PROCEEDINGS OF THE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

VOLUME 42

22- 23 April – 2010

Visit our web site:

http://mrrc.ngrrec.org/

PROCEEDINGS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

VOLUME 42

MISSISSIPI RIVER RESEARCH CONSORTIUM, INC.

42nd ANNUAL MEETING
22 – 23 APRIL 2010
RADISSON HOTEL
LA CROSSE, WISCONSIN

2009-2010 Board of Directors

Contents

Platform Program 3
Poster Program.....9
Platform Presentation Abstracts.....12
Poster Presentation Abstracts.....23
Minutes of the 2009 Meeting.....32
Treasurer's Report 34
2010 Business Meeting Agenda.....35
Constitution of the Mississippi River Research Consortium, Inc.....37
Bylaws of the Mississippi River Research Consortium, Inc 38
Past recipients of the MRRC Friend of the River Award.....44
Past Meetings and Officers 45
Acknowledgements 50

PLATFORM PROGRAM

Radisson Hotel –Ballroom B (All Sessions)
La Crosse, Wisconsin
Thursday, 22 April 2010

8:10-8:20 am Welcome and Announcements – **Greg Sass**, MRRC President

SESSION I – HABITAT, HYDROLOGY, AND CARBON MODELING (Moderator: Doug Schnoebelen)

8:20-8:40 am DEFINING ECOSYSTEM RESTORATION POTENTIAL USING A MULTIPLE REFERENCE CONDITION APPROACH: UPPER MISSISSIPPI RIVER ECOSYSTEM, USA
Charles Theiling. U.S. Army Corps of Engineers and University of Iowa, IIHR Hydroscience, Rock Island District, Economic and Environmental Policy Branch, PO Box 2004, Clock Tower Bldg., Rock Island, IL 61204-2004.

8:40-9:00 am SIMULATION OF SPATIAL AND TEMPORAL TRENDS IN PHYSICAL HABITAT SUITIBILITY IN UPPER MISSISSIPPI RIVER POOL 8
Thomas J. Smith, Nathan C. Young, Douglas J. Schnoebelen, and Larry J. Weber. IIHR–Hydroscience & Engineering, University of Iowa, 100 C. Maxwell Stanley Hydraulics Laboratory, Iowa City, IA 52242.

9:00-9:20 am COMPUTATIONAL FLUID DYNAMICS SIMULATION OF NITRATE REMOVAL IN ROUND LAKE, UPPER MISSISSIPPI RIVER POOL 8
Michael A. Schubert[1], Nathan C. Young[1], Douglas J. Schnoebelen[1], William B. Richardson[2], and Larry J. Weber[1]. [1] IIHR–Hydroscience & Engineering, University of Iowa, 100 C. Maxwell Stanley Hydraulics Laboratory, Iowa City, IA 52242, USA.[2] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., LaCrosse, WI 54603.

9:20-9:40 am A SPATIALLY EXPLICIT CARBON CYCLING MODEL TO TEST SOURCES OF PRODUCTIVITY IN THE UPPER MISSISSIPPI RIVER
Katherine R. Amato[1], Benjamin Martin[2], **Aloah Pope[2]**, Charles Theiling[3], Kevin Landwehr[3], Kari Layman[4], Brian Ickes[5], Jeffrey Houser[5], Bruce Hannon[6] & Richard Sparks[7]. [1]Program in Ecology, Evolution & Conservation Biology, University of Illinois at Urbana-Champaign, Urbana, IL 61801. [2]Department of Natural Resources & Environmental Sciences, University of Illinois at Urbana-Champaign, Urbana, IL 61801. [3]Rock Island District, U.S. Army Corps of Engineers, Rock Island, IL. [4]St. Paul District, U.S. Army Corps of Engineers, St. Paul, MN. [5]Upper Midwest Environmental Sciences Center, U.S. Geological Survey, La Crosse, WI, 54603. [6]Department of Geography, University of Illinois at Urbana-Champaign, Urbana, IL 61801. [7]National Great Rivers Research & Education Center, Godfrey, IL 62035-2466.

9:40-10:00 am **BREAK (HOTEL FOYER)**

SESSION II – RIVER MANAGEMENT AND RESTORATION (Moderator: Kathryn McCain)

10:00-10:20am EFFECTS OF THE HISTORIC AUGUST 2007 FLOOD ON RECENTLY TRANSLOCATED MUSSELS, SOUTH FORK OF THE ZUMBRO RIVER, ROCHESTER, MINNESOTA, AUGUST 2008
Marian E. Havlik. Malacological Consultants, 3412 Levy Lane, La Crosse, WI 54601-6609.

10:20-10:40am THE NATURE CONSERVANCY'S EMIQUON PRESERVE: THE EMERGING FOOD WEB IN A NEWLY RESTORED FLOODPLAIN LAKE
Nerissa N. Michaels[1, 2], Greg G. Sass[1], and Timothy W. Spier[2]. [1] Illinois Natural History Survey, Illinois River Biological Station, Institute of Natural Resource Sustainability, University of Illinois at Urbana-Champaign, Havana, IL 62644. [2] Western Illinois University, Department of Biological Sciences, Macomb, IL 61455.

10:40-11:00am INFORMATION NEEDS AND DIFFICULTIES WITH FLOODPLAIN MANAGEMENT
Kathryn N.S. McCain. Missouri Department of Conservation, Open Rivers and Wetlands Field Station, Jackson, MO 63755.

KEYNOTE PRESENTATION

11:00-11:50am CONSTRAINTS ON PHYTOPLANKTON ABUNDANCE AND THEIR CONTRIBUTION TO FOOD WEBS OF THE OHIO, UPPER MISSISSIPPI AND MISSOURI RIVERS
Paul A. Bukaveckas[1], Anthony Aufdenkampe[2], John Chick[3], John E. Havel[4], Ted R. Angradi[5], David W. Bolgrien[5], Terri M. Jicha[5], Debra Taylor[5].
[1]Department of Biology, Center for Environmental Studies, Virginia Commonwealth University. [2]Stroud Water Research Center. [3]Illinois Natural History Survey, Great Rivers Field Station. [4]Department of Biology, Missouri State University. [5]United States Environmental Protection Agency, Mid-Continent Ecology Division.

11:50-1:20 pm **LUNCH** (on your own)

SESSION III – MOVEMENT AND DISTRIBUTION OF FISH AND WILDLIFE
(Moderator: Kevin Irons)

1:20 – 1:40 pm MOVEMENT PATTERNS OF SEVERAL FISH SPECIES IN THE UPPER MISSISSIPPI RIVER
Sara Tripp[1], Heather Ann Calkins[1], Mike Hill[1], David Herzog[2], David Ostendorf[2], Travis Moore[3], Ron Brooks[4], Jim Garvey[1]. [1]Fisheries and Illinois Aquaculture Center, Department of Zoology, Center for Ecology, Southern Illinois University, Carbondale, IL 62901. [2] Missouri Department of Conservation, Big Rivers and Wetlands Field Station, 3815 East Jackson Blvd, Jackson, MO 63755. [3]Missouri Department of Conservation, 653 Clinic Road, Hannibal, MO 63401. [4]Kentucky Department of Fish and Wildlife Resources, #1 Sportsman's Lane, Frankfort, KY 40601.

1:40 – 2:00 pm CATFISHES IN THE UPPER MISSISSIPPI RIVER SYSTEM. DISTRIBUTION AND TRENDS AS NOTED BY THE LONG TERM RESOURCE MONITORING PROGRAM
Kevin S. Irons, T. Matthew O'Hara, Michael A. McClelland, Thad R. Cook, Nerissa N. Michaels, and Greg G. Sass. Illinois River Biological Station, Illinois Natural History Survey, Institute of Natural Resource Sustainability, University of Illinois at Urbana-Champaign, 704 North Schrader Avenue, Havana, IL 62644.

2:00 – 2:20 pm ECOSYSTEM-SCALE EVALUATION OF SOUND BUBBLE BARRIER TECHNOLOGIES TO PREVENT RANGE EXPANSIONS OF ASIAN CARPS
Blake C. Ruebush[1,2], Greg G. Sass[2,1], and John H. Chick[3,1]. [1]University of Illinois, Department of Natural Resources and Environmental Sciences, Champaign, IL. [2]Illinois Natural History Survey, Illinois River Biological Station, Havana, IL. [3]Illinois Natural History Survey, Great Rivers Field Station, Brighton, IL.

2:20 – 2:40 pm NESTING HABITATS OF BALD EAGLES IN THE UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE & FISH REFUGE, WINONA DISTRICT
Tony Bilyeu[1], Brian Pember[2], Maria Fosado[3], Mary Stefanski[2], and **Neal Mundahl**[1]. [1]Department of Biology, Winona State University, Winona, MN 55987. [2]Upper Mississippi River National Wildlife & Fish Refuge, 51 East 4th Street, Winona, MN 55987. [3]Minnesota Valley National Wildlife Refuge, 3815 American Blvd. E., Bloomington, MN 55425.

2:40 – 3:00 pm **BREAK (HOTEL FOYER)**

SESSION IV – FLOODPLAIN HETEROGENEITY AND SEDIMENTATION
(Moderator: Nathan De Jager)

3:00 – 3:20 pm LONG-TERM SEDIMENT ACCUMULATION, UPPER MISSISSPPI RIVER BACKWATERS POOLS 8 AND 11
Colin S. Belby. Department of Geography and Earth Science, University of Wisconsin-La Crosse, La Crosse, WI 54601.

3:20 – 3:40 pm AQUATIC HABITAT RICHNESS-AREA SCALING RELATIONSHIPS AS COARSE-SCALE INDICATORS OF THE STRUCTURAL COMPLEXITY OF THE UPPER MISSISSIPPI AND ILLINOIS RIVERS
Nathan R. De Jager, Jason J. Rohweder, John C. Nelson. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI 54603.

3:40 – 4:00 pm TREATING CONTIGUOUS FLOODPLAIN LAKES OF THE UPPER MISSISSIPPI RIVER AS STUDY UNITS FOR LIMNOLOGICAL STUDIES: AN EVALUATION USING CHLOROPHYLL *a* AND INORGANIC SUSPENDED SOLIDS DATA
Brian R. Gray, James R. Rogala and Jeffrey N. Houser. Upper Midwest Environmental Sciences Center, U.S. Geological Survey, La Crosse, WI 54603.

4:00 – 4:20 pm SPATIAL AND TEMPORAL PATTERNS OF SURFACE WATER TEMPERATURE OBERVATIONS IN MAIN AND SIDE CHANNELS FROM THE MIDDLE MISSISSIPPI RIVER, 1993-2007
Robert A. Hrabik and Laura B. Mills. Missouri Department of Conservation. Open Rivers and Wetlands Field Station, Jackson, MO 63755.

4:20 – 4:40 pm **BREAK (HOTEL FOYER)**

4:40 – 6:00 pm **POSTER SESSION IN THE RADISSON HOTEL FOYER**

6:30 – 9:00 pm **BANQUET – RADISSON BALLROOM A**

Radisson Hotel – Ballroom B (All Sessions)
Friday, 23 April 2010

8:30-8:40 am Morning Welcome and Announcements – **Greg Sass,** MRRC President

SESSION V – PHYTOPLANKTON AND AQUATIC VEGETATION DYNAMICS AND PRODUCTION (Moderator: Yao Yin)

8:40-9:00 am PHYTOPLANKTON DYNAMICS ALONG A HYDRAULIC CONNECTIVITY GRADIENT IN THE UPPER MISSISSIPPI RIVER.
Brent Knights[1], William Richardson[1], Lynn Bartsch[1], Jillian Decker[2], Jeff Houser[1], Michelle Bartsch[1], Jon Vallazza[1], and Steve Gutreuter[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603. [2]Louis Calder Center – Biological Field Station, Fordham University, Armonk, NY 10504.

9:00-9:20 am DARKNESS AT THE BREAK OF NOON: A MODEL FOR ALGAL NET PRODUCTION IN THE LOWER MISSISSIPPI RIVER
Clifford A. Ochs and Orathai Pongruktham. Department of Biology, University of Mississippi, University, MS.

9:20- 9:40 am EFFECTS OF HYDROLOGICAL CONNECTIVITY ON PHYSICOCHEMICAL PROPERTIES AND PHYTOPLANKTON BIOMASS AND PRODUCTION IN THE LOWER MISSISSIPPI RIVER'S CONNECTED OXBOW LAKES
Orathai Pongruktham and Clifford A. Ochs. Department of Biology, University of Mississippi, University, MS.

9:40-10:00 am MODELING SUBMERSED AQUATIC VEGETATION IN THE UPPER MISSISSIPPI RIVER
Yao Yin[1], Becky Kreiling[1], Heidi Langrehr[2] , and Megan Moore[3]. [1]U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, WI 54603. [2]Wisconsin Department of Natural Resources, La Crosse, WI 54603. [3]Minnesota Department of Natural Resources, Lake City, MN 55041.

10:00-10:20 am **BREAK (HOTEL FOYER)**

SESSION VI – ZOOPLANKTON AND MACROINVERTEBRATES (Moderator: Susan Romano)

10:20-10:50 am SPATIAL AND TEMPORAL DISTRIBUTION OF ZOOPLANKTON IN MAIN CHANNEL AND BACKWATER HABITATS OF POOL 4, UPPER MISSISSIPPI RIVER
Robert M. Burdis [1] and John H. Hoxmeier [2]. [1]Minnesota Department of Natural Resources, Lake City LTRMP Field Station, Lake City, MN 55041. [2]Minnesota Department of Natural Resources, Fisheries Research, Lake City, MN 55041.

10:50-11:10 am SPATIAL AND TEMPORAL DIFFERENCES IN MACROINVERTEBRATE AND ZOOPLANKTON DIVERSITY IN THE HEADWATERS OF THE MISSISSIPPI RIVER
Matthew B. Phillips, Debbie L. Guelda, and Richard W. Koch. Department of Biology, Bemidji State University. Bemidji, MN 56601.

11:10-11:30 am COMMON FILTER-FEEDING CADDISFLY LARVAE BREAKDOWN LARGE WOOD DEBRIS IN THE UPPER MISSISSIPPI RIVER
Alexander J. Devonald[1] and Roger J. Haro[1]. River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

11:30-12:30 **LUNCH – BALLROOM A**

12:30-1:30 pm **BUSINESS MEETING – BALLROOM B**

1:30-2:30 pm **RAFFLE AND SILENT AUCTION**

POSTER PRESENTATIONS
RADISSON HOTEL
THURSDAY APRIL 22, 2010 12:00 PM – 6:00 PM
Authors Present 5:00 PM – 6:00 PM
(Listing by Topic)

LIMNOLOGY

1) A SYNOPSIS OF SEVEN YEARS OF PRE-CONSTRUCTION AQUATIC COMMUNITY AND WATER QUALITY MONITORING OF SCHENIMANN CHUTE IN THE UNIMPOUNDED UPPER MISSISSIPPI RIVER
Sara J. Tripp[1], **Jason W. Crites[2]**, and Levi E. Solomon[2]. [1] Fisheries and Illinois Aquaculture Center, Department of Zoology, Southern Illinois University, Carbondale, Illinois, USA 62901. [2] Missouri Department of Conservation, Open Rivers and Wetlands Field Station, Jackson, MO, USA 63755.

2) WATER QUALITY IMPLICATIONS OF PERVOUS SURFACES NEAR DUBUQUE, IOWA
Brittany Stringer[1], Adam R. Hoffman[1], Eric Schmechel[2]. [1] Department of Natural and Applied Sciences, Dubuque, Iowa 52001. [2] Dubuque Soil & Water Conservation District, Epworth, Iowa 52045.

FISH ECOLOGY

3) THE EFFECT OF RIPARIAN VEGETATION ON THE DISTRIBUTION OF SCULPIN IN SOUTHWESTERN WISCONSIN STREAMS
Katri H. Laukkanen, Mark B. Sandheinrich, Roger J. Haro. River Studies Center, University of Wisconsin - La Crosse, WI 54601.

4) TESTING FISH LOCKAGE AS A MEANS OF FISH PASSAGE AT MELVIN PRICE LOCKS AND DAM (26) ON THE MISSISSIPPI RIVER
Eric J. Gittinger, John H. Chick. Illinois Natural History Survey, National Great Rivers Research and Education Center, Alton, IL, 62002.

5) EVOLUTION OF LTRMP FISH SAMPLING: BEGINNING A NEW DECADE
Eric N. Ratcliff[1], T. Matt O'Hara[2] and John H. Chick[1]. [1]National Great Rivers Research and Education Center, Illinois Natural History Survey, University of Illinois, 8450 Montclair Ave., Brighton, IL 62012. [2]Illinois River Biological Station, Illinois Natural History Survey, University of Illinois, 704 North Schrader Ave, Havana, IL 62644.

6) POPULATION TRENDS OF FLATHEAD CATFISH (*Pylodictis olivaris*), CHANNEL CATFISH (*Ictalurus punctatus*), AND BLUE CATFISH (*I. furcatus*) IN IMPOUNDED AND UNIMPOUNDED REACHES OF THE UPPER MISSISSIPPI RIVER (1993-2007)
Kathryn N.S. McCain and **Joe W. Ridings**. Missouri Department of Conservation, Resource Science Division, Open Rivers and Wetlands Field Station, 3815 E. Jackson Blvd., Jackson MO 63755.

POSTER PRESENTATIONS
(Continued)

INVERTEBRATES

7) ABIOTIC-BIOTIC CONTROLS OF ROTIFER COMMUNITY STRUCTURE IN A LARGE RIVER ECOSYSTEM
Joseph C. Bottcher[1], Michael D. Delong[1], and William B. Richardson[2]. [1]Large River Studies Center, Biology Department, Winona State University, Winona MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse WI, 54603.

8) POTENTIAL REGULATION OF ROTIFER COMMUNITY STRUCTURE AND SPECIES ABUNDANCE IN A LARGE FLOODPLAIN RIVER
Taylor A. Drogemuller[1], Michael D. Delong[1], and William B. Richardson[2]. [1]Large River Studies Center and Biology Department, Winona State University, Winona MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

9) EVIDENCE OF AN ESTABLISHED POPULATION OF THE EXOTIC INVASIVE CLADOCERAN, DAPHNIA LUMHOLTZI, IN THE MISSISSIPPI RIVER NEAR DUBUQUE, IOWA (POOL 12)
Daniel J. Call, Michael J. Malon, Michael J. Breitbach, Justin D. Goemaat, Aren T. Helgerson, Christopher W. Kuhle, Kimberly M. Parsons, Garrett J. Sheldon, and Brittany M. Stringer. Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001.

10) FACTORS INFLUENCING CLADOCERAN COMMUNITY STRUCTURE IN A LARGE RIVER SYSTEM
Megan D. Rude[1], Michael D. Delong[1], and William B. Richardson[2]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987. [2]Upper Midwest Environmental Science Center, U.S. Geological Survey, LaCrosse, WI 54603.

11) TROPHIC INTERACTIONS IN THE ZOOPLANKTON COMMUNITY OF A LARGE FLOODPLAIN RIVER
Aaron L. Wood[1], Michael D. Delong[1] and William B. Richardson[2]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

12) PATTERNS IN SPECIES RICHNESS AND COMMUNITY STRUCTURE OF NATIVE MUSSELS IN THE UPPER MISSISSIPPI RIVER
S. J. Zigler[1], T.J. Newton[1], J. Rogala[1], and M. Davis[2]. [1]USGS Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI 54603. [2]MN Department of Natural Resources, 1801 South Oak Street, Lake City, MN 55041.

POSTER PRESENTATIONS
(Continued)

WILDLIFE ECOLOGY

13) FOREST INVENTORY AND NEST ASSESSMENTS IN THE MERTES SLOUGH HERONRY, UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE & FISH REFUGE
Edward Hetzer[1], Amanda Phetteplace[1], Brian Pember[2], Mary Stefanski[2], and **Neal Mundahl**[1]. [1]Department of Biology, Winona State University, Winona, MN 55987. [2]Upper Mississippi River National Wildlife & Fish Refuge, 51 East 4th Street, Winona, MN 55987.

14) SHOREBIRD RESPONSE TO ISLAND RESTORATION IN THE POOL 8 WISCONSIN ISLANDS CLOSED AREA ON THE UPPER MISSISSIPPI RIVER
Craig Kelling[1], Kevin Kenow[2], Neal Mundahl[1], Steve Houdek[2], Pete Boma[2], Eileen Kirsch[2]. [1]Winona State University, Winona, MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

15) EVALUATION OF A VOLUNTARY PROGRAM TO CURTAIL BOAT DISTURBANCE TO MIGRATING WATERFOWL USING THE WISCONSIN ISLANDS CLOSED AREA, POOL 8 OF THE UPPER MISSISSIPPI RIVER
Kevin P. Kenow[1], Brian Gray[1], Pete Boma[1], Steve Houdek[1], Jessica Larson[2], and Paul Dummer[1]. [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.

16) SMALL-SCALE SPATIAL AND TEMPORAL DIVERSITY IN A RIVER TURTLE COMMUNITY
Casey J. Arensdorf, Gerald L. Zuercher, Christopher Kuhle, Garrett J. Sheldon, Megan Goesse, Lisa LaBudde, and Patrick Cloyd. Department of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

17) MISSISSIPPI RIVER WATER QUALITY AND ITS EFFECTS ON TURTLE TRAPPING NEAR DUBUQUE, IOWA
Garrett J. Sheldon, Christopher W. Kuhle, Adam R. Hoffman, Casey J. Arensdorf, and Gerald L. Zuercher. Department of Natural and Applied Sciences, University of Dubuque, Dubuque, Iowa 52001.

PLATFORM PRESENTATION ABSTRACTS
ALPHABETICAL LISTING (by Presenting Author)

LONG-TERM SEDIMENT ACCUMULATION, UPPER MISSISSPPI RIVER BACKWATERS POOLS 8 AND 11

Colin S. Belby.
Department of Geography and Earth Science, University of Wisconsin-La Crosse, La Crosse, WI.

Topsoil erosion is a major nonpoint source of pollution to the Upper Mississippi River (UMR), causing rapid in-filling of backwaters, homogenization of floodplain topography, and deposition of nutrients and heavy metals. Numerous studies have documented historical UMR backwater sedimentation rates, but few have placed their findings in the context of long-term deposition rates. This study's findings indicate that European-American settlement and lock and dam closure had profound impacts on sedimentation rates and sediment characteristics in Pools 8 and 11. Rates of accumulation increased from a pre-settlement average of 0.06 cm yr^{-1} (540 g m^{-2} yr^{-1}) to 0.25 cm yr^{-1} (2000 g m^{-2} yr^{-1}) following land clearance for agriculture in the mid-19th century. Greater connectivity of the main channel to the floodplain after lock and dam closure in 1937 increased sedimentation rates to an average of 0.72 cm yr^{-1} (4500 g m^{-2} yr^{-1}). While improvements in agricultural land use in the surrounding watersheds led to large reductions in sediment yield following the 1960s, a similar magnitude decrease in sedimentation on the UMR floodplain did not occur. After 1963, sedimentation rates averaged 0.71 cm yr^{-1} (3500 g m^{-2} yr^{-1}). Based on post-1963 rates of deposition, it is estimated that the backwaters will fill to the water surface found under flat pool conditions within 55-130 years, though consolidation of the sediment has the possibility of increasing this to a range of 70-350 years depending on the site. A combination of continued improvements in upland land use and river management is required to maintain the backwater resource.
Keywords: sedimentation, backwaters, organic matter, carbonates, Mississippi River

CONSTRAINTS ON PHYTOPLANKTON ABUNDANCE AND THEIR CONTRIBUTION TO FOOD WEBS OF THE OHIO, UPPER MISSISSIPPI AND MISSOURI RIVERS.

Paul A. Bukaveckas[1], Anthony Aufdenkampe[2], John Chick[3], John E. Havel[4], Ted R. Angradi[5], David W. Bolgrien[5], Terri M. Jicha[5], Debra Taylor[5].
[1]Department of Biology, Center for Environmental Studies, Virginia Commonwealth University. [2]Stroud Water Research Center. [3]Illinois Natural History Survey, Great Rivers Field Station. [4]Department of Biology, Missouri State University. [5]United States Environmental Protection Agency, Mid-Continent Ecology Division.

A survey of the Ohio, Missouri and Upper Mississippi Rivers revealed large (five-fold) differences in summer average chlorophyll a (CHLa). Average concentrations were highest in the Mississippi (32.3 $\pm$ 1.8 µg L^{-1}) with lower values in the Missouri (19.7 $\pm$ 1.1 µg L^{-1}) and Ohio (6.8 $\pm$ 0.5 µg L^{-1}). Inter-annual variation was low suggesting that basin- specific factors exert greater control over river-wide CHLa than regional-scale processes influencing climate and discharge. The large majority of sites were characterized by low light availability (< 4 E m^{-2} d^{-1}) and elevated nutrient concentrations (TP > 25 µg L^{-1}; DIN > 150 µg L^{-1}). Regression analyses revealed that TP was the best predictor of inter- and intra- river variation in CHLa and that light utilization efficiency was also influenced by TP. Light and TP were inversely related suggesting that shifts in resource availability may result in co-limitation. Microzooplankton (principally rotifers) were the dominant grazers accounting for >80% of benthic and pelagic filtration. Estimation of CHLa loss rates due to grazing and sedimentation yielded required doubling times on the order of 1-2 d to sustain CHLa downriver. CHLa and POC were positively correlated in all three rivers suggesting that phytoplankton were an important component of suspended organic matter. Their contribution to POC in these rivers was similar to that of lakes but lower relative to reservoirs.
Keywords: Chlorophyll a, nutrients, particulate organic carbon, light, river production

SPATIAL AND TEMPORAL DISTRIBUTION OF ZOOPLANKTON IN MAIN CHANNEL AND BACKWATER HABITATS OF POOL 4, UPPER MISSISSIPPI RIVER

Robert M. Burdis [1] and John H. Hoxmeier[2]
[1]Minnesota Department of Natural Resources, Lake City LTRMP Field Station, Lake City, MN. [2]Minnesota Department of Natural Resources, Fisheries Research, Lake City, MN.

The Upper Mississippi River (UMR) is home to over 100 species of native fishes, most of which utilize zooplankton as a food item at sometime during their life history. Currently there is concern over the potential impact planktivorous Asian carps *Hypophthalmichthys spp.* may have on the zooplankton community. In an effort to provide baseline information for understanding ecosystem changes that may occur we used a stratified random sampling design to examine the spatial and temporal distribution of zooplankton in Pool 4 of the UMR. Analysis revealed significant differences in zooplankton density and community structure across habitats and seasons. The turbid backwater habitat of the upper reach of the pool had the highest total zooplankton density, comprised largely of rotifers that exhibited obvious seasonality. The lower reach of the pool is influenced by a natural riverine lake that retains sediment, improves water clarity and creates an environment favorable for large-bodied crustacean zooplankton that are exported to the main channel of the lower reach. The backwater habitat in this reach has abundant aquatic vegetation in which macrophyte-associated cladocerans are common.
Keywords: zooplankton, habitat, Mississippi River, rotifers, vegetation

AQUATIC HABITAT RICHNESS-AREA SCALING RELATIONSHIPS AS COARSE-SCALE INDICATORS OF THE STRUCTURAL COMPLEXITY OF THE UPPER MISSISSIPPI AND ILLINOIS RIVERS

Nathan R. De Jager, Jason J. Rohweder, John C. Nelson
U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI.

The complexity of ecological systems arises from interactions among a variety of different components at different hierarchical levels (e.g. genes to landscapes). Patterns and processes that operate at the coarsest levels (e.g. landscapes) often constrain those at finer scales (e.g. species). Yet despite such complexity, most systems exhibit striking regularities that take the form of scaling laws. Such laws can provide a measure of ecosystem complexity and give insights into the underlying mechanisms that structure ecosystems (anthropogenic or other).

In this study, we tested the hypothesis that aquatic habitat richness of the Upper Mississippi (UMR) and Illinois rivers (IR) can be quantified by the power function $R=cA^z$ which predicts an increase in aquatic habitat richness (R) with increasing area (A). We also hypothesized that variation in c and z would be associated with modifications to the geometry of the river and floodplain (i.e. river engineering). Using photo-interpreted maps of the distribution of 11 aquatic habitats, we centered focal windows of various sizes (1, 2, 5, 10, 15, 25, 50, and 100 ha) on each of 19.3 million 10m aquatic pixels, estimated habitat richness within each window, and summarized the results for four floodplain reaches and 107 management units of the UMR and IR.

R^2 values exceeded 0.93 for all four floodplain reaches and 107 management units of the river system and were >0.97 for all reaches and 96 units. Estimates of c ranged from 1.0 in areas with a single habitat type within 1 ha windows to 2.5 in areas with multiple habitat types within 1 ha windows. Estimates of z ranged from 0.11 where habitat richness increased slowly with increasing window size to ~0.25 where habitat richness increased more quickly with window size. Differences in c and z were associated with modifications to the geometry of the rivers and floodplains. Estimates of c were homogeneously low (<1.6) where % of the floodplain impounded by locks-and-dams exceeded 10%. Estimates of z were lowest (~0.11) where impoundment exceeded 60% of the floodplain and increased to ~0.25 with increases in the % area in secondary channels. Thus, variation in the parameter estimates c and z appear to be useful coarse-scale indicators of the impacts of river engineering on the structural complexity of the Upper Mississippi and Illinois Rivers.
Keywords: aquatic habitat, complexity, landscape indicator, richness, scaling laws

COMMON FILTER-FEEDING CADDISFLY LARVAE BREAKDOWN LARGE WOOD DEBRIS IN THE UPPER MISSISSIPPI RIVER

Alexander J. Devonald[1] and Roger J. Haro[1]
[1]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI.

Large woody debris (LWD) in rivers provides critical habitat for fish and macroinvertebrates. LWD was historically an important source of allochthonous carbon for the upper Mississippi River (UMR). The slow breakdown of LWD mediated by microbes (primarily fungi) meant that the residence times for these habitats could be long. Anthropogenic reduction and fragmentation of floodplain forests and the removal of snags to maintain barge traffic has drastically reduced woody habitats in the UMR. While assessing invertebrate production rates in main-channel border areas of the UMR, larval filter-feeding caddisflies (*Hydropsyche orris* and *Cheumatopsyche camplya*) were observed excavating pits in Masonite® plates of Hester-Dendy artificial substrate samplers. Larvae built fixed-retreats over the pits and used the excavated Masonite® particles to reinforce silk-side walls. An experiment was conducted in the summer of 2009 to determine if larvae excavate natural wood and to test if processing rates differed by wood type (i.e., hard vs. soft). Processing rates were expected to be greater on softer wood (poplar) than on harder wood (oak). Natural wood-substrates were made using these two wood types to mimic common floodplain tree species: sugar maple and red oak. Unenclosed, pre-weighted substrates for both wood types (treatments) and controls (substrates in invertebrate exclosures) were placed mid-water in a main-channel border area of the UMR (Navigation Pool 8) for 113 days. After removal from the river, substrates were cleaned, dried and reweighed. Extensive pitting was observed on both wood-type treatments. Control substrates were not pitted. Poplar and oak treatments lost an average of 10.5% and 6.2% of their original weight, respectively. Statistical analysis found that the differences in the average percent weight loss between wood types was significant ($P = 0.03$). Breakdown of LWD by larval caddisflies represents an overlooked, but potentially historically important ecosystem service operating in the upper Mississippi River.

Keywords: Large woody debris, Mississippi River, Hydropsychid caddisflies, processing rates

TREATING CONTIGUOUS FLOODPLAIN LAKES OF THE UPPER MISSISSIPPI RIVER AS STUDY UNITS FOR LIMNOLOGICAL STUDIES: AN EVALUATION USING CHLOROPHYLL *a* AND INORGANIC SUSPENDED SOLIDS DATA

Brian R. Gray, James R. Rogala and Jeffrey N. Houser
Upper Midwest Environmental Sciences Center, U.S. Geological Survey, La Crosse, WI.

Floodplain river ecosystems exhibit heterogeneity in space that reflects their complex geomorphology. We investigated whether this heterogeneity might be expressed at the scale of contiguous floodplain lakes ('lakes') in the Upper Mississippi River (UMR) and, if so, whether that heterogeneity might be exploited for comparative study of limnological processes within the UMR. We evaluated these questions using three criteria: can we demonstrate lake-to-lake variation (rather than sampling variation masquerading as lake-to-lake variation)? Can lakes be treated as essentially independent? And, do we find associations between limnological variables and covariates *after* adjusting for correlation between observations from the same lake? We used Long Term Resource Monitoring Program chlorophyll *a* (CHL) and inorganic suspended solids (ISS) data from summer, and from lakes in the southern section of Navigation Pool 4, and in Navigation Pools 8 and 13. Sampling occurred from 1993 through 2005 (except 2003); numbers of lakes per reach and median lake area varied from 7 to 19 and from 53 ha to 101 ha, respectively. CHL and ISS levels were modeled linearly, with lake, year and lake×year effects treated as random. For all reaches, the proportions of variation in CHL and ISS attributable to differences among lakes (including lake and lake×year effects) were substantial (i.e., range of 18% to 73%)—indicating real differences in CHL and ISS means among lakes. Further, lakes appeared effectively uncorrelated at spatial scales ≈ 2.5 – 4 km—suggesting that lakes separated by those distances might be treated as study units for CHL and ISS studies. Last, CHL- and ISS-covariate associations included both those that varied within lakes (e.g., CHL with log(ISS)) and among lakes (e.g., ISS with lake connectivity). These findings confirm the utility of treating contiguous floodplain lakes as study units for comparative studies and natural experiments in the UMR; the use of lakes separated by < 2.5 km may require adjustment of precision estimates for spatial correlation.

Keywords: backwater lakes, chlorophyll *a*, habitat heterogeneity, inorganic suspended solids

EFFECTS OF THE HISTORIC AUGUST 2007 FLOOD ON RECENTLY TRANSLOCATED MUSSELS, SOUTH FORK OF THE ZUMBRO RIVER, ROCHESTER, MINNESOTA, AUGUST 2008

Marian E. Havlik, Malacological Consultants, 3412 Levy Lane, La Crosse, WI.

Prior to construction of a sewer trunk line in Rochester, MN, six potential river crossing sites were surveyed in 2005 in the South Fork of the Zumbro River. In 2006 over 600 living mussels were translocated from four sites, including Minnesota state listed mussel species: *Alasmidonta marginata* (20.0%), *Lasmigona costata* (nearly 2.0%), and *L. compressa* (2.3%). There was at modest reproduction of most mussel species. Nearly all state listed mussels (24.4%) were externally aged, measured, and etched with unique numbers on both valves. Common species were hash-marked on both anterior valves. Moved to the upstream Translocation Site were 404 mussels from Site 1 (the largest area, 18.07% listed mussels); 136 from Site 2 (44.85% listed mussels), while 33 (15.15% listed mussels), and 31 mussels (22.58% listed mussels) were from Sites 3 and 4 respectively. In 2007 there was a 95.1% survival of 83 numbered state listed mussels, and 85.3% survival of 68 hash-marked common mussels.

During the last required follow-up, in August 2008, 173 mussels were recovered from the Translocation Site: 86 numbered state listed species mussels (90.7% survival), 56 hash-marked common mussels (96.3% survival), and 31 unmarked mussels (including five live listed mussels). Of the surviving numbered mussels, 59.7% did not show any change in size, or even a decrease in growth from August 2007 to August 2008. Eleven mussels (16.4%) were the same size during that year. We had never seen this phenomenon during mussel translocations previously, and concluded that possibly this was a result of the record area flooding 10 days after the 2007 follow-up (excess turbidity or acidic conditions). Only 36% (24) of the numbered mussels showed some growth in 2008. Seventeen numbered mussels not found in 2007 were found in 2008.

	2008 Results: Mussel Species	**Numbered**	**Marked**	**Unmarked**	**Total**
1	*Pyganodon grandis*		2	2	4
2	*Anodontoides ferussacianus*			2	2
3	*Strophitus undulatus*		21	1	22
4	***Alasmidonta marginata***	**71**	**1**	**4**	**76**
5	*Lasmigona c. complanata*			2 D	2D
6	***Lasmigona costata***	**13**		**1**	**14**
7	***Lasmigona compressa***	**2**			**2**
8	*Leptodea fragilis*		2	3	5
9	*Lampsilis siliquoidea*			1	1
10	*Lampsilis cardium*		30	15	45
	Total mussels (alive and dead):				173
	Total live mussels	78	54	29	161
	Total dead mussels	8	2	2	12
	Total listed mussels / % survival	86; 90.7%	1	5	92
	Total mussel species	3	6	9	10

Keywords: mussel distribution, Mississippi River tributary mussel species, threatened and endangered mussels, unionid age and density data, mussel markings

SPATIAL AND TEMPORAL PATTERNS OF SURFACE WATER TEMPERATURE OBERVATIONS IN MAIN AND SIDE CHANNELS FROM THE MIDDLE MISSISSIPPI RIVER, 1993-2007

Robert A. Hrabik and Laura B. Mills
Missouri Department of Conservation. Open Rivers and Wetlands Field Station, Jackson, MO.

Water quality has been continuously monitored by the Long Term Resource Monitoring Program (LTRMP) in the Middle Mississippi River (also known as the "open" portion of the Upper Mississippi River) since 1991. The original fixed-point sampling design was augmented by a stratified-random design in 1993 and includes both "water physical" and "water chemical" parameters. Data collection is rigidly standardized and sampling effort is equally divided between main and side channel strata. To characterize and display these large datasets so managers can use the information to make informed decisions about habitat mitigation and future restoration, we summarized 14 years of long-term data into descriptive and time-series outputs. Visual display of time-series data for surface water temperature was completed by examining *t*-statistic deviations of both the main and side channel observational means standardized to main channel means. Using a GIS, we plotted deviations of *t*-values in both the main and side channels, emphasizing side channel variation using the main channel as the standard for comparison. Plots of these data highlight reaches in both the main and side channels where patterns have emerged through time and causes of such patterns can be described by the occurrence of physical structures in the river and river regulation management.
Keywords: Middle Mississippi River, water quality, long-term monitoring, spatial patterns, temporal patterns; surface water temperature

CATFISHES IN THE UPPER MISSISSIPPI RIVER SYSTEM. DISTRIBUTION AND TRENDS AS NOTED BY THE LONG TERM RESOURCE MONITORING PROGRAM.

Kevin S. Irons, T. Matthew O'Hara, Michael A. McClelland, Thad R. Cook, Nerissa N. Michaels, and Greg G. Sass
Illinois River Biological Station, Illinois Natural History Survey, Institute of Natural Resource Sustainability, University of Illinois at Urbana-Champaign, 704 North Schrader Avenue, Havana, IL 62644.

Catfishes (Ictaluridae) are often recognized by the most dominant taxa in the family, as well as those that have a value as a sport or commercially valuable fish, such as channel catfish *Ictalurus punctatus* and flathead catfish *Pylodictis olivaris*. Catfishes are collected by the Long Term Resource Monitoring Program which has monitored the fish community of the Upper Mississippi River System (UMRS) since 1989 at six regional trend areas, five on the Mississippi River, and one on the Illinois River. Of the nine species and 130,920 catfishes collected, channel catfish (81.1%) and flathead catfish (5.6%) are the most common. Bullheads (black *Ictalurus melas* – 4.9%, yellow *Ictalurus natalis* – 1.4%, and brown *Ictalurus nebulosus* – 1.0%) and madtoms (Stonecat *Noturus flavus* – 0.1%, freckled madtom *Noturus nocturnus* – 0.1%, and tadpole madtom *Noturus gyrinus* – 1.7%) make up the majority of remaining catfishes collected. Blue catfish *Ictalurus furcatus* are only collected consistently in two southern areas: the open river reach of the Mississippi and Pool 26 consisting of 3.1% of total catfishes collected in the UMRS. Analyses revealed stable populations temporally with responses to hydrological events for common species noted. Low catches of rare species prohibited temporal analyses; however, distinct geographical patterns exist (e.g. freckled madtoms are common in the south and tadpole madtoms most common in the north). This synthesis brings together all the catfishes collected to aid managers in understanding the catfish's role in a large river system, especially the madtoms as the LTRMP data extends to the northern parts of this Genus' range.
Keywords: catfish, bullhead, madtom, LTRMP, Mississippi River, Illinois River

PHYTOPLANKTON DYNAMICS ALONG A HYDRAULIC CONNECTIVITY GRADIENT IN THE UPPER MISSISSIPPI RIVER.

Brent Knights, William Richardson, Lynn Bartsch, [1]Jillian Decker, Jeff Houser, Michelle Bartsch, Jon Vallazza, and Steve Gutreuter
U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI.[1]Louis Calder Center – Biological Field Station, Fordham University, Armonk, NY.

Growing evidence suggests that phytoplankton rather than allochthonous carbon is the dominant source of nutrition for consumers in large rivers. In these systems, hydraulic connectivity is a driver of physicochemical regimes that regulate phytoplankton. Connectivity is often manipulated as part of habitat restoration in the Mississippi River

System. Phytoplankton assemblages and nutrients sampled across a gradient of connectivity in the Upper Mississippi River exhibited temporal variation consistent with strong hydraulic control. Connected sites with high dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) exhibited a Bacillariophyta peak in May and Cyanophyta and Bacillariophyta peaks in August. The phytoplankton response varied at more isolated sites with low DIN and either high or low SRP. An isolated site with high SRP exhibited an August bloom of Cyanophyta followed by Bacillariophyta. This Cyanophyta bloom (1940 mm^3L^{-1}) was 2 orders of magnitude greater than others. At the isolated site with low SRP, phytoplankton biovolume was low with no prominent peaks. These results suggest that connectivity can have significant effects on phytoplankton dynamics that likely have consequences for the production of higher trophic levels.
Keywords: phytoplankton, hydraulic connectivity, nutrients, Cyanophyta, Bacillariophyta, Mississippi River

INFORMATION NEEDS AND DIFFICULTIES WITH FLOODPLAIN MANAGEMENT
Kathryn N.S. McCain[1]
[1] Missouri Department of Conservation, Open Rivers and Wetlands Field Station, Jackson, MO 63755.

In terms of large river ecosystems, "where have we been?", "where are we?", and "where do we go from here?" are important questions to answer as we move the science of large river ecology forward. The "where do we go from here?" question is vital to start answering now since we are faced with many uncertainties in a changing world. To start answering the above questions, the Missouri Department of Conservation (MDC) is developing a program of study pertaining to large river floodplains. The first step in this process was a floodplain manager survey to address the past, present, and future needs faced by MDC managers. Ninety-seven conservation areas in close proximity to the larger rivers in Missouri were surveyed to (1) determine questions, uncertainties, and management issues faced by managers, and (2) determine what information managers need to better manage their areas into the future**.** The key information needs included detailed topography for better water management and better methods of invasive plant control. The key difficulties plaguing floodplain managers included flooding, altered flow regimes, and socio-political factors involving neighbors. The next step will be to develop a future workshop in order to design a scientific research project (i.e. use an adaptive management approach) that could be conducted on MDC floodplains answering the questions posed by MDC floodplain managers as well as test ecological theory posed by river experts.
Keywords: floodplain management, information needs, Missouri large rivers, survey, uncertainty

THE NATURE CONSERVANCY'S EMIQUON PRESERVE: THE EMERGING FOOD WEB IN A NEWLY RESTORED FLOODPLAIN LAKE
Nerissa N. Michaels[1, 2], Greg G. Sass[1], and Timothy W. Spier[2]
[1] INHS, Illinois River Biol. Sta., Inst. of Natural Resource Sustainability, U. of Illinois at Urbana-Champaign, Havana, IL 62644. [2] Western Illinois University, Department of Biological Sciences, Macomb, IL.

Two backwater lakes along the Illinois River, Thompson and Flag lakes, were historically known as two of the most productive backwater lakes of the Illinois River. In the early 1920's, Thompson and Flag lakes were leveed from the Illinois River, drained, and farmed. The area has recently been reclaimed by The Nature Conservancy and labeled the Emiquon Preserve. We collected stomach contents from largemouth bass *Micropterus salmoides* using a gastric lavage technique on a bi-weekly basis April – October, 2008 in order to determine the emerging food web at the Emiquon Preserve. A shift in diet contents from less profitable prey items (cladocerans, benthic invertebrates) to higher profitable prey items (fish) was observed in mid-July, 2008 as seen in community analysis and Index of Relative Importance (IRI) values for each prey group. Additionally, diet breadth (B) of largemouth bass significantly decreased over time ($p = 0.034$, $r^2 = 0.266$). These results are consistent with optimal foraging tenants and suggest that largemouth bass utilized less profitable prey items prior to the availability of more profitable prey items, such as young-of-year *Lepomis* spp. These observations may correspond to the fish management goal of maintaining bass at a hungry state at the appropriate time to inhibit the potential recruitment of invasive fish species in the early stages of the restoration process. Continued diet analysis will provide information regarding management implications for the fish community at Thompson Lake and for future floodplain lake restoration efforts.
Keywords: Emiquon Preserve, largemouth bass, *Micropterus salmoides*, floodplain lake, food web

NESTING HABITATS OF BALD EAGLES IN THE UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE & FISH REFUGE, WINONA DISTRICT

Brian Pember[1], Maria Fosado[2], Mary Stefanski[1], and **Neal Mundahl**[3]
[1]Upper Mississippi River National Wildlife & Fish Refuge, 51 East 4th Street, Winona, MN. [2]Minnesota Valley National Wildlife Refuge, 3815 American Blvd. E., Bloomington, MN. [3]Department of Biology, Winona State University, Winona, MN.

This project examined habitat variables associated with bald eagle (*Haliaeetus leucocephalus*) nest sites (n=56) in the Winona District of the Upper Mississippi River National Wildlife & Fish Refuge (Pools 4, 5, 5A, and 6). During the period February-April 2009, nest trees were identified and measured, nest heights were determined, distances to nearest water bodies were assessed, and forest inventories were conducted for the standing timber surrounding the nest trees. Eastern cottonwood (*Populus deltoides*) and silver maple (*Acer saccharinum*) were the most common species (64 and 23%, respectively) selected as nest trees. Nest trees averaged 27.8 in height and 86.1 cm in diameter at breast height (DBH). Eagle nests averaged 19.0 m from the ground (range 10.7-28.7 m) and were placed in trees an average of 58.4 m from water. Tree communities surrounding eagle nests consisted of silver maple (43%), eastern cottonwood (31%), and mixed hardwoods (eight species collectively comprising 26%). Surrounding trees averaged 20.5 m in height and 50.0 cm in DBH. Bald eagles tended to select superdominant trees for nest sites, placing nests near the height of the surrounding canopy.
Keywords: bald eagle, Mississippi River, nest trees, nesting habitat, *Haliaeetus leucocephalus*

DARKNESS AT THE BREAK OF NOON: A MODEL FOR ALGAL NET PRODUCTION IN THE LOWER MISSISSIPPI RIVER

Clifford A. Ochs and Orathai Pongruktham
Department of Biology, University of Mississippi, University, MS.

The importance of autochthonous production in large, turbid floodplain rivers in the temperate zone is unclear and controversial as there have been few detailed studies. We examined temporal patterns in suspended algal biomass and production in the main channel of the Lower Mississippi River. From samples collected during all seasons over 3 years (n = 52), we derived photosynthesis-irradiance curves to estimate values of algal photosynthetic parameters. From values of these parameters, average river depth, light environment, temperature, algal biomass, and estimated respiration rates, we modeled areal NPP. During the study period, algal biomass varied between about 3-24 micrograms chlorophyll/liter, and largely consisted of diatoms. NPP was negative from spring to mid-summer, when the river was high and turbid. In contrast, during the low-water period of late-summer and fall, when the suspended sediment load was reduced, NPP became positive, with a maximum rate of 1.7 grams C produced/square meter/day. These results indicate that the temporal pattern in LMR autochthonous production is directly related to seasonal variation in terrestrial inputs of water and soil particles.
Keywords: Mississippi, LMR, algae, phytoplankton, production

SPATIAL AND TEMPORAL DIFFERENCES IN MACROINVERTEBRATE AND ZOOPLANKTON DIVERSITY IN THE HEADWATERS OF THE MISSISSIPPI RIVER

Matthew B. Phillips, Debbie L. Guelda, and Richard W. Koch
Department of Biology, Bemidji State University. Bemidji, MN.

In order to assess the importance of lake systems to riverine primary and secondary production, macroinvertebrate and zooplankton samples were collected from seven sites along a 70 mile stretch of the headwaters of the Mississippi River. Riverine invertebrate specimens were collected twice during the summer of 2009 at the influent and effluent of the following lake systems: Irving/Bemidji, Wolf/Andrusia/Cass, and Winnibigoshish within the Mississippi River. Particulate organic carbon (POC), chlorophyll *a*, phosphate (PO_4), nitrate (NO_3), and abiotic parameters DO, ambient light, pH, temp, turbidity and flow were collected. Results indicate that the highest density of invertebrates occurred in an area that is upstream or unaffected by a lentic system (2588 ind M^{3-1}). However, most organism diversity occurred at the effluent of a lake. This could be due to high amounts of POC (0.042 g/L^{-1}) and zooplankton (152 ind L^{-1}). General trends indicate that the highest macroinvertebrate density was located at sites upstream of a lake while the highest density of zooplankton was found downstream.
Keywords: Mississippi River, zooplankton, macroinvertebrate, POC, river/lake continuum

EFFECTS OF HYDROLOGICAL CONNECTIVITY ON PHYSICOCHEMICAL PROPERTIES AND PHYTOPLANKTON BIOMASS AND PRODUCTION IN THE LOWER MISSISSIPPI RIVER'S CONNECTED OXBOW LAKES

Orathai Pongruktham and Clifford A. Ochs
Department of Biology, University of Mississippi, University, MS.

We examined the relationship of hydrological connectivity between the main channel of the Lower Mississippi River (LMR) and several floodplain lakes on chemical properties, and biomass and production of lake phytoplankton communities. Between Nov 07 and Sep 09, samples were collected from the main river channel and three oxbow lakes having different degrees of hydrological connection to the river. During this period, the hydrological dynamics of the LMR changed dramatically, with a fluctuation of river stage of up to 12 meters. As river water flowed into the lakes during high river stage, the lakes experienced elevated turbidity and NO_3 concentration, and had relatively low chlorophyll concentrations and pH. As the lakes disconnected, water turbidity decreased while NO_3 remained high. This resulted in a rapid increase in phytoplankton biomass and production, contributing to high dissolved oxygen and pH, but a rapid decrease in NO_3 concentration. The dramatic seasonal and spatial variations in lake phytoplankton community properties were strongly linked to the degree of connection with the main channel.
Keywords: connectivity, LMR, Mississippi, phytoplankton, lakes

A SPATIALLY EXPLICIT CARBON CYCLING MODEL TO TEST SOURCES OF PRODUCTIVITY IN THE UPPER MISSISSIPPI RIVER

Katherine R. Amato[1], Benjamin Martin[2], **Aloha Pope[2]**, Charles Theiling[3], Kevin Landwehr[3], Kari Layman[4], Brian Ickes[5], Jeffrey Houser[5], Bruce Hannon[6] & Richard Sparks[7]

[1]Program in Ecology, Evolution & Conservation Biology, University of Illinois at Urbana-Champaign, Urbana, IL. [2]Department of Natural Resources & Environmental Sciences, University of Illinois at Urbana-Champaign, Urbana, IL. [3]Rock Island District, U.S. Army Corps of Engineers, Rock Island, IL. [4]St. Paul District, U.S. Army Corps of Engineers, St. Paul, MN. [5]Upper Midwest Environmental Sciences Center, U.S. Geological Survey, La Crosse, WI. [6]Department of Geography, University of Illinois at Urbana-Champaign, Urbana, IL. [7]National Great Rivers Research & Education Center, Godfrey, IL.

Three theories, the river continuum concept, the flood-pulse concept, and the river productivity model, differ in the importance they assign to allochthonous vs. autochthonous sources of organic matter. A spatially explicit model is under development to mimic the carbon cycle in Pool 5 of the Mississippi River to test the tenets of each theory regarding sources of organic matter. The current version of the model consists of 10 stocks: phytoplankton, macrophytes, herbivores, consumers in the water column/sediments, dissolved organic carbon, particulate organic carbon, detritus, and decomposers in the water column/sediments. Simulated flow between patches is estimated with depth, velocity, and flow vectors in each $30m^2$ patch based on outputs generated by an ADH 2-dimensional hydraulic model for Pool 5. The 19-day model run reported here was for a constant discharge of 88,000 cfs at Pool 5, which is a moderate seasonal flood. Primary productivity responds to temperature, light, and water velocity. There are space limitations and prey refuges (i.e., prey cannot be reduced to zero). Flowing stocks (phytoplankton, DOC, POC, and water decomposers, at $0.3gC/m^2$) were introduced into the main channel at the upstream end of Pool 5. Primary productivity occurred throughout the river; phytoplankton outcompeted macrophytes in backwaters while macrophyte biomass was greatest in secondary and tertiary channels. Consumers in the water column closely mimicked the distribution of phytoplankton, while consumers in the sediments had the highest densities where macrophytes were present. The density of carbon flowing out of Pool 5 equaled the amount of carbon input into Pool 5. Since consumer densities spatially followed primary productivity and outputs equaled inputs, the model predicts that autochthonous production is sufficient to sustain consumers, supporting the river productivity model, at least under the conditions simulated in this run of the model. The model was developed for a reach of the Upper Mississippi River (UMR), but is applicable to other river systems. Key rate coefficients were based on literature or data from the UMR. Different ecological parameters and hydraulic maps could be developed to test whether upstream and lateral sources of organic matter are important under different hydraulic conditions or to tailor the model to other reaches or rivers.
Keywords: carbon cycle, spatial model, river productivity

ECOSYSTEM-SCALE EVALUATION OF SOUND BUBBLE BARRIER TECHNOLOGIES TO PREVENT RANGE EXPANSIONS OF ASIAN CARPS

Blake C. Ruebush[1,2], Greg G. Sass[2,1], and John H. Chick[3,1]
[1]University of Illinois, Department of Natural Resources and Environmental Sciences, Champaign, IL. [2]Illinois Natural History Survey, Illinois River Biological Station, Havana, IL. [3]Illinois Natural History Survey, Great Rivers Field Station, Brighton, IL.

Bighead *(Hypophthalmichthys nobilis)* and silver *(Hypophthalmichthys molitrix)* carps have invaded the Mississippi River Basin and have successfully established populations in the La Grange reach of the Illinois River. The invasion of Asian carps in the Illinois River has negatively influenced native fish populations and now they pose an imminent threat to invading Lake Michigan through the Chicago Sanitary and Ship Canal (CSSC). Sound Projector Array Bio-Acoustic Fish Fence (ie. sound-bubble-strobe light barrier) technologies may have the ability to slow or eliminate Asian carp range expansions. In 2005, sound-bubble barrier technologies were shown to be 95% effective at deterring adult bighead carp passage in hatchery raceways. However, in order to use this technology for Asian carps management, barrier effectiveness trials must be conducted at an ecosystem-scale. We tested the effectiveness of sound-bubble-strobe light barriers at repelling Asian carps and native fish passage in the fall of 2009 within Quiver Creek, a tributary to the Illinois River. To test barrier effectiveness, Asian carps and native fishes were removed from upstream of the barrier. The upstream portion of Quiver Creek above the barrier is pooled by a lowhead dam preventing fishes from moving further upstream. All captured fishes were measured for length, weight, and received a floy-tag prior to being released downstream of the barrier. Barrier effectiveness was determined by upstream recaptures. Our preliminary results suggest 100% effectiveness at repelling silver carp passage and 97% effectiveness against passage by native fishes. If further testing concludes that this system is effective at repelling Asian carps passage, sound-bubble-strobe light technologies could be used as a redundant technology in the CSSC in addition to the current electric barriers and in locations where Asian carps have not yet invaded, but pose a threat.

Keywords: Asian carps, *Hypophthalmichthys nobilis, Hypophthalmichthys molitrix,* Sound Projector Array Bio-Acoustic Fish Fence, ecosystem-scale

COMPUTATIONAL FLUID DYNAMICS SIMULATION OF NITRATE REMOVAL IN ROUND LAKE, UPPER MISSISSIPPI RIVER POOL 8

Michael A. Schubert[1], Nathan C. Young[1], Douglas J. Schnoebelen[1], William B. Richardson[2], and Larry J. Weber[1]
[1] IIHR–Hydroscience & Engineering, University of Iowa, 100 C. Maxwell Stanley Hydraulics Laboratory, Iowa City, IA.[2] United States Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., LaCrosse, WI.

As the broad impacts of anthropogenic nutrient delivery to aquatic ecosystems are realized, nutrient management in large river systems is growing in importance. Existing fate and transport models fail to consider the influence of local hydrodynamics in the nutrient removal process or the multidimensional nature of the nitrate in aquatic ecosystems. Through coupling highly-resolved three-dimensional hydrodynamic and nitrate removal models, local processes governing transport and removal in aquatic systems can be more accurately represented. A coupled modeling system can improve predictive capabilities and aid in the design and management of engineered and natural systems to enhance ecological health. Round Lake, a backwater in Pool 8 of the Upper Mississippi River is the focus for a proof of concept model. Model geometry, boundary conditions, and validation data have been compiled from IIHR–Hydroscience & Engineering field measurements and United States Geological Survey bathymetric measurements and long-term water quality monitoring data. Computational Fluid Dynamics simulations were used to perform particle tracking and species transport and removal analyses. Analyses indicated that nitrate removal is limited significantly by short-circuiting, a condition in which the majority of water passes through the lake with little lateral mixing with low velocity areas. The species transport and reaction model was calibrated to measured inlet and outlet concentrations and verified using observed spatial patterns in the lake. The predictive utility of the model was demonstrated by simulating the effects of a constructed island on nitrate removal. Future work will incorporate a greater number of biogeochemical processes and investigate model application in diverse aquatic environments and at larger spatiotemporal scales in support of science-based adaptive ecosystem management.

Keywords: Nitrate Removal, CFD, Upper Mississippi River, Round Lake, Denitrification

SIMULATION OF SPATIAL AND TEMPORAL TRENDS IN PHYSICAL HABITAT SUTIBILITY IN UPPER MISSISSIPPI RIVER POOL 8

Thomas J. Smith, Nathan C. Young, Douglas J. Schnoebelen, and Larry J. Weber
IIHR–Hydroscience & Engineering, University of Iowa, 100 C. Maxwell Stanley Hydraulics Laboratory, Iowa City, IA.

Understanding of habitat suitability is critical to conservation and management of our natural resources. Many habitat suitability assessments are limited in spatial extent or resolution, and neglect to consider temporal changes in habitat features. The goal of the present study is simulate spatial and temporal trends in physical habitat suitability within large aquatic systems like those found in the Upper Mississippi River. Using two-dimensional hydrodynamic models, physical habitat metrics important to aquatic species can be predicted over large areas, with high spatial resolution, and with consideration of seasonal and event-driven changes in flow. Coupled with appropriate habitat suitability models, accurate two-dimensional simulations can be valuable tools in the design and management of engineered and natural river systems.

Initial modeling efforts focus on Upper Mississippi River Pool 8. Numerical simulations are conducted using the United States Bureau of Reclamation (USBR) Sediment and River Hydraulics - Two-Dimensional (SRH-2D) model. Model geometry was developed within the Surface water Modeling System (SMS) program based upon United States Geological Survey (USGS) topographic and bathymetric surveys. Model boundary conditions were established United States Army Corps of Engineers river gage data. The model is being calibrated and validated using USGS LiDAR data and Acoustic Doppler Current Profiler (ADCP) measurements. Results are being applied to habitat suitability models for freshwater mussels and other species of interest.

Keywords: Hydrodynamics, Numerical Modeling, Habitat Suitability, Upper Mississippi River

DEFINING ECOSYSTEM RESTORATION POTENTIAL USING A MULTIPLE REFERENCE CONDITION APPROACH: UPPER MISSISSIPPI RIVER ECOSYSTEM, USA

Charles Theiling
U.S. Army Corps of Engineers and University of Iowa, IIHR Hydroscience, Rock Island District, Economic and Environmental Policy Branch, PO Box 2004, Clock Tower Bldg., Rock Island, IL 61204-2004.

Ecosystem restoration planning requires quantitative rigor to support evaluation of alternatives, define end states, report progress, and perform environmental benefits analysis. Unfortunately, existing planning frameworks are, at best, semi-quantitative. In this research, I describe a quantitative restoration framework based on a comprehensive, but simple mathematical framework that can be used to effectively apply restoration knowledge. I apply the framework and evaluate restoration alternatives with an example application of large scale planning from the Upper Mississippi River System (UMRS) using widely available geomorphic, hydrologic, and hydraulic indicators. The framework allows development of a scalable restoration strategy based on hydrogeomorphic trends that effect potential habitat and biodiversity. My analysis documents large scale geomorphology for ecological analysis, assesses impacts of river stage alteration for navigation, and simulates potential floodplain inundation under various historic references, existing conditions, and potential floodplain management scenarios. The results will help determine the best potential restoration condition relative to the hydrogeomorphic alterations imposed by river-floodplain development.

Keywords: geomorphology, stage hydrology, floodplain inundation, ecosystem restoration

MOVEMENT PATTERNS OF SEVERAL FISH SPECIES IN THE UPPER MISSISSIPPI RIVER

Sara Tripp[1], Heather Ann Calkins[1], Mike Hill[1], David Herzog[2], David Ostendorf[2], Travis Moore[3], Ron Brooks[4], Jim Garvey[1]

[1]Fisheries and Illinois Aquaculture Center, Department of Zoology, Center for Ecology, Southern Illinois University, Carbondale, IL. [2]Missouri Department of Conservation, Big Rivers and Wetlands Field Station, 3815 East Jackson Blvd, Jackson, MO. [3]Missouri Department of Conservation, 653 Clinic Road, Hannibal, MO 63401. [4]Kentucky Department of Fish and Wildlife Resources, #1 Sportsman's Lane, Frankfort, KY.

Quantifying spatial and temporal movement patterns of large river fishes is critical for defining populations and understanding their habitat needs. However, limited information regarding this topic exists because of the inherent difficulties associated with these large complex aquatic systems. Because of this lack of information, we investigated broad scale movement patterns of several riverine fish species in the Upper Mississippi River using telemetry. Over the course of our four year evaluation, we have observed species-specific movement patterns and how these trends are affected by factors such as water level, season, proximity to necessary habitats, and lock and dam management. Up to this point, we have collected a substantial amount of simultaneous data about multi-species movements in the Upper Mississippi River. To the best of our knowledge, these data are unprecedented. As the number of detections increases over time, our understanding of how fish move and interact with the river is also increasing.

Keywords: movement, passage, Upper Mississippi River, transmitter, stationary receiver

MODELING SUBMERSED AQUATIC VEGETATION IN THE UPPER MISSISSIPPI RIVER

Yao Yin[1], Becky Kreiling[1] and Heidi Langrehr[2], Megan Moore[3]

[1]United States Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, WI 54603
[2]Wisconsin Department of Natural Resources, La Crosse, WI 54603
[3]Minnesoda Department of Natural Resources, Lake City, MN 55041

The Long Term Resource Monitoring Program (LTRMP) of the Upper Mississippi River System initiated a pool-scale, stratified random sampling protocol in 1998 to monitor aquatic plants. Since then the program has accumulated 12 annual increments of an unbroken string of data in Pools 4, 8 and 13. We are analyzing this data set to reveal and estimate the effects of recent adaptive management actions of island constructions (HREP) and water level reductions (Drawdown).

We developed a statistical model to predict probability of submersed aquatic vegetation (SAV) occurrence at individual sites based on a few site-specific and a few pool-wide variables. A subset of the LTRMP data was used to estimate the parameters of the model while the rest of the data set was used to validate the prediction of the model. Vegetation changes inside the Stoddard HREP project area, both observed and predicted, were compared with a reference area of Pool 8. Daily water level in Pool 8 during summers of 2001 and 2008 under the assumption of no Drawdown were estimated based on historical discharge-water level relationship. The estimated daily water levels were entered into the statistical model to predict vegetation occurrence under the no Drawdown assumption.

Our analysis revealed distinct signals of HREP enhancement inside project area where SAV occurrence rose sharply immediately after construction was completed and remained near 100% since 2002. SAV occurrence in the non-project reference area was at the lowest level in 2002 at 25%. Occurrence increased progressively thereafter, reaching 80% by 2009.

SAV occurrence in Pool 8 was at 45% (excluding isolated backwater stratum) during the summer of 2001 while water level was being lowered. Since then, occurrence increased progressively to 80% by 2009. Our model indicated a small amount of reduction of SAV in 2001 and a sizable net gain in 2003. We are still searching for an innovative analysis to reveal how long Drawdown enhancement lasted after 2003.

Keywords: submersed aquatic vegetation, adaptive management, drawdown, restoration, statistical model

POSTER PRESENTATION ABSTRACTS
ALPHABETICAL LISTING (by Presenting Author)

SMALL-SCALE SPATIAL AND TEMPORAL DIVERSITY IN A RIVER TURTLE COMMUNITY

Casey J. Arensdorf, Gerald L. Zuercher, Christopher Kuhle, Garrett J. Sheldon, Megan Goesse, Lisa LaBudde, and Patrick Cloyd.
Department of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

In order to assess the importance of small-scale spatial and temporal diversity on community structure of river turtles, we sampled on and around 9-Mile Island within the Upper Mississippi River Wildlife and Fish Refuge (Pool 12) between May and October. Four sites were sampled: the main channel side of the island (MC), the Molo Slough side of the island (MS), a backwater area located on the south end of the island (BW), and a small side-channel that runs within the island (SC). Overall, six species of river turtles were captured during this project: *Chrysemys picta* (painted turtle; $n = 89$), *Graptemys geographica* (common map turtle; $n = 11$), *Apalone spinifera* (spiny softshell; $n = 10$), *Chelydra serpentina* ($n = 3$), *G. ouachitensis* (Ouachita map turtle; $n = 1$), and *G. pseudogeographica* (false map turtle; $n = 1$). We recorded 31 total recaptures; 6 recaptures were tagged during 2009 while the remaining 25 had been tagged during 2007 or 2008. We recorded a total lack of captures at the main channel site (MC). The Molo Slough site (MS) yielded the highest diversity ($n = 5$) while the backwater site (BW) yielded the most total captures ($n = 88$). Turtle diversity remained low between May and July. Diversity peaked in August through early September. Captures remained low throughout the project with the exception of a late September session. 2009 was a cooler than normal summer that may have negatively impacted our capture success which was lower than in previous years.

Keywords: 9-Mile Island, Mississippi River, spatial diversity, temporal diversity, turtles

ABIOTIC-BIOTIC CONTROLS OF ROTIFER COMMUNITY STRUCTURE IN A LARGE RIVER ECOSYSTEM

Joseph C. Bottcher[1], Michael D. Delong[1], and William B. Richardson[2]
[1]Large River Studies Center, Biology Department, Winona State University, Winona MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse WI, 54603.

Previous studies of rotifers in rivers have suggested that both biotic and abiotic factors influence rotifer community structure. The extent to which either abiotic or biotic factors were key regulators was dictated by duration of hydrological retention within different habitats. This study investigates which biotic and abiotic factors could potentially influence rotifer populations and community structure within the Upper Mississippi River. Sites used in the current study varied from main channel locations to slackwaters along the channel margins to sites with limited connectivity to channels. This assortment of habitats reflects the range of environmental conditions present in a complex system. A predetermined volume of water was pumped through a 38-µm sieve at each location once monthly from the Upper Mississippi River, June – Sept 2009. Abiotic measurements included: pH, temperature, current velocity, total nitrogen, Secchi depth, turbidity, and conductivity. Biotic measurements included total chlorophyll concentration, dissolved organic carbon, relative abundance of aquatic vegetation, and composition of the crustacean zooplankton community. Rotifers were identified to genus level. Preliminary results indicate that total number of rotifers L^{-1} was positively correlated with chlorophyll concentration, total nitrogen concentration, and total number of cladocerans L^{-1}. An important significant negative correlation between water temperature and total rotifer numbers L^{-1} was also observed. This suggests that both biotic and abiotic factors influence rotifer community structure. Further analysis of these results will examine interactions between these variables in shaping rotifer community structure, including changes in their impact temporally and the influence of the types of crustacean zooplankton taxa present.

Keywords: rotifer, zooplankton, community structure, hydrological retention, community regulation

EVIDENCE OF AN ESTABLISHED POPULATION OF THE EXOTIC INVASIVE CLADOCERAN, *DAPHNIA LUMHOLTZI*, IN THE MISSISSIPPI RIVER NEAR DUBUQUE, IOWA (POOL 12)

Daniel J. Call, Michael J. Malon, Michael J. Breitbach, Justin D. Goemaat, Aren T. Helgerson, Christopher W. Kuhle, Kimberly M. Parsons, Garrett J. Sheldon, and Brittany M. Stringer.
Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001.

Daphnia lumholtzi, an exotic invasive cladoceran native to Africa and Australia, was first reported in North America in 1991 from a reservoir in East Texas. It has rapidly spread eastward and northward, with the Mississippi River likely serving as a corridor for northward expansion. Since 2003, it has been observed in samples from Frentress Lake (IL, Pool 12, River Mile 576,), a backwater lake connected to the Mississippi River. In September, 2009, several water samples were collected from this lake to assess its population status. In the deeper northern lake basin, samples were collected at three depths (0.5, 3-4, and 8 m) by repeated plankton net (153 micron mesh) tows at an estimated speed of 0.45 m/sec for 2 min each. The population density of *D. lumholtzi* was greatest at a depth of approximately 3-4 m, where it was 0.71 ± 0.43 animals/L (n=3). Various life-stages were present, including brood pouch embryos, juveniles and mature adults, indicating a reproducing population. In the deepest water sampled (8 m), *D. lumholtzi* was found in association with larvae of a predatory phantom midge, *Chaoborus sp*. It was also collected at a site in the shallower southern basin of the lake. Its presence in Mud Lake (IA, Pool 11, River Miles 587-589) was also confirmed. However, it was not present in a plankton net tow from Big Pond (IA, Pool 11, River Mile 614.5), a backwater lake that is not readily accessible to motorized boats. Compared to native cladoceran species with a similar mode of non-predatory filter-feeding, *D. lumholtzi* is larger and possesses long protective head and tail spines. Its ecological impact in the Mississippi River ecosystem in terms of competition with native cladocerans and position in the food web remains to be determined. Based on its rapid spread in North America, its dispersal into lakes of the Upper Midwest that border the Mississippi River may be imminent.
Keywords: *Daphnia lumholtzi,* exotic, invasive, Mississippi River, zooplankton

A SYNOPSIS OF SEVEN YEARS OF PRE-CONSTRUCTION AQUATIC COMMUNITY AND WATER QUALITY MONITORING OF SCHENIMANN CHUTE IN THE UNIMPOUNDED UPPER MISSISSIPPI RIVER

Sara J. Tripp[1], **Jason W. Crites[2]**, and Levi E. Solomon[2]
[1] Fisheries and Illinois Aquaculture Center, Department of Zoology, Southern Illinois University, Carbondale, Illinois, USA 62901. [2] Missouri Department of Conservation, Open Rivers and Wetlands Field Station, Jackson, MO, USA 63755.

The Middle Mississippi River (MMR) is unique in that it still contains an intricate mosaic of habitat types; however modifications have drastically reduced the amount of off-channel habitats by closing secondary channels and disconnecting the floodplain. Off-channel habitats (*i.e.,* side channels, sloughs, and backwaters) provide crucial areas that few riverine organisms, at some stage of their life, can survive or develop without (Flinn et al. 2008). Sedimentation has decreased the diversity and availability of habitat within these side channels and substantially impacted seasonal water quality. In 2000 the U.S. Army Corps of Engineers (USACE) proposed that there was a critical need for habitat rehabilitation and conservation in the side channels of the MMR. One side channel that was listed as high priority was Schenimann Chute, which is located north of Cape Girardeau, Missouri in the MMR. Thus, we initiated a pre-construction fish assemblage and water quality monitoring program to assess the impacts of the proposed modifications to the chute complex. Overall, the fish community data shows that this side channel is an important refuge for many species including the federally endangered pallid sturgeon as well as nine other state species of concern. Cyprinidae dominated fish catch in all seasons at approximately 80% of total catch with a drop in the summer season to 50%. Stratification was observed in late summer and early fall. The Schenimann Chute complex is a highly variable system that is periodically inundated with flows from the mainstem MMR. The seven-year term collection of fisheries and water quality data indicates variation among seasons. Many studies benefit greatly by incorporating a pilot study into the plan of study. Perhaps continued pre-construction monitoring data would help to reduce variation in the data string allowing us to determine "true" treatment effect.
Keywords: fish monitoring, restoration, Schenimann Chute, side channel, water quality monitoring

POTENTIAL REGULATION OF ROTIFER COMMUNITY STRUCTURE AND SPECIES ABUNDANCE IN A LARGE FLOODPLAIN RIVER

Taylor A. Drogemuller[1], Michael D. Delong[1], and William B. Richardson[2]
[1]Large River Studies Center and Biology Department, Winona State University, Winona MN 55987,
[2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

Varying degrees of hydrological retention form a complex network of ecological patches in floodplain rivers. These patches have the potential to exhibit a range of physical conditions, all shaped by the extent of their connectivity to channels. It is the range of these conditions which likely determines taxonomic diversity and abundance of planktonic rotifers. The primary goal of this study was to examine the role of these factors toward shaping rotifer community structure in the Upper Mississippi River. Water samples were passed through a 38-µm sieve for collection of rotifers. Samples were collected monthly, June - September 2009, at 16 locations. Turbidity, temperature, pH, total nitrogen, Secchi depth, ratio of Secchi depth to site depth, aquatic vegetation abundance, dissolved organic matter, and chlorophyll concentration were also measured monthly at the same sites. Multivariate comparisons of environmental factors to the total abundance of individuals L^{-1} for each rotifer genus identified Secchi depth and relative abundance of aquatic vegetation as important in determining species composition (ρ = 0.474). In general, intermediate levels of both relative abundance of aquatic vegetation and Secchi depth correlated with the greatest abundance of rotifers. Cluster analysis of the 16 sites showed three distinct groupings based on rotifer community structure: isolated sites; sites with strong channel absolution; and sites at the lower end of the study area where pooling effects from Lock and Dam 6 influence hydrological conditions. Biotic factors such as predation and competition could account for a significant proportion of the variation in rotifer community structure, which would account for the low correlation to environmental variables.

Keywords: rotifer, Upper Mississippi River, environmental variables, community structure, aquatic vegetation, community regulation

TESTING FISH LOCKAGE AS A MEANS OF FISH PASSAGE AT MELVIN PRICE LOCKS AND DAM (26) ON THE MISSISSIPPI RIVER.

Eric J. Gittinger, John H. Chick
[1]Illinois Natural History Survey, National Great Rivers Research and Education Center, Alton, IL, 62002.

Constraints to fish passage on the Upper Mississippi River System (UMRS) have been a concern for many native fish and mussel species since the locks and dams were constructed some 80 years ago. These structures have long been considered partial or complete barriers to highly migratory fish species like the Skipjack Herring (*Alosa chrysochloris*) and their associated mussels. It is only in the last decade that a serious effort to fund, study and plan for fish passage on the UMRS has begun. Melvin Price Locks and Dam (L&D 26) and Lock and Dam 22 were chosen to study and construct fish passage. One of the feasibility studies being conducted is to determine the extent to which lockage could be used as a means of fish passage through L&D 26. Hydroacoustics will be the primary tool to test fish movements through the lock chamber. A hydroacoustic array consisting of 4 split beam transducers operating 24/7 was installed upstream of the miter gates of the auxiliary lock at L&D 26. Fish numbers, estimated size, timing and movement can be tracked through a cross section covering most of the lock chamber. The study will track fish movement through the lock during normal and manipulated (attracting flow) lockage without vessels as well as lockage with a tow boat. Some of the lock manipulation hydroacoustics work will be combined with DIDSON Sonar to compare the 2 systems and offer more detail to the study. Results of this study will help determine if fish lockage is a viable option to assist fish passage on UMRS L&D.

Keywords: fish passage, Mississippi River, Melvin Price Locks and Dam 26, monitoring, hydroacoustics

SHOREBIRD RESPONSE TO ISLAND RESTORATION IN THE POOL 8 WISCONSIN ISLANDS CLOSED AREA ON THE UPPER MISSISSIPPI RIVER

Craig Kelling[1], Kevin Kenow[2], Neal Mundahl[1], Steve Houdek[2], Pete Boma[2], Eileen Kirsch[2]
[1]Winona State University, Winona, MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

The U.S. Geological Survey Upper Midwest Environmental Sciences Center and Winona State University collaborated to develop and implement a survey of shorebird use within the Wisconsin Islands Closed Area (WICA) in Navigation Pool 8 of the Upper Mississippi River. Shorebird surveys were conducted during July and August 2009 on several islands that were recently constructed as part of a major island restoration project (Environmental Management Program Pool 8 Phase III Habitat Rehabilitation and Enhancement Project). Shorebirds were surveyed on islands N1, N3-N6, and W1-W4, to analyze abundance related to experimental features incorporated into island designs using a combination of boat and onshore observation. To determine potential availability of food, substrate samples collected at selected experimental features are being evaluated for invertebrate abundance, but this information is not yet available. Twelve surveys were conducted, during which 803 shorebirds were identified, representing eight different species (Spotted Sandpiper *Actitis macularius*, Semipalmated Sandpiper *Calidris pusilla*, Killdeer *Charadrius vociferus*, Pectoral Sandpiper *Calidris melanotos*, Least Sandpiper *Calidris minutilla*, Semipalmated Plover *Charadrius semipalmatus*, Solitary Sandpiper *Tringa solitaria*, and Lesser Yellowlegs *Tringa flavipes*). The Spotted Sandpiper was the most abundant shorebird comprising approximately 43% of the total number of birds identified. Concentrations of Spotted Sandpipers and most of the remaining species tended to be highest on or near sand-flat and mudflat structures. Results of this study will provide useful information for resource managers as they consider refinements in the design of future island restoration projects on the Upper Mississippi River.

Keywords: Shorebirds, Mississippi River, Pool 8, Environmental Management Program, Wisconsin Islands Closed Area

EVALUATION OF A VOLUNTARY PROGRAM TO CURTAIL BOAT DISTURBANCE TO MIGRATING WATERFOWL USING THE WISCONSIN ISLANDS CLOSED AREA, POOL 8 OF THE UPPER MISSISSIPPI RIVER

Kevin P. Kenow[1], Brian Gray[1], Pete Boma[1], Steve Houdek[1], Jessica Larson[2], and Paul Dummer[1]
[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.

The Wisconsin Islands Closed Area (WICA) is a 26.5 km^2 (6,538-acre) area within Navigation Pool 8 of the Upper Mississippi River that is closed to hunting and trapping during the duck hunting season; migratory bird hunting is prohibited at all times. The purpose of the closed area is to provide resting and feeding stopovers for migratory waterfowl and to disperse waterfowl hunting opportunities on the Upper Mississippi River National Wildlife and Fish Refuge (UMRNWFR). Construction of a major island restoration project (Pool 8 Phase III Habitat Rehabilitation and Enhancement Project [HREP]) within the WICA was initiated in 2006 under the Upper Mississippi River System Environmental Management Program to restore and enhance aquatic habitats.

A voluntary avoidance (limited entry) area was established in the WICA in 2007 to reduce boating disturbance to migratory waterfowl. Objectives of this study were to determine boater compliance with the WICA Voluntary Avoidance program, determine changes in boater compliance with construction of the Pool 8 Phase-III HREP, identify the types of watercraft and boating activities involved in intrusions into the WICA, and document waterfowl disturbance resulting from intrusions. Boating activity was observed from an elevated site on private property on the Minnesota bluffs adjacent to the WICA. Monitoring was conducted in fall 2007 to provide baseline data regarding boater compliance prior to island restoration, and again in fall 2008 and 2009 to determine if boater use patterns and disturbance changed with construction of island restoration features.

We targeted observations three days per week each fall, during the 65-day Wisconsin (with 5-day split) and 60-day Minnesota waterfowl hunting seasons. Here we report on changes observed in boating activity, disturbance to waterfowl, and intrusions into the WICA Voluntary Avoidance Area over the past three years. We also identify boating activities that were most likely to result in intrusion into the Voluntary Avoidance Area and associated disturbance to waterfowl. Results of these analyses will be used to determine if it will be necessary to implement more restrictive regulations to maintain an effective waterfowl refuge area.

Keywords: boating, disturbance, migration, staging area, waterfowl

THE EFFECT OF RIPARIAN VEGETATION ON THE DISTRIBUTION OF SCULPIN IN SOUTHWESTERN WISCONSIN STREAMS

Katri H. Laukkanen, Mark B. Sandheinrich, Roger J. Haro
River Studies Center, University of Wisconsin - La Crosse, WI 54601.

The distribution of stream fish, such as freshwater sculpin (*Cottus* spp.), are frequently associated with the quantity and quality of macroinvertebrate prey. The density and composition of aquatic macroinvertebrates, in turn, are influenced by the presence of riparian vegetation, which may provide a potential source of allochthonous organic matter used by shredders and collectors. Conversely, the overhead canopy of riparian forests may shade streams, reducing the amount of photosynthetically active radiation reaching stream beds and the autochthonous production of food resources used by grazing macroinvertebrates. We hypothesized that open canopies would increase primary and secondary production in riffles and result in greater densities of sculpin than in riffles underlying closed canopies. The quantity of periphyton and macroinvertebrates, and the density and size-frequency distribution of sculpin were monitored for three months in riffles with open or closed canopy in three streams in the Coon Creek watershed. Initial analysis of the data indicates that the density of sculpin was not significantly different between riffles with open or closed canopies. However, the size-frequency distribution of sculpin varied among sites within each of the three stream systems; a larger proportion of juvenile sculpin were collected in riffles with open canopies. There was not a significant difference in the standing crop of periphyton (Chl *a*) between riffles with open or closed canopies. The composition and density of macroinvertebrates at these sites have yet to be analyzed. These initial results suggest that the quantity of photosynthetically active radiation may not directly influence the density of sculpins, but may indirectly influence the size distribution of sculpins at each site.
Keywords: sculpin, riparian canopy, macroinvertebrates, primary production, Coon Creek watershed

FOREST INVENTORY AND NEST ASSESSMENTS IN THE MERTES SLOUGH HERONRY, UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE & FISH REFUGE

Edward Hetzer[1], Amanda Phetteplace[1], Brian Pember[2], Mary Stefanski[2], and **Neal Mundahl**[1]
[1]Department of Biology, Winona State University, Winona, MN 55987.
[2]Upper Mississippi River National Wildlife & Fish Refuge, 51 East 4th Street, Winona, MN 55987.

Trees within the Mertes Slough heronry, Pool 6, Upper Mississippi River National Wildlife & Fish Refuge were inventoried and nests of Great Blue Herons (*Ardea herodias*) and Great Egrets (*Ardea alba*) were counted during January and February 2009 as part of an on-going, long-term (30+-year) study by the U.S. Fish & Wildlife Service and Saint Mary's University of Minnesota. Trees within the boundaries of the heronry (tagged by previous researchers) were identified and measured (height, diameter at breast height [DBH]), and the numbers of nests in each tree were tabulated. Of the 327 tagged trees tallied, 32 (9.8%) had died, 164 (50.2%) contained no nests, and 131 (40.1%) contained a total of 401 nests (range of 1 to 14 nests/tree). The herony contained three species of mature trees: silver maple *Acer saccharinum* (90% of trees bearing 95.5% of the nests), swamp white oak *Quercus bicolor* (8% of trees, 3.5% of nests), and green ash *Fraxinus pennsylvanica* (2% of trees, 1% of nests). Trees with nests were significantly taller (by 2.3 m on average) and had greater DBH (by 8 cm on average) than trees without nests, and there was a significant, positive relationship between tree height and the number of nests per tree. All nests were located in trees taller than 16.8 m with DBH >30 cm, with trees taller than 20.4 m and > 40 cm DBH capable of supporting multiple nests. Mertes Slough heronry continues to be an important nesting area for herons and egrets within the Winona District of the refuge.
Keywords: heronry, Mississippi River, nest trees, *Ardea herodias*, *Ardea alba*

EVOLUTION OF LTRMP FISH SAMPLING: BEGINNING A NEW DECADE

Eric N. Ratcliff[1], T. Matt O'Hara[2] and John H. Chick[1]
[1]National Great Rivers Research and Education Center, Illinois Natural History Survey, University of Illinois, 8450 Montclair Ave. Brighton, IL 62012. [2]Illinois River Biological Station, Illinois Natural History Survey, University of Illinois, 704 North Schrader Ave, Havana, IL 62644.

An important component of any long-term monitoring program is to adopt procedures that insure data will be collected using standardized methods and equipment among different sites and through time. Strategies to achieve this goal include training, oversight, and the use of procedures manuals. However, for a long-term program to remain viable it is critical that procedures are scrutinized and refined periodically. The Long Term Resource Monitoring Program (LTRMP) has become a model for monitoring programs throughout the United States and the world. Several states have adopted LTRMP monitoring designs and methods and in the near future Chinese researchers may implement the program's fish sampling methods on the Yangtze River. The LTRMP has been sampling fishes in six regional trend areas of the Upper Mississippi River System (UMRS) since 1989. During the first two decades of data collection on the distribution and abundance of UMRS fishes, the component has sampled more than 36,000 sites and collected nearly 5 million fishes of 146 species. Although the general goals have not changed, several procedural refinements have been made which have led the fish component to revise its procedures manual. Modifications that will be reflected in the new manual include changes of sampling gear and strata, improvements in efficiency, technological advancements, and modifications to increase safety. Since the introduction of the procedures manual, statistical review of the fish data aimed at improving sampling efficiency resulted in the elimination of four sampling gears and two strata, while retaining nearly all of the essential program information. Recent safety concerns have led to several field stations replacing their smaller, easily-overloaded electrofishing boats with larger, more stable boats equipped with various forms of silver carp protection. In the past decade, technological progress has led to greater efficiencies in the recording and management of this massive data set; most notably, the electronic data entry application and the elimination of paper data recording. Now entering its third decade, the fish component continues to evolve and protocols are continually being refined to make this program a model for long term, large river fish sampling programs throughout the United States and the world.
Keywords: LTRMP, UMRS, revisions, procedures, fish sampling

POPULATION TRENDS OF FLATHEAD CATFISH (*Pylodictis olivaris*), CHANNEL CATFISH (*Ictalurus punctatus*), AND BLUE CATFISH (*I. furcatus*) IN IMPOUNDED AND UNIMPOUNDED REACHES OF THE UPPER MISSISSIPPI RIVER (1993-2007)

Kathryn N.S. McCain and **Joe W. Ridings**
Missouri Department of Conservation, Resource Science Division, Open Rivers and Wetlands Field Station, 3815 E. Jackson Blvd., Jackson MO.

Using 15 years of Long Term Resource Monitoring Program data collected from impounded (Pool 26) and unimpounded (Open River) reaches of the Upper Mississippi River, we investigated the population dynamics of flathead catfish (*Pylodictis olivaris*), channel catfish (*Ictalurus punctatus*), and blue catfish (*I. furcatus*) from random sites located in side channel border (SCB) and main channel border (MCB) habitats. The objectives of this study were to (1) compare long-term trends (1993-2007) of three catfish species collected in the Pool 26 and Open River reaches of the Upper Mississippi River; and (2) to provide needed information to managers on population dynamics through time (catch-per-unit-effort, proportional size distribution, relative weight, and length-class distributions) using a multiple gear approach of active (day electrofishing using 60 Hz as standard frequency) and passive gears (hoop nets, mini-fyke nets, and fyke nets).

Overall, active gears resulted in a higher catch-per-unit-effort (CPUE) of all fish species in each habitat-reach combination as compared to the passive gears. Passive gears resulted in negligible catches of blue and flathead catfishes (e.g., mean of <1 fish/net night). CPUE using active gear resulted in a greater number of channel catfish captured in Pool 26 as compared to the Open River, with the Open River SCB habitat having the lowest CPUE in most years. For blue catfish, the Open River had a higher CPUE using active gear as compared to Pool 26, with the Open River MCB having the greatest CPUE every year. For flathead catfish, the MCB habitat had a higher CPUE as compared to SCB habitat, with the Open River MCB having the highest CPUE in most years. However, declining trends in flathead catfish appears to be occurring in the Open River habitats, while Pool 26 SCB appears to be slightly increasing.

FACTORS INFLUENCING CLADOCERAN COMMUNITY STRUCTURE IN A LARGE RIVER SYSTEM.

Megan D. Rude[1], Michael D. Delong[1], and William B. Richardson[2]
[1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.
[2]Upper Midwest Environmental Science Center, U.S. Geological Survey, LaCrosse, WI 54603.

Cladocerans are critical resources for larval fish, adult planktivorous fish, and many filter-feeding benthic invertebrates in rivers. Previous river studies suggest that biotic and abiotic factors control cladoceran community structure but the nature of these interactions is still not fully understood. The objective of this study was to investigate the effects of abiotic and biotic variables on cladoceran community structure in a large floodplain river. Samples were taken monthly from the Upper Mississippi River between Winona, MN and Trempealeau, WI, June – September 2009. Cladocera samples were taken at 16 sites that reflect a potential range of hydrological conditions. Environmental factors (temperature, pH, turbidity, Secchi depth, conductivity, total nitrogen, and the ratio of Secchi depth to total depth) as well as dissolved organic carbon (DOC), chlorophyll concentrations, copepod abundance and rotifer abundance were collected at the same time. Cladocerans were identified to species level when possible. Preliminary results reveal a positive correlation of total numbers of individuals L^{-1} with the ratio of Secchi depth to total depth. Biotic factors such as DOC, total number of rotifers and zooplankton also showed a positive correlation. Turbidity and relative abundance of aquatic vegetation were negatively correlated with total numbers of cladoderans L^{-1}. These findings identify abiotic and biotic factors that influence total number of individuals of cladocerans. Further analysis to be presented will use the temporal extent of this study for addressing species-level responses and timing of the relative importance of these variables in shaping cladocerans community structure.
Keywords: River, zooplankton, Cladocera, abiotic factors, biotic factors, hydrological retention

MISSISSIPPI RIVER WATER QUALITY AND ITS EFFECTS ON TURTLE TRAPPING NEAR DUBUQUE, IOWA

Garrett J. Sheldon[1], Christopher W. Kuhle[1], Adam R. Hoffman[1], Casey J. Arensdorf[1], and Gerald L. Zuercher[1]
[1]Department of Natural and Applied Sciences, University of Dubuque, Dubuque, Iowa 52001.

In conjunction with the trapping of turtles near 9-Mile Island in pool 12 of the Mississippi River, we collected water samples at five sites over the course of the summer and fall of 2009. This purpose of this experiment was twofold 1) determine if water quality has an effect on amounts or variety of turtles caught at a particular site, and 2) determine if any temporal changes occurred with respect to water chemistry at the different sites. The water was tested for such chemical parameters as pH, dissolved oxygen, nitrate, nitrite, chloride, total phosphate, dissolved reactive phosphorous, heavy metals, calcium, and total suspended solids. Subtle differences in two areas of water chemistry were noted, as both nitrate and pH varied slightly between sampling periods and sites, while there were unchanging concentrations of nitrate and chloride over the same time-span. The null hypothesis that will be tested for the objectives are that there will be no difference in amounts of turtles caught in water with varying chemical parameters and that the water quality parameters will show no temporal differences. The variation in water quality parameters in the Mississippi River will be discussed.
Keywords: Water Quality, Mississippi River, 9-Mile Island, Nitrogen, Phosphorus

WATER QUALITY IMPLICATIONS OF PERVOUS SURFACES NEAR DUBUQUE, IOWA

Brittany Stringer[1], Adam R. Hoffman[1], Eric Schmechel[2]
[1] Department of Natural and Applied Sciences, Dubuque, Iowa 52001. [2] Dubuque Soil & Water Conservation District, Epworth, Iowa 52045.

This study examined stormwater runoff originating from the parking lot at the Swiss Valley Nature Center in Peosta, Iowa. In 2008, the Nature Center installed pervious asphalt to capture runoff from the rooftop and parking lot to aid its goal of becoming stormwater neutral. The objectives of our study were to look at several different parameters in comparing the influence of pervious surfaces to the health of the nearby Catfish Creek. Samples were collected for rainfalls greater than 0.5" using a first flush device to capture runoff prior to infiltrating the ground. Other samples were taken at a man-hole located at the bottom of the drainage pipe for the impervious asphalt, and in Catfish Creek. Dissolved reactive P, chloride, nitrate, and nitrite were observed in lesser concentrations in the first flush than in the creek samples. Organic compound analysis showed that the first flush was capturing anthropogenic contaminants, suggesting the pervious asphalt was helping to protect water quality. Implications on the water quality of Catfish Creek and its downstream water bodies, including the Mississippi River, due to the pervious asphalt will be discussed.

Keywords: pervious asphalt, stormwater, Catfish Creek, dissolved reactive phosphorus, anthropogenic pollution

TROPHIC INTERACTIONS IN THE ZOOPLANKTON COMMUNITY OF A LARGE FLOODPLAIN RIVER

Aaron L. Wood[1], Michael D. Delong[1] and William B. Richardson[2]
[1]Large River Studies Center, Biology Department, Winona State University, Winona, MN. 55987.
[2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

Zooplankton communities are represented by herbivores, detritivores, and carnivores, making them an important part of energy flow in many aquatic ecosystems. Little is known, however, about the trophic interactions between zooplankton species in rivers despite their role as a link between the base of the food web and pelagic-based consumers. The objective of this study was to identify the presence of positive and negative interactions through competition and predation in the zooplankton community. Samples of rotifer and crustacean zooplankton were taken from a variety of habitats in the Upper Mississippi River between Winona, MN, and Trempealeau, WI. Samples were collected monthly from June - September 2009. Chlorophyll concentration and dissolved organic carbon (DOC), a surrogate for microbial resources, were sampled at the same time as zooplankton. Rotifers, collected using 38-□m mesh, were identified to genus, whereas crustacean zooplankton (64-µm mesh) were identified to species for cladocerans, when possible, and to order for copepods. Preliminary examination of results indicates that total number of rotifers is significantly correlated with taxa richness of crustacean zooplankton, total number of cladocerans, and chlorophyll concentration. Total number of cladocerans also exhibits a significant positive relationship with chlorophyll concentration as well as total number of copepods. The results of these gross analyses show no negative relationships, suggesting an absence of negative impacts for consumers or resources. More detailed analysis of species to species interactions and associations of basal resources, will be performed to gain greater resolution on possible indirect and direct effects from trophic interactions.

Keywords: zooplankton communities, trophic interactions, Upper Mississippi River

PATTERNS IN SPECIES RICHNESS AND COMMUNITY STRUCTURE OF NATIVE MUSSELS IN THE UPPER MISSISSIPPI RIVER

S. J. Zigler[1], T.J. Newton[1], J. Rogala[1], and M. Davis[2]
[1]USGS Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI 54603.
[2]MN Department of Natural Resources, 1801 South Oak Street, Lake City, MN 55041.

In the past century about 20 mussel species have been functionally lost from the Upper Mississippi River (UMR) basin, and at least 28 species are state or federally listed. Anecdotally, community composition appears to have changed considerably from pre-European settlement times toward communities dominated by pollution-tolerant, habitat generalists (e.g., *Amblema plicata*, *Fusconaia flava*), but rigorous studies are lacking. To evaluate patterns in mussel communities in the UMR, we analyzed data from systematic surveys of native mussels that were conducted in three reaches (Navigation Pools 5, 6, and 18) from 2005-2007. These surveys resulted in >560 quadrat samples taken systematically at >280 sites (two samples per site) in each navigation pool. Although study reaches contained similar densities of mussels, differences in mussel communities were evident from exploratory nonmetric multidimensional scaling analyses. Permutation tests (ANOSIM) indicated that communities significantly differed (global Rank Similarity statistic, RS=0.38; $P<0.01$) among reaches. Pairwise tests of rank similarities showed that the mussel community in Navigation Pool 18 was substantially different from the community in Navigation Pool 5 (RS=0.52) and moderately different from the community in Navigation Pool 6 (RS=0.28), whereas communities in Navigation Pools 5 and 6 were relatively similar (RS=0.18). The dissimilarity between the mussel community in Navigation Pool 18 and the other two Navigation Pools was primarily the result of higher abundances of three *Quadrula* species (*Q. quadrula, Q. pustulosa,* and *Q. nodulata*), and lower abundances of *A. plicata* and *F. Flava*. Rarefaction analyses showed that species richness and species density was higher in Navigation 18 compared to the other two Pools. The results of our study suggest that management goals and actions in the UMR may need to account for important differences in mussel communities that occur among reaches.

Keywords: mussel, community, species richness, species density, survey

MINUTES OF THE 2009 BUSINESS MEETING

ANNUAL MEETING OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

May 1, 2009

President Haro called the business meeting to order at 12:41 pm. Officers attending were Roger Haro (President), Greg Sass (Vice-President), Susan Romano (Secretary), and approximately 30 Consortium members.

President's Report

Acknowledgements

President Haro acknowledged members of the executive committee, Greg Sass, Neal Mundahl, and Susan Romano for their help with planning and proceedings. He also acknowledged Cammy Smith and Katri Laukkanen for their help with registration, the University of Wisconsin-La Crosse River Studies Center for providing the poster display boards, UMESC and LTRMP INHS for operating the video equipment, and Kevin Irons for his video presentation. President Haro also thanked the following for their efforts for the raffle: Terry Dukerschein, Cammy Smith, Jim Lamer, Tom Claflin, Brent Knights, Brian Ickes, Nathan De Jager, Melinda Knutson, and David Ford. He also thanked UMESC for their efforts in maintaining the MRRC website. Platform moderators were acknowledged including Nathan De Jager, Greg Sass, Yao Yin, Matt O'Hara, Brian Ickes, and Jennie Sauer. Judges for student presentations and posters were also acknowledged.

Minutes

Our President asked members of the consortium for corrections or additions to the 2008 MRRC minutes as presented in the 41st Annual Proceedings. A motion to approve the minutes as published was made by Mike DeLong, seconded by John Chick.

Meeting Attendance

President Haro announced meeting attendance as 100 registrants (77 pre-registrations and 23 registrations on arrival).

Awards

President Haro presented the best student platform presentation award to Joseph Riebe, University of Wisconsin-La Crosse, and the best student poster presentation award to Elizabeth Howe, Winona State University, accepted for her by Mike DeLong.

Student Travel Awards were presented to James Moore, University of Memphis, Melissa Roberts, Western Illinois University, and Nerissa Michaels, Western Illinois University.

The Friend of the River Award was awarded to Karl Korschgen. Jim Wiener accepted this award for him and read a statement from Karl.

Treasurer's Report

Neal Mundahl, Treasurer, prepared the Treasurer's report published in the 2009 Consortium Proceedings. President Haro presented the report, indicating an income of $9,103.96 and expenses of $7,385.40 as of June 30, 2008. Transactions from July 1, 2008 to March 1, 2009, resulted in $446.01 as income, and $10 as expenses. Accounts as of March 1, 2009, were $7,174.91 in the checking account, and $5,983.47 in savings, for a total of $13,158.38. Bob Miller motioned to approve the Treasurer's Report, Mike Romano seconded the motion, and consortium members unanimously approved the Treasurer's Report as presented.

Old Business

Future meetings are scheduled at the Radisson in La Crosse for the following dates: April 22-23, 2010; April 28-29, 2011; April 26-27, 2012.

New Business

River Conference Announcements

John Chick announced a conference sponsored by the National Great Rivers Research and Education Center, August 10-13, 2009, in Collinsville, Illinois.

Greg Sass announced the International Society of River Scientists meeting, July 12-17, St. Petersburg, Florida.

40th Anniversary Special Publication

Susan Romano provided an update on the 40th Anniversary Special Publication. A contract was signed for $3225 to purchase a minimum of 50 journals as $64.50 per copy. Nine manuscripts have been submitted or are in development including the following topics and authors: Introduction by Rip Sparks; Hydrology by Chuck Theiling and John Nestler; Contaminants by Jim Wiener and Mark Sanheinrich; Nutrients by Jeff Houser and Bill Richardson; Food Webs by Mike DeLong; Submersed, emergent and moist soil vegetation by Megan Moore, Susan Romano, and Thad Cook; floodplain forest by Susan Romano and Yao Yin; Reptiles and Amphibians by John Tucker, Mike Romano, and Jim Lamer; and Fish by Brian Ickes, Jim Garvey, and Steve Zigler. Jim Wiener and Bob Miller led a discussion of ideas for advertising the journal volume.

Election of Officers

Jeff Houser was nominated by the executive board as our next Vice-President. Bob Miller motioned to close the nomination, and Mike DeLong seconded the motion. Jeff Houser was unanimously approved by consortium members as the next Vice-President. Susan Romano will remain as Secretary for another year to complete her 2-year term.

Passing of the Presidency

In accordance with MRRC bylaws, President Haro turned the meeting over to the new President, Greg Sass. President Sass presented Dr. Haro with a plaque commemorating his year of service as the President of MRRC.

President Sass welcomed Jeff Houser as the new Vice-President, and thanked Roger Haro for his efforts. He reiterated acknowledgements to those who helped with this year's consortium.

Other New Business

The National Great Rivers Research and Education Center offered to sponsor the MRRC website. Bob Miller motioned to accept the offer, and Jim Wiener seconded the motion. Jim Wiener also suggested that a thank you letter should be sent to USGS for their years of sponsoring the website.

Georgina had also provided many years of support for the consortium, and some type of recognition for her was recommended.

Additional help for Cammy Smith during registration was recommended, possibly soliciting student help with registration waivers.

President Sass also recommended a committee for recruitment and fostering integration with other groups to meet at the International Society of River Scientists meeting in St. Petersburg, Florida.

Adjournment

President Sass entertained a motion to adjourn by Mike Romano, seconded by Bob Miller. The motion passed, and President Sass adjourned the 2009 Business Meeting of the MRRC at approximately 1:30 pm.

MISSISSIPPI RIVER RESEARCH CONSORTIUM
TREASURER'S REPORT - SUBMITTED BY NEAL D. MUNDAHL
9 MARCH 2010

Accounts as of 30 June 2007			$11,003.81
Accounts as of 30 June 2008			$12,722.37
Transactions, 1 July 2008 to 30 June 2009			
INCOME			
	2008 Registration and dues	440.00	
	2009 Registration and dues	6750.00	
	2009 Raffle proceeds	755.00	
	2009 T-shirt sales	163.00	
	Book sales	516.00	
	Interest	11.95	
Total		8635.95	
EXPENSES			
	2009 meeting (Radisson)	4898.09	
	2009 Proceedings	658.06	
	2009 Keynote expenses	158.90	
	2009 Raffle prizes	171.53	
	2009 Awards	196.00	
	2009 Student Travel Awards	600.00	
	T-shirts	97.60	
	Postage, mailing, supplies	57.60	
	2008 Corporation fee	10.00	
Total		6847.78	
Accounts as of 30 June 2009			$14,510.54
Transactions, 1 July 2009 to 1 March 2010			
INCOME			
	Interest	6.04	
Total		6.04	
EXPENSES			
	Postage	44.41	
Total		44.41	
Accounts as of 1 March 2010			
Accounts			$14,472.17
	Checking account	8476.72	
	Savings account	5995.45	
		14472.17	

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.
BUSINESS MEETING AGENDA

23 April 2010, 12:30 PM
Radisson Hotel, LaCrosse, Wisconsin

---

1. Call to Order

2. President's Report

   - Acknowledgments
   - Approval of 2009 minutes and Proceedings
   - 2010 attendance/participation growth information
   - Awards

3. Treasurer's Report – N. Mundahl

4. Old Business

   - Future Meeting Dates
   - 2011 Meeting in La Crosse, WI

5. New Business

   - Executive board nomination
   - Election of officers
   - Passing of the Presidency
   - Other new business

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 Incarnation
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, 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 Purpose
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 of 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 bylaws,
(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 is 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 except in situations when the Board identifies an alternative location for special occasions. 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.

6.01a. *Keynote Speaker* - The Board of Directors shall invite a keynote speaker to address the membership at each annual meeting. A 60 minute time slot shall be allocated for the keynote speaker's address, including a question and answer period.

6.01b. *Student Travel Awards* - The Board of Directors shall advertise for and select graduate and undergraduate students for travel awards for attending the annual meeting and presenting a platform presentation. Criteria of selection of students for the awards

shall be based on academic achievements and the scientific contribution of the student's project to the field of river ecology. The number of awards provided shall be determined each year based on the applicant pool and annual budget.

6.01c (draft). *Special symposia* - The Board of Directors may advertise and assemble special symposia within the annual conference program with the following limitations: a) symposia shall not be scheduled concurrently with standard conference sessions; b) symposia shall not exceed ½ day within the annual conference program; c) symposia subject matter shall be proposed by the Board to the membership 1 year or more in advance; and d) the membership must move to adopt the proposal and vote in majority favor of the proposal.

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 By The Membership.
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 RECIPIENTS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM FRIEND OF THE RIVER AWARD

Friend of the River	Organization	Year	Meeting	Presenter
Calvin R. Fremling	Winona State University	1992	24th	Neal Mundahl
Thomas O. Claflin	University of Wisconsin-La Crosse	1993	25th	Ronald G. Rada
Pamela Thiel	U.S. Fish & Wildlife Service	1997	29th	Terry Dukerschein
Richard V. Anderson	Western Illinois University	1998	30th	Michael A. Romano
Ronald G. Rada	University of Wisconsin-La Crosse	1999	31st	Terry Dukerschein
Marian E. Havlick	Malacological Consultants, La Crosse, Wisconsin	2008	40th	Brian Ickes
Carl Korschgen	USGS, Columbia Environmental Research Center, Columbia, Missouri 65201 USA	2009	41st	Roger Haro and Jim Wiener

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
15th	1982	Radisson Hotel, La Crosse, WI	Dr. Richard Anderson Dr. Dave McConville Dr. Jim Wiener

Meeting	Year	Location	Board of Directors
-----	1983	No Meeting	----------
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
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
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

Meeting	Year	Location	Board of Directors
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

Meeting	Year	Location	Board of Directors
32nd	2000	Radisson Hotel, La Crosse, WI	Dr. Richard Anderson Dr. Yao Yin Mr. Brent Knights Dr. Neal Mundahl
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	Dr. Michael Romano Mr. Jim Fischer Dr. Neal Mundahl
36th	2004	Radisson Hotel, La Crosse, WI	Dr. Michael Romano Dr. Mark Pegg Mr. Jim Fischer Dr. Neal Mundahl
37th	2005	Radisson Hotel, La Crosse, WI	Dr. Mark Pegg Dr. Michael Delong Mr. Lynn Bartsch Dr. Neal Mundahl
38th	2006	Radisson Hotel, La Crosse, WI	Dr. Michael Delong Dr. John Chick Mr. Lynn Bartsch Dr. Neal Mundahl
39th	2007	Radisson Hotel, La Crosse, WI	Dr. John Chick Mr. Brian Ickes Dr. Robert Miller Dr. Neal Mundahl

Meeting	Year	Location	Board of Directors
40th	2008	Grand River Center, Dubuque, IA	Mr. Brian Ickes Dr. Roger Haro Dr. Robert Miller Dr. Neal Mundahl
41st	2009	Radisson Hotel, La Crosse, WI	Dr. Roger Haro Dr. Greg Sass Dr. Susan Romano Dr. Neal Mundahl
42nd	2010	Radisson Hotel, La Crosse, WI	Dr. Greg Sass Dr. Jeff Houser Dr. Susan Romano 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.

ACKNOWLEDGMENTS 2010

The following persons or institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 42nd Annual Meeting of the Mississippi River Research Consortium. The 2009-2010 Board of Directors and Consortium members gratefully acknowledge their efforts.

Local Meeting Arrangements, Meeting Announcements, and Mailings

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

Roger Haro, University of Wisconsin, La Crosse, Wisconsin

Program and Proceedings

Greg Sass, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Jeff Houser, USGS Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin.

Susan Romano, Western Illinois University, Macomb, Illinois

Registration Table

Cammy Smith, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Poster Boards

University of Wisconsin – La Crosse River Studies Center, La Crosse, Wisconsin

T-shirt Logo Design

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

Visual Aids, Poster Arrangements, and Awards

Martin Tagesen, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Susan Romano, Western Illinois University-Quad Cities, Moline, Illinois.

Sales and Arrangements (Raffle and T-shirt)

Terry Dukerschein, Wisconsin Department of Natural Resources, La Crosse, Wisconsin

Cammy Smith, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Randy Hines, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Website

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

Isaac Chapman, National Great Rivers Research and Education Center

Cammy Smith, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Platform Session Moderators

Nathan De Jager, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, LaCrosse, Wisconsin

Yao Yin, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, LaCrosse, Wisconsin

Doug Schoebelen, IIHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa

Kevin Irons, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Kathryn McCain, Missouri Department of Conservation, Open Rivers and Wetlands Field Station, Jackson, MO

Susan Romano, Western Illinois University-Quad Cities, Moline, Illinois.

Photography

Cammy Smith, Illinois River Biological Station, Illinois Natural History Survey, Havana, Illinois

Donators of Raffle and Silent Auction Prizes MRRC 2010 (as of printing date)

Dr. Tom Claflin, T.O.C. Fishing Rods, La Crosse, WI, 54601

Dr. Nathan De Jager, U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, WI

Gordon and Beverly Dukerschein, Artisans, *www.**artisans**inc.com*
Glen Flora, WI

Russ and Terry Dukerschein, La Crescent, MN

Dr. Jim Eckblad, http://www.oakleafsystems.net, Decorah, Iowa

David Ford Contracting, La Crosse, WI

Dr. Roger Haro, UW-La Crosse River Studies Center, La Crosse, WI

Brian Ickes, U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, WI.

Dr. David Kennedy, U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, WI.

Sara Lubinski, A Sense of Place, www.saralubinski.com, Brownsville, MN

Nerissa Michaels, Illinois River Biological Station, Havana, IL

Melissa Meier, U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, WI.

Dr. Greg Sass, Illinois River Biological Station, Havana, IL

Larry Stone, http://larrystonesiowa.com, Elkader, Iowa

Dr. James Wiener and Gloria Wiener, La Crosse, WI

Xiaoli Yuan, Upper Midwest Environmental Sciences Center, La Crosse, WI