by phone or mailed or given by telegram to each director at such address or telephone number as such director shall have designated with the secretary, not less than ten (10) days, or a number of days to be decided by the Board, prior to such meeting. Whenever any notice whatever is required to be given to any director of the corporation under the Articles of Incorporation or By-Laws or any provision of law, a waiver thereof in writing, signed at any time, whether before or thereof in writing, signed at any time, whether before or after the time of the meeting, by the director entitled to such notice, shall be deemed equivalent to the giving of such notice. The attendance of a director at a meeting shall constitute a waiver of notice of such meeting, except where a director attends a meeting and objects to the transaction of any business because the meeting is not lawfully called or convened. Neither the business to be transacted at, nor the purpose, or any regular or special meeting of the Board of Directors need be specified in the notice or waiver.

3.06 Quorum.

A majority of the elected members of the Board is necessary for the transaction of business at any meeting, and a majority vote of these present shall be sufficient for any decision or election.

3.07 Conduct of Meetings.

The president and in his or her absence a vice-president and in their absence, any director chosen by the directors present shall call meetings of the Board of Directors to order and shall act as the presiding officer of the meetings. The secretary of the corporation shall act as secretary of all of the meetings of the Board of Directors, but in the absence of the secretary, the presiding officer may appoint any assistant secretary or any director or other person present to act as secretary of the meeting.

3.08 Vacancy.

Any vacancy occurring in the Board of Directors because of death, resignation, removal, disqualification or otherwise, shall be filled as soon as possible by the majority action the Board. If the president vacates office, the vice-president shall become president and the Board shall fill the vice-president position. A vacancy shall be filled for the unexpired portion of the term.

3.09 Executive Director of the Corporation.

The Board may retain and compensate and give directives to an executive officer. Said executive director shall not be considered as a member of the Board of Directors.

3.10. Duties of Officers

All officers have the responsibility of carrying out the objectives of the organization, assisting in the organization of the annual meeting, and preparing a Procedures Manual for the organization. In addition, the president shall:

(a) Act as chairperson of the Board and of any executive committee,
(b) Appoint all committees unless otherwise specified by the Board,

(c) Be executive on behalf of the Board of all written instruments except as provided or directed by the Board,
(d) Be responsible for the agenda to be used at the meeting,
(e) Perform all duties incident to the office of a president and such other duties as shall from time to time be assigned to him by the Board.

The vice-president shall:

(a) Perform the duties and exercise the functions of the president at the request of the president, and when so acting shall have the power of the president,
(b) Be responsible for the preparation and updating of the Procedures Manual for the organization,
(c) Perform such other duties as delegated by the president.

The secretary shall:

(a) Keep the minutes of the meetings of the Board,
(b) See to it that all notices are fully given in accordance with the provisions of the By-Laws,
(c) Be custodian of the records of the Board,
(d) Perform all duties incident to the office of the secretary of the Board, and such other duties as from time to time may be assigned by the president of the Board.

The treasurer shall:

(a) Be responsible for financial record keeping and assessment of dues as established by the Board of Directors,
(b) Supervise the preparation of the annual budget,
(c) Receive all funds paid to the organization and shall pay all bills incurred by the Consortium,
(d) Perform other duties as from time to time may be assigned by the president.

3.11 Other Assistance to Acting Officers.

The Board of Directors shall have the power to appoint any person to act as an assistant to any officer, or agent for the corporation in his stead, or to perform the duties of such officer when for any reason it is impractical for such officer to act personally, and such assistant or acting officer or other agent so appointed by the Board of Directors shall have the power to perform all of the duties of the office to which he or she is so appointed to be assistant or as to which he or she is so appointed to act, except as such powers may be otherwise defined or restricted by the Board of Directors.

ARTICLE 4: MEMBERSHIP AND DUES

4.01 Membership and Eligibility.

Membership to include anyone interested in the research and study of the Mississippi River and its valley.

4.02 Membership and Dues.

Membership to be for one (1) year with annual dues determined by the Board of Directors.

ARTICLE 5: COMMITTEES

5.01 Nominating Committee.

The Board of Directors shall serve as the nominating committee, and file its report with the members at the annual meeting.

5.02 Other Committees.

The Board may provide for such other committees as it deems advisable and may discontinue the same at its pleasure. Each entity shall have the power and shall perform such duties as may be assigned to it by the Board and shall be appointed and the vacancies filled in the manner determined by the Board. In the absence of other direction, the president shall appoint all committees.

ARTICLE 6: MEETING OF MEMBERSHIP

6.01 Annual Meeting.

The annual meeting of the organization shall be held in La Crosse, Wisconsin. The time of the meeting shall be established by the Board of Directors and announced at the previous annual meeting. Reports of officers and committees shall be delivered at the meeting. The Board of Directors shall be elected from those individuals nominated by the Nominating Committee and those nominated from the floor with prior consent of the nominee. All persons attending the annual meeting shall be required to pay membership dues for that year and be a member of the organization in order to participate. Notice of the annual meeting shall be sent in writing to all members.

6.02 Special Meetings.

Special Meetings may be called by the president or by a majority of the Board and shall be called by the secretary on request of five (5) members in writing. The time and place of special meetings shall be announced at least two (2) weeks in advance.

6.03 Quorum.

At all meetings the members of the corporation present shall constitute a quorum for the transaction of business.

ARTICLE 7: AMENDMENTS

7.01 <u>By The Membership.</u>

These Bylaws may also be altered, amended or repealed and new Bylaws may be adopted by the Board of Directors by affirmative vote of two-thirds (2/3rds) of the members present at a meeting at which a quorum is in attendance.

PAST MEETINGS AND OFFICERS
OF THE
MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

Meeting	Year	Location	President
1st	1968*	St. Mary's College, Winona, MN	Brother George Pahl
2nd	1969	Wisconsin State Univ., La Crosse, WI	Dr. Thomas Claflin
3rd	1970	Winona State College, Winona, MN	Dr. Calvin Fremling
4th	1971	St. Cloud State College, St. Cloud, MN	Dr. Joseph Hopwood
5th	1972	Loras College, Dubuque, IA	Dr. Joesph Kapler
6th	1973	Quincy College, Quincy, IL	Rev. John Ostdiek
7th	1974	No Meeting	---
8th	1975	Monmouth College, Monmouth, IL	Dr. Jacob Verduin
9th	1976	St. Mary's College, Winona, MN	Mr. Rory Vose
10th	1977	Winona State University, Winona, MN	Dr. Dennis Nielsen
11th	1978	Univ. Wisconsin-La Crosse, La Crosse, WI	Dr. Ronald Rada
12th	1979	Cancelled	Dr. Edward Cawley
13th	1980	Loras College, Dubuque, IA	Dr. Edward Cawley
14th	1981	Ramada Inn, La Crosse, WI	Mr. Michael Vanderford
			Executive Committee
15th	1982	Radisson Hotel, La Crosse, WI	Dr. Richard Anderson Dr. Dave McConville
-------	1983	No Meeting	Dr. Jim Wiener
16th	1984	Radisson Hotel, La Crosse, WI	Dr. Ken Lubinski Ms. Rosalie Schnick Dr. Miles Smart
17th	1985	Radisson Hotel, La Crosse, WI	Mr. Ray Hubley Dr. John Nickum Ms. Pam Thiel
			Board of Directors
18th	1986	Radisson Hotel, La Crosse, WI	Dr. Jim Eckblad Dr. Carl Korschgen Dr. Jim Peck
19th	1987	Univ. of Wisconsin-La Crosse, La Crosse, WI	Mr. Hannibal Bolton Dr. Leslie Holland Dr. Mike Winfrey
20th	1988	Univ. of Wisconsin-La Crosse, La Crosse, WI	Mr. John Pitlo Mr. Verdel Dawson Dr. Nani Bhowmik

Meeting	Year	Location	Board of Directors
21st	1989	Holiday Inn, La Crosse, WI	Dr. Larry Jahn Mr. Jerry Rasmussen Dr. Bill LeGrande
22nd	1990	Island Inn, La Crosse, WI	Mr. Doug Blodgett Dr. John Ramsey Mr. John Sullivan
23rd	1991	Holiday Inn, La Crosse, WI	Mr. Kent Johnson Dr. Mike Romano Dr. Joe Wlosinski
24th	1992	Holiday Inn, La Crosse, WI	Dr. Richard Anderson Mr. Mike Dewey Mr. Kent Johnson Dr. Joe Wlosinski
25th	1993	Holiday Inn, La Crosse, WI	Dr. Richard Anderson Dr. Teresa Naimo Mr. Charles Theiling Dr. Joe Wlosinski
26th	1994	Holiday Inn, La Crosse, WI	Dr. Teresa Naimo Dr. Mark Sandheinrich Mr. Charles Theiling Dr. Neal Mundahl
27th	1995	Holiday Inn, La Crosse, WI	Dr. Mark Sandheinrich Mr. Rob Maher Dr. Michael Delong Dr. Neal Mundahl
28th	1996	Holiday Inn, La Crosse, WI	Dr. Mark Sandheinrich Ms. Therese Dukerschein Dr. Michael Delong Dr. Neal Mundahl
29th	1997	Holiday Inn, La Crosse, WI	Ms. Therese Dukerschein Mr. Mark Steingraeber Dr. William Richardson Dr. Neal Mundahl
30th	1998	Yacht Club Resorts, La Crosse, WI	Mr. Mark Steingraeber Dr. Melinda Knutson Dr. William Richardson Dr. Neal Mundahl
31st	1999	Yacht Club Resorts, La Crosse, WI	Dr. Melinda Knutson Dr. Richard Anderson Mr. Brent Knights Dr. Neal Mundahl
32nd	2000	Radisson Hotel, La Crosse, WI	Dr. Richard Anderson Dr. Yao Yin Mr. Brent Knights Dr. Neal Mundahl

Meeting	Year	Location	Board of Directors
33rd	2001	Radisson Hotel, La Crosse, WI	Dr. Yao Yin Mr. Brent Knights Dr. Michael Romano Dr. Neal Mundahl
34th	2002	Radisson Hotel, La Crosse, WI	Mr. Brent Knights Mr. Jeff Arnold Dr. Michael Romano Dr. Neal Mundahl
35th	2003	Radisson Hotel, La Crosse, WI	Mr. Jeff Arnold Dr. Michael Romano Mr. Jim Fischer Dr. Neal Mundahl

*The proceedings of the annual meetings of the Mississippi River Research Consortium, Inc. have been published since 1968. Volumes 7 and 12 were not published, as annual meetings were not convened in 1974 and 1979, respectively.

Notes

ACKNOWLEDGEMENTS 2003

The following persons or institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 35th Annual Meeting of the Mississippi River Research Consortium. The 2002-2003 Board of Directors and Consortium members gratefully acknowledge their efforts.

Local Meeting Arrangements, Meeting Announcements, And Mailings

Georginia Ardinger, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Jeff Arnold, National Park Service, Yellowstone National Park, Wyoming

Jim Fischer, Wisconsin Department of Natural Resources, LTRMP Field Station, Onalaska, Wisconsin

Kevin Mauel, Wisconsin Department of Natural Resources, LTRMP Field Station, Onalaska, Wisconsin

Neal Mundahl, Department of Biology, Winona State University, Winona, Minnesota

Michael Romano, Department of Biological Sciences, Western Illinois University, Macomb, Illinois

Program and Proceedings

Jeff Arnold, National Park Service, Yellowstone National Park, Wyoming

Jim Fischer, Wisconsin Department of Natural Resources, LTRMP Field Station, Onalaska, Wisconsin

Michael Romano, Department of Biological Sciences, Western Illinois University, Macomb, Illinois

Registration Table

Georginia Ardinger, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Mike Dewey, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Neal Mundahl, Department of Biology, Winona State University, Winona, Minnesota

T-shirt Logo Design

Heidi Imker, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Visual Aids and Poster Arrangements

John Kalas, U. S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Bob Kratt, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Robin Tyser and University of Wisconsin La Crosse Biology Department, University of Wisconsin-La Crosse, Wisconsin

Sales and Arrangements (Raffle and T-shirt)

Georginia Ardinger, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Mike Dewey, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Michael Romano, Department of Biological Sciences, Western Illinois University, Macomb, Illinois

Website

Mike Caucutt, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Brent Knights, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Platform Session Moderators

John Chick, Great Rivers Field Station, Illinois Natural History Survey, Brighton, Illinois

Sean Jenkins, Department. of Biological Sciences, Western Illinois University, Macomb, Illinois

Brent Knight, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Heidi Langrehr, Wisconsin Department of Natural Resources, Onalaska Field Station, Onalaska, Wisconsin

Megan Moore, Minnesota Department of Natural Resources Lake City Field Station, Lake City, Minnesota

Mark Pegg, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Judges for Student Presentations

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