PROCEEDINGS OF THE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

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PROCEEDINGS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

VOLUME 34

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

34th ANNUAL MEETING
25-26 APRIL 2002
RADISSON HOTEL
LA CROSSE, WISCONSIN

Contents

PLATFORM PROGRAM
HOTEL BALLROOM B
THURSDAY, APRIL 25, 2002

7:50- 8:00 AM Welcome and Announcements
Brent Knights, MRRC President

8:00- 8:20 AM A ROLE FOR MRRC IN EXPANSION OF LARGE RIVER RESEARCH: LESSONS FROM OCEANOGRAPHY. **Richard E. Sparks**. University of Illinois, Illinois Water Resources Center, Urbana, IL 61801.

SESSION I – INVASIVE SPECIES
(Moderator: Pam Thiel)

8:20- 8:40 AM HISTORY OF THE CHICAGO SANITARY AND SHIP CANAL AND CREATION OF AN AQUATIC NUISANCE SPECIES DISPERSAL BARRIER. **Phil Moy**. Wisconsin Sea Grant.

8:40- 9:00 AM ROLE OF LAKE PEPIN IN SUSTAINING ZEBRA MUSSEL POPULATIONS IN THE UPPER MISSISSIPPI RIVER. **James A. Stoeckel**[1], Daniel W. Schneider[2], Chris Rehmann[3], and Dianna K. Padilla[4]. [1]Illinois River Biological Station, INHS, Havana, IL 62644, [2]Department of Urban and Regional Planning / INHS, University of Illinois, Champaign, IL 61820, [3]Department of Civil and Environmental Engineering, University of Illinois, Urbana, IL 61801, [4]Department of Ecology and Evolution, SUNY, Stony Brook, New York 11794-5245.

9:00- 9:20 AM UTILIZATION OF THE EXOTIC CLADOCERAN, *DAPHNIA LUMHOLTZI*, BY YOUNG-OF-YEAR FISH WITHIN AN ILLINOS RIVER FLOODPLAIN LAKE. **A. Maria Lemke**, James A. Stoeckel, Amy E. George, Mark A. Pegg. Illinois Natural History Survey, Illinois River Biological Station, Havana, IL 62644.

9:20- 9:40 AM WHITE PERCH DISTRIBUTIONS IN THE ILLINOIS RIVER: DETECTING AN INVASIVE SPECIES WITH THE LONG TERM RESOURCE MONITORING PROGRAM. **Kevin S. Irons**, T. Matthew O'Hara, Michael A. McClelland, and Mark A. Pegg. Illinois Natural History Survey, Illinois River Biological Station, 704 N. Schrader Ave., Havana, IL 62644.

9:40-10:00 AM STATUS OF BIGHEAD CARP AND SILVER CARP ON THE LA GRANGE REACH, ILLINOIS RIVER AND POSSIBLE IMPACTS TO THE COMMERCIAL FISHERY. **Timothy M. O'Hara**, Kevin S. Irons, Mike A. McClelland and Mark A. Pegg. Illinois Natural History Survey, Illinois River Biological Station, Havana, IL 62644.

10:00-10:20 AM **BREAK**

SESSION I – INVASIVE SPECIES continued
(Moderator: Jeff Arnold)

10:20-10:40 AM MONITORING INVASIVE SUBMERSED AND FLOATING-LEAF PLANTS IN THE UPPER MISSISSIPPI RIVER SYSTEM - WHAT SHOULD WE WATCH FOR? **Heidi A. Langrehr**. Wisconsin Department of Natural Resources, Onalaska Field Station, Onalaska, WI 54650.

10:40- 11:00 AM EFFECTS OF VANTAGE® (SETHODYDIM) ON SEED HEAD DENSITY AND BIOMASS OF REED CANARYGRASS (*PHALARIS ARUNDINACEA* L.). **Craig A. Annen**[1, 2], Robin W. Tyser[1, 3], and Eileen M. Kirsch[3]. [1]University of Wisconsin – La Crosse, La Crosse WI 54601, [2]U.S. Army Corps of Engineers, Mississippi River Project, La Crescent, MN 55947, [3]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

11:00- 11:20 AM THE EFFECTS OF PURPLE LOOSESTRIFE BIOLOGICAL CONTROL BEETLES (*GALERUCELLA SPP*.) ON PURPLE LOOSESTRIFE PLOTS ON THE UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE AND FISH REFUGE. **Lara Hill**. U.S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge, Onalaska, WI 54650.

SESSION II – TSS AND SEDIMENTATION
(Moderator: Jeff Arnold)

11:20- 11:40 AM DETECTION OF TOTAL SUSPENDED SOLIDS AND TURBIDITY WITH SATELLITE REMOTE SENSING FOR POOLS 4, 8, 13 AND 26 OF THE UPPER MISSISSIPPI RIVER. **Michael J. Erickson**[1,2], Robin W. Tyser[1], and Cynthia J. Berlin[2]. [1]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601, [2]Geography Department, University of Wisconsin-La Crosse, La Crosse WI 54601.

11:40- 12:00 PM RATES OF BACKWATER SEDIMENTATION BETWEEN 1997 AND 2002 IN POOLS 4, 8, AND 13 OF THE UPPER MISSIPPIPPI RIVER. **James T. Rogala** and Peter J. Boma. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

12:00-1:00 PM **LUNCH** (on your own)

SESSION III – ORGANIC MATTERS AND PLANKTON
(Moderator: Michael Delong)

1:00- 1:20 PM COMPARISON OF SEDIMENTATION AND LEAF LITTER DECOMPOSITION RATES AMONG MODIFIED RIVER FLOODPLAIN SYSTEMS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY. **Mehdi Molavi** and Jack W. Grubaugh. Department of Biology, University of Memphis, Memphis, TN 38152.

1:20- 1:40 PM IDENTIFICATION OF CRITICAL RESOURCES IN LARGE RIVER FOOD WEBS THROUGH SEPARATION OF ALGAL AND DETRITAL COMPONENTS OF TRANSPORTED ORGANIC MATTER. **Michael D. Delong**. Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

1:40- 2:00 PM RESOURCE LIMITATION IN RIVERINE BACTERIOPLANKTON: INTERACTIONS OF TEMPERATURE AND DISCHARGE. **Richard W. Koch**[1] and Paul A. Bukaveckas[2]. [1]North Central Research Station, USDA Forest Service, Grand Rapids, MN 55744, [2]Department of Biology, University of Louisville, Louisville, KY 45292.

2:00- 2:20 PM TEMPORAL AND SPATIAL VARIATION IN ZOOPLANKTON FLUX RATES IN THE OHIO RIVER**. Debbie L. Guelda** [1,2], Richard W. Koch [3,2], Jeff D. Jack [2], and Paul A. Bukaveckas[2]. [1]Bemidji State University, Bemidji, MN 56601, [2]Department of Biology and Center for Watershed Research, University of Louisville, Louisville, KY 40292, [3]North Central Research Station, USDA Forestry Service, Grand Rapids MN 55744.

SPECIAL PRESENTATION

(Introduction by Kenneth Lubinski)

2:20- 2:40 PM DEVELOPMENT OF MISSISSIPPI RIVERSIDE ENVIRONMENTAL RESEARCH STATION (MRERS) AT IOWA DNR'S FISH HATCHERY SITE IN FAIRPORT, IOWA. **Tatsuaki Nakato**. IIHR-Hydroscience & Engineering, The University of Iowa, Iowa City, IA 52242.

2:40- 3:00 PM **BREAK**

SESSION IV – BIRDS AND A FROG

(Moderator: Thomas Dunsan)

3:00- 3:20 PM THE IMPACT OF SHOREBIRD FORAGING ON MACROINVERTEBRATES IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY. **Darren W. Mitchell** and Jack W. Grubaugh. The University of Memphis, Department of Biology, Memphis, TN 38152.

3:20- 3:40 PM CHARACTERIZATION OF MACROINVERTEBRATE ABUNDANCE AND BIOMASS ASSOCIATED WITH DIFFERING WATERFOWL MANAGEMENT TREATMENTS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY. **Jack W. Grubaugh[1]**, Darren W. Mitchell[1], Catharina R. Grubaugh[2], and Daniel B. Grubaugh[2]. [1]Department of Biology, University of Memphis, Memphis, TN 38152 [2]White Station Public Schools, Memphis, TN 38111.

3:40- 4:00 PM INTERACTION BETWEEN GREAT BLUE HERONS AND OSPREYS ON UPPER POOL 20, MISSISSIPPI RIVER. **Robert L. Connour II**[1] and Thomas C. Dunstan[2]. [1]Dept. of Math, Life, and Natural Sciences, Owens Community College, Findlay, OH 45840. [2]Dept. of Biological Sciences, Western Illinois University, Macomb, IL 45840.

4:00- 4:20 PM OSPREY (*Pandion haliaëtus*) NIGHT ROOSTING AT LOCK AND DAM 19, MISSISSIPPI RIVER. **Heather R. Grimm**, and T. C. Dunstan. Department of Biology, Western Illinois University, Macomb, IL, 61455.

4:20- 4:40 PM EFFECTS OF AGRICULTURAL POND WATER ON THE SURVIVAL OF ANURANS IN THE UPPER MIDWEST. **Joshua M. Kapfer**[1], Mark B. Sandheinrich[1], Melinda G. Knutson[2]. [1]University of Wisconsin-La Crosse, Department of Biology and River Studies Center, La Crosse, WI 54601, [2]U. S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd. La Crosse, WI 54603.

5:00- 6:00 PM **POSTERS**

6:30- 8:00 PM **BANQUET**

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SESSION V – WATER LEVEL MANAGEMENT: POOL 8 DRAWDOWN
(Moderator: Gretchen Benjamin)

8:00- 8:20 AM FOUR YEARS OF PLANNING TO PULL OFF THE 2001 DRAWDOWN – UMR POOL 8 **Gretchen Benjamin** Wisconsin Department of Natural Resource, 3550 Mormon Coulee Road, La Crosse, WI 54601 and the River Resources Forum - Water Level Management Task Force.

8:20- 8:40 AM VEGETATION RESPONSE TO A DEMONSTRATION DRAWDOWN ON POOL 8 OF THE UPPER MISSISSIPPI RIVER. **Kevin P. Kenow**, James E. Lyon, Randy K. Hines, and Larry R. Robinson. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

8:40- 9:00 AM SHOREBIRD USE ON MISSISSIPPI RIVER POOL 8 DURING THE 2001 EXPERIMENTAL WATER LEVEL REDUCTION. **Ric Zarwell**[1], Lara Hill[2], Amy Papenfuss[2]. [1]Birding Contractor, Lansing, IA 52151 [2]U.S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge.

9:00- 9:20 AM EFFECT OF WATER LEVEL DRAWDOWN ON NITROGEN CYCLING PROCESSES IN UPPER MISSISSIPPI RIVER POOL 8. **Eric A. Strauss**, William B. Richardson, Lynn A. Bartsch, Jennifer C. Cavanaugh, Denise A. Bruesewitz, Heidi J. Imker, and Dave M. Soballe. US Geological Society, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, Wisconsin 54603.

SESSION VI – FRESHWATER MUSSELS

(Moderator: Michelle Bartsch)

9:20- 9:40 AM THE MISSISSIPPI RIVER UNIONOID SURVEY OF 1907. **David H. Stansbery**. The Ohio State University Museum of Biological Diversity, 1315 Kinnear Rd., Columbus, OH 43212, Stansbery.1@osu.edu (614.263.2133).

9:40- 10:00 AM A COMPARATIVE STUDY OF MISSISSIPPI RIVER UNIONOID SURVEYS, ST. PAUL, MINNESOTA, TO CAIRO, ILLINOIS. **Marian E. Havlik**. Malacological Consultants, 1603 Mississippi Street, La Crosse, WI 54601-4969. havlikme@aol.com (608-782-7958).

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

10:20- 10:40 AM FRESHWATER MUSSEL SURVEY OF THE UPPER MISSISSIPPI (DAYTON, MN. TO LOCK AND DAM 3), LOWER ST. CROIX, AND LOWER MINNESOTA RIVERS, 2000-01. **Dan Kelner**[1] and Mike Davis[2]. Minnesota Department of Natural Resources, Division of Ecological Services. [1]500 Lafayette Rd. St. Paul, Mn 55155, [2]1801 S. Oak St. Lake City, Mn 55041.

10:40- 11:00 AM MULTIPLE QUANTITATIVE UNIONIDAE SURVEYS OF THE SAME TRANSECT WITH SPECIMEN REMOVAL BETWEEN SURVEYS; CHIPPEWA RIVER, WISCONSIN. **Chris Wallace** and Terry Balding. University of Wisconsin-Eau Claire, Biology Department, Eau Claire, WI 54702.

SESSION VII – FISH AND CONNECTIVITY

(Moderator: Mark Pegg)

11:00- 11:20 AM SPATIAL VARIATION OF FISH COMMUNITIES IN THE UPPER MISSISSIPPI RIVER BASIN. **John H. Chick**[1], Mark A. Pegg [2], Todd M. Koel [3]. [1] Illinois Natural History Survey, Great Rivers Field Station; [2] Illinois Natural History Survey, Illinois River Biological Station; [3]National Park Service, Yellowstone National Park.

11:20- 11:40 AM ECOSYSTEM FACTORS INFLUENCING FISH SPECIES RICHNESS WITHIN AQUATIC HABITATS OF THE UPPER MISSISSIPPI RIVER. **Michelle Cripps[1]**, Barry Johnson[2], Mark Sandheinrich[1], Roger Haro [1], Abdulaziz Elfessi[1], and Todd Koel[3]. [1]River Studies Center, University of Wisconsin-La Crosse, WI 54602, [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602, [3]U.S. Park Service, Yellowstone National Park, Mammoth, WY 82190.

11:40- 12:00 PM EVIDENCE FOR HABITAT LIMITATION OF CENTRARCHID FISHES OVER A BROAD SPATIAL SCALE IN THE UPPER MISSISSIPPI RIVER SYSTEM. **Steve Gutreuter**. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI 54603.

12:00- 12:20 PM MEASURES OF RIVER-FLOODPLAIN CONNECTIVITY I: ISOLATED BACKWATERS IN SELECTED REACHES OF THE UPPER MISSISSIPPI RIVER. **Kenneth S. Lubinski**[1] and Jeffrey A. Yanke[1,2]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602, [2]University of Wisconsin-La Crosse, La Crosse, WI 54601.

12:20 PM **LUNCH, BUSINESS MEETING AND RAFFLE**

SESSION VII - VEGETATION

(Moderator: Kevin Kenow)

1:40- 2:00 PM ASSESSING AND RESTORING MISSISSIPPI RIVER BLUFFLAND OAK SAVANNAH USING GIS. **Kirkpatrick, C**[1]., L. Powell[1] and D. Mills[2]. [1]University of Dubuque, Environmental Science/Biology Dept., 2000 University Ave. Dubuque IA, 52001, [2]Iowa Natural Heritage Foundation, Land Conservation Specialist.

2:00- 2:20 PM AN ESTIMATE OF LIGHT AVAILABILITY FOR AQUATIC VEGETATION IN POOLS 4, 8, 13, AND 26 OF THE UPPER MISSISSIPPI RIVER FROM 1993 to 1999. **Dennis M. Wasley**[1,2], James T. Rogala[1], and David M. Soballe[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603, [2]University of Wisconsin-La Crosse, La Crosse, WI 54601**.**

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2:20- 2:40 PM AQUATIC VEGETATION COMMUNITIES OF POOL 13 OF THE UPPER MISSISSIPPI RIVER SYSTEM. **Amy Waterman**[1] and Theresa Blackburn[2]. [1]Environmental Science Program, University of Dubuque, Dubuque, IA 52001 [2]Iowa Department of Natural Resources, Long Term Resource Monitoring Program, Bellevue, IA 52031.

2:40- 3:00 PM PRELIMINARY RESULTS OF WILDCELERY (*VALISNARIA AMERICANA)* RE-ESTABLISHMENT EFFORTS IN LAKE CHAUTAUQUA, ILLINOIS RIVER. **Thad R. Cook** and Mark A. Pegg Illinois Natural History Survey, Illinois River Biological Station, Long Term Resource Monitoring Program, 704 North Schrader Ave., Havana, IL 62644.

3:00- 3:20 PM *VALLISNERIA AMERICANA* REVISITED ON LAKE ONALASKA IN POOL 7, UPPER MISSISSIPPI RIVER. **Amy Papenfuss** [1,2] . [1]U.S. Fish and Wildlife Service, Upper Mississippi River National Wildlife & Fish Refuge – La Crosse District, Onalaska, WI 54650, [2]St. Mary's University of Minnesota – Winona Campus, Winona, MN 55987

3:20- 3:40 PM AQUATIC VEGETATION IN NAVIGATION POOL 11 OF THE UPPER MISSISSIPPI RIVER SYSTEM. **Jeffrey A. Yanke**[1,2] and Yao Yin[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI 54602, [2]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

3:40- 4:00 PM **STUDENT AWARDS AND STAY-TO-THE-END-RAFFLE**

4:00 PM **ADJOURN**

N O T E S

NOTES

POSTER PRESENTATIONS
THURSDAY, APRIL 25, 2002, 10:00 AM - 6:00 PM
Authors Present 5:00- 6:00 PM
(Listing by topic)

FRESHWATER MUSSELS

1) EFFECTS OF AMMONIA ENRICHMENT ON SURVIVAL AND GROWTH OF JUVENILE MUSSELS IN THE ST. CROIX RIVERWAY. **Michelle Bartsch**[1], John O'Donnell[2], Teresa Newton[1], LeeAnne Thorson[2], and Bill Richardson[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI, [2]University of Wisconsin-La Crosse, River Studies Center, La Crosse, WI.

2) EFFECTS OF UN-IONIZED AMMONIA ON JUVENILE UNIONIDS IN SEDIMENT TOXICITY TESTS. **Teresa Newton**[1], Jon O'Donnell[2], Michelle Bartsch[1], LeeAnne Thorson[2], and Bill Richardson[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI, [2]University of Wisconsin-La Crosse, River Studies Center, La Crosse, WI.

BIRDS

3) SCIENCE SUPPORT FOR REGIONAL AND REFUGE BIRD CONSERVATION PLANNING. **Craig R. Beckman**[1], Shawn Weick[1], Melinda G. Knutson[1], John R. Sauer[2], Timothy J. Fox[1], Eileen M. Kirsch[1], Brian R. Gray[1], Christine A. Ribic[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603 [2]U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD 20708.

4) USING TELEMETRY AND DNA ANALYSES TO DETERMINE NATAL DISPERSAL RATES OF WOOD THRUSHES. **Jason Hass**[1], Lara Scott[1], Abigail Garner[1], Larkin Powell[2] and Justin Streit[3]. [1]Department of Environmental Science, University of Dubuque, Dubuque IA 52001, [2]School of Natural Resources, University of Nebraska, Lincoln, NE 68583, [3]Department of Biology, Northland College, Ashland, WI 54806.

AMPHIBIANS

5) FLOW CYTOMETRY AS A TOOL FOR DETECTING GENOTOXIC EFFECTS IN AMPHIBIANS BREEDING IN SOUTHEASTERN MINNESOTA FARM PONDS. **Bart L.Bly**[1], Dean A. Jobe[2], Mark B. Sandheinrich[1], Melinda G. Knutson[3], Brian R. Gray[3], Shawn Weick[3]. [1]University of Wisconsin-La Crosse, Department of Biology, 1725 State Street, La Crosse, WI 54601, [2]Microbiology Research Laboratory, Gundersen-Lutheran Medical Center, 1836 South Ave, La Crosse, WI 54601, [3]USGS, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd, La Crosse, WI 54603.

6) EFFECTS OF AGRICULTURAL AND URBAN LAND USES ON MOVEMENT AND HABITAT SELECTI0N BY NORTHERN LEOPARD FROGS (*RANA PIPIENS*). **Brian C. Pember**[1], Melinda G. Knutson[2], Brent Knights[2] and Shawn Weick[2]. [1]River Studies Center, University Wisconsin-La Crosse, La Crosse, WI 54601, [2]U. S. Geological Survey, Midwest Environmental Sciences Center, La Crosse, WI 54602.

7) AMPHIBIAN RESEARCH AND MONITORING INITIATIVE (ARMI) IN THE MIDWEST. **Samuel J. Bourassa**, James E. Lyon, and Melinda G. Knutson. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

8) FARM PONDS AS CRITICAL HABITATS FOR NATIVE AMPHIBIANS. **Shawn Weick**[1], Melinda G. Knutson[1], William Richardson[1], Mark Sandheinrich[2], Dan Sutherland[2], Brent Knights[1], Jeff Parmelee[3]. [1]USGS Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, WI 54603, [2]Department of Biology and River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601, [3]Simpson College, 701 N. C. Street, Indianola, IA 50125.

DRAWDOWN AND SEDIMENTS

9) WATER LEVEL DRAWDOWN: IMPACTS ON SEDIMENT CHARACTERISTICS AND POREWATER NITROGEN IN MISSISSIPPI RIVER POOL 8. **J. C. Cavanaugh**, D. A. Bruesewitz, L. A. Bartsch, E. A. Strauss, W. B. Richardson, D. M. Soballe, A. M. Mahan. US Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI, 54603.

10) SUBMERSED VEGETATION AND WATER QUALITY IN POOL 8, UPPER MISSISSIPPI RIVER, DURING THE DRAWDOWN OF 2001. Heidi A. Langrehr, **James R. Fischer,** J. Therese Dukerschein. Wisconsin Department of Natural Resources, Onalaska Field Station, 575 Lester Avenue, Onalaska, WI 54650.

11) ANALYSIS OF HISTORICAL SEDIMENTATION TRANSECT DATA FOR SIX PERMANENTLY MARKED RIVER MILE TRANSECTS IN POOL 22 OF THE UPPER MISSISSIPPI RIVER. **Joseph S. Lundh,** Gary V. Swenson. US Army Corps of Engineers, Mississippi River Project, PO Box 534, Pleasant Valley , IA 52767.

AQUATIC INVERTEBRATES AND ORGANIC MATTER

12) PATTERNS OF SECONDARY PRODUCTION OF HEPTAGENIID MAYFLIES IN MAIN AND SIDE CHANNEL HABITATS. **Karie S. Hiam, Leila Desotelle** and Micheal D. Delong. Larger Rivers Studies Center, Biology Department, Winona State University, Winona, MN 55987.

13) INVERTEBRATE COMMUNITY STRUCTURE ON SNAGS IN MAIN CHANNEL AND SIDE CHANNEL HABITATS OF THE UPPER MISSISSIPPI RIVER. **Beth Rycyzyn** and Michael Delong. Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

14) HABITAT RELATED DIFFERENCES IN SECONDARY PRODUCTION OF HYDROPSYCHID CADDISFLY LARVAE IN THE UPPER MISSISSIPPI RIVER. **Paige Wein** and Michael Delong. Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

15) SPATIAL AND TEMPORAL VARIABILITY IN FOOD QUALITY OF TRANSPORT ORGANIC MATTER. **Paul D. Hoppe** and Michael D. Delong. Large River Studies Center, Biology Department, Winona State University, Winona MN 55987.

VEGETATION

16) PREDICTING BIOMASS OF SUBMERSED AQUATIC VEGETATION USING THE LTRMP AQUATIC VEGETATION RAKE METHOD. **Kevin P. Kenow[1]**, James E. Lyon[1], Randy K. Hines[1], and Abdulaziz Elfessi[2]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603, [2]Department of Mathematics, University of Wisconsin-La Crosse, La Crosse, WI 54602.

17) SUBMERSED AQUATIC VEGETATION MONITORING IN LAWRENCE LAKE, POOL 8, UPPER MISSISSIPPI RIVER SYSTEM, 1992-2001. **Heidi A. Langrehr,** James R. Fischer, and J. Therese Dukerschein. Wisconsin Department of Natural Resources, Onalaska Field Station, Onalaska, WI 54650.

18) *VALLISNERIA AMERICANA* MICHX DISTRIBUTION AND ABUNDANCE WITH A FEW CHEMICAL AND PHYSICAL PARAMETERS. **Rebecca M. Thums** [1], and Yao Yin[2]. [1]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, Onalaska, WI 54650.

MAMMALS

19) A STUDY OF BAT HABITAT AND ACTIVITY AT TWO SITES IN DUBUQUE COUNTY, IOWA: MINES OF SPAIN AND WHITE PINE HOLLOW. **Brian Lex** and Laura Cady. Environmental Science Program, Biology Department, University of Dubuque, Dubuque, IA 52001.

FISH

20) FEEDING ECOLOGY OF LARVAL BLUE SUCKER (*CYCLEPTUS ELONGATUS*) IN MISSISSIPPI RIVER BACKWATERS. **Michael B. Flinn**[1], S.Reid Adams[2], and Matt R. Whiles[1]. [1]Department of Zoology, Southern Illinois University, Carbondale, IL, USA 62901, [2]Department of Zoology, and Fisheries and Illinois Aquaculture Center, Southern Illinois University, Carbondale, IL, USA, 62901.

Notes

EFFECTS OF VANTAGE® (SETHODYDIM) ON SEED HEAD DENSITY AND BIOMASS OF REED CANARYGRASS (*PHALARIS ARUNDINACEA* L.)

Craig A. Annen[1, 2], Robin W. Tyser[1, 3], and Eileen M. Kirsch[3]
[1]University of Wisconsin – La Crosse, La Crosse WI 54601 [2]U.S. Army Corps of Engineers, Mississippi River Project, La Crescent, MN 55947 [3]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

Reed canarygrass (*Phalaris arundinacea* L.) is an invasive cool season perennial grass that threatens the biodiversity of native vegetation in sedge meadows, wet meadows, and wet prairies. This species is widely distributed along the floodplains of the Upper Mississippi River (UMR) and its major tributaries. Vantage®, a grass-specific herbicide, may facilitate reestablishment of native vegetation with concomitant chemical control of reed canarygrass. A study was conducted to test the efficacy of Vantage® for reducing seed head density and biomass of reed canarygrass. Three treatments were tested in a randomized complete block design with eight replications: (1) control (no herbicide application), (2) one herbicide application (early summer), and (3) two herbicide applications (early & late summer). The application site was a wet meadow along the La Crosse River dominated by reed canarygrass. Treatment with Vantage® reduced seed head density by 91 – 98% of the controls. Aboveground biomass was reduced by 46 – 56%. There were no biologically significant differences between the two treatment regimes for either of the responses measured. We conclude that Vantage® herbicide controls reed canarygrass at economic rates without harming sedges and forbs, but that multiple-year applications may be necessary to completely eradicate the species.

Keywords: *Phalaris arundinacea*, Vantage® herbicide, invasive species control, biomass reduction, seed head suppression

FOUR YEARS OF PLANNING TO PULL OFF THE 2001 DRAWDOWN – UMR POOL 8

Gretchen Benjamin
Wisconsin Department of Natural Resource, 3550 Mormon Coulee Road, La Crosse, WI 54601 and the River Resources Forum - Water Level Management Task Force.

During the summer of 2001, Upper Mississippi River Pool 8 was drawn down 18 inches at Lock and Dam 8 for the purpose of habitat restoration, specifically aquatic vegetation and potential sediment consolidation. The Water Level Management Task Force worked for more than four years to develop and implement the plan for the 2001 drawdown. A number of elements had to be set up prior to the implement of the plan, including an extensive public involvement process. Initially the task force worked on small-scale drawdowns in diked off backwaters. Three projects were completed and appeared to prove beneficial so the decision was made to attempt a large-scale drawdown in an entire pool. Four pools offered the best chance of success so the task force went to the public for input on pool selection for a demonstration project. Pool 8 was chosen, based on public acceptance, the chance to benefit a large number of acres in lower Pool 8, manageable main channel dredging, manageable recreation impacts, and the ability to do extensive monitoring. A video was produced to document this process and outline the issues associated with use of water level management in the future.

(The Water Level Management Task Force recognizes substantial contributions from traditional federal and state agencies like, USFWS, USACE, USGS, WDNR, MDNR but also nontraditional participants like Kent Pehler -Brennan Marine, Lee J. Nelson - Upper Mississippi Service, Sol Simon - Mississippi River Revival and other concerned citizens.)

SPATIAL VARIATION OF FISH COMMUNITIES IN THE UPPER MISSISSIPPI RIVER BASIN

John H. Chick 1, Mark A. Pegg 2, Todd M. Koel 3
1 Illinois Natural History Survey, Great Rivers Field Station; 2 Illinois Natural History Survey, Illinois River Biological Station; 3 National Park Service, Yellowstone National Park.

Since 1991, researchers with the Long Term Resource Monitoring Program have collected fish abundance and composition data from six regional trend areas (RTA) in the Upper Mississippi River System (UMRS): Mississippi River navigation pools 4, 8, 13, and 26, the La Grange pool of the Illinois River, and an open river reach on the Mississippi River near Cape Girardeau, MO. These six RTAs were chosen to represent the range of conditions present throughout the UMRS and are meant to allow for system wide inferences about fish population and community dynamics. To test the adequacy of these six RTAs in representing the variation of fish communities present in the UMRS, additional sampling was conducted during 2000 from areas above and below (out-pools) three RTAs, and from navigation pools 19 and 20. Cluster analysis and non-metric multi-dimensional scaling of species composition (presence absence) and community structure data revealed two major spatial groups of pools, and four sub-groups. Northern and southern pools formed the two major pool groups. The sub-groups identified included open river reaches, southern pools, northern pools, and the La Grange reach of the Illinois River. Out pools generally grouped with the closest RTA, but pools 19 and 20 grouped with southern pools in terms of species composition with northern pools in terms of community structure. This analysis suggests the six RTAs may be adequate to capture the major spatial differences in fish communities within the UMRS, namely southern versus northern pools, but additional research is needed to clarify how fish communities in pools 19 and 20 contrast with other areas in the UMRS.

Keywords: Upper Mississippi River System, fish communities, spatial variation, multivariate statistical analysis

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INTERACTION BETWEEN GREAT BLUE HERONS AND OSPREYS ON UPPER POOL 20, MISSISSIPPI RIVER

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Great Blue Herons (*Ardea herodias*) are common residents along the Mississippi River and are year round residents in many portions of their range. Ospreys (*Pandion haliaetus*), although less common, are seen in greater numbers as they begin their fall migration in August and September. For this study, data on great blue herons were collected from 29 May to 29 September 1997. Also in 1997 ospreys (N=30) first appeared in the study area on 27 August and were counted, along with herons, three times per day three days per week until 27 September. Numbers of herons seen remained consistent with numbers prior to the ospreys' appearance, and the two species did not appear to displace one another, often being seen in close proximity. This is probably due to differences in foraging strategies. Although the two species often perched in trees along the same shorelines, it is noteworthy that they were never observed together in the same tree. Herons were often spotted along the water's edge directly below ospreys that were perched in trees above. Although herons were common along the Iowa shoreline where much area is exposed and open for wading, no ospreys were seen along this edge. This is probably due to the complete lack of suitable perch trees along this area compared to the more wooded areas along the Illinois and Missouri shorelines. Both species were common near Lock and Dam 19 and along the Illinois shorelines.

Key words: Great Blue Heron, Osprey, Mississippi River, migration, shoreline

PRELIMINARY RESULTS OF WILDCELERY (*VALISNARIA AMERICANA)* RE-ESTABLISHMENT EFFORTS IN LAKE CHAUTAUQUA, ILLINOIS RIVER.

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The abundance of aquatic vegetation in Illinois River backwaters in the early 1900's is well documented. For example, Peoria Reach was described as having extensive populations of pondweeds *(Potamogeton spp.),* wild celery *(Valisnaria americana),* and coontail *(Ceratophyllum demersom)* between 1910 and 1914. As early as 1915, submersed aquatic vegetation (SAV) began to disappear from Peoria Reach following the diversion of Lake Michigan waters to the Illinois River. By 1920, SAV had almost completely disappeared from the river, its connecting sloughs, and backwater lakes. Similarly, the present distribution of SAV within the Lower Illinois River is very limited. Efforts to re-establish this life form within these connected backwaters have been met with limited success. In 2001, we began investigating factors limiting SAV, specifically wild celery, in Lake Chautauqua, an isolated backwater. Wild celery winter buds were planted at four sites in Lake Chautauqua at a density of 6.9 buds/m² in two treatments (enclosed 3 x 3-m cage and an unprotected 3 x 3-m area) plus an additional enclosed control with no plantings. Sites were visited bi-weekly where leaf measurements of each plant were taken to evaluate success. Subsequent daughter plants were documented and measured when present. We collected water quality data (e.g., temperature, DO, turbidity) to assess the physical conditions around the enclosures. A subset of plants were allowed to complete their annual life cycle and harvested to determine success of winter bud production. All plantings not protected by enclosures encountered a high occurrence of leaf cropping. Initial growth was good, but none of the unprotected plants survived the growing season. Results varied within the enclosures as some sites were unsuccessful while others grew and reproduced successfully. Production of winter buds from the initial tubers planted in the enclosures ranged from 0/m² to 927/m². Limited success within the enclosures suggests that abiotic factors limited plant growth. Our study suggests that biotic and abiotic factors can limit wild celery growth in Lake Chautauqua. However, the probability of establishment of this species can be high given the appropriate conditions.

Keywords: Illinois River, *Vallisneria americana*, Wild celery

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ECOSYSTEM FACTORS INFLUENCING FISH SPECIES RICHNESS WITHIN AQUATIC HABITATS OF THE UPPER MISSISSIPPI RIVER.

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Because of anthropogenic effects on the biological integrity of the upper Mississippi River, maintaining the diversity of native species of fish has become increasingly important. Consequently, identifying and quantifying the abiotic factors governing diversity in this system is requisite for conservation of fish species. The objective of our study was to assess the relationship between fish species diversity and habitat heterogeneity, space, connectivity, water level variability, and tributary influences. Species richness, measured by the rarefaction method, was used as a measure of fish species diversity. Based on electrofishing data collected in 1998 to 2000 by the Long Term Resource Monitoring Program, the number of fish species was calculated for contiguous floodplain lakes, secondary side channels, contiguous impounded areas, and main channel border areas of Pools 4, 8, 13, 26, an open river reach, and the La Grange Reach of the Illinois River. Fish species richness was compared among the habitat types in all pools relative to measured abiotic variables.

Keywords: fish species diversity, rarefaction, aquatic habitat comparisons, habitat heterogeneity, and connectivity

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IDENTIFICATION OF CRITICAL RESOURCES IN LARGE RIVER FOOD WEBS THROUGH SEPARATION OF ALGAL AND DETRITAL COMPONENTS OF TRANSPORTED ORGANIC MATTER.

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Past studies of large river food webs using natural stable isotope ratios of carbon and nitrogen as tracers indicated that fine organic matter (particles 1 mm - 100 μm in diameter) transported in the water column and dissolved nutrients (DN) were primary food resources for consumers. C/N ratios of these components suggested that these food resources were primarily autochthonous in origin. Greater resolution, however, was necessary to elucidate their composition and to develop better functional models of large river food webs. This study used a colloidal silica extraction technique to separate the living and detrital components of both fine (FTOM) and ultrafine (100 - 1 μm in diameter; UTOM) transported organic matter. Carbon and nitrogen isotopic ratios were determined separately for each component so that linkages with consumers could be established. Samples were collected July 2001 over a 12-km long section of Reach 6 of the Upper Mississippi River. A single transported organic matter sample consisted of an 80-L sample collected across a single perpendicular transect at four points. Equal volumes of water were drawn at four depths at each point and all water samples on a transect were pooled to create a composite. In addition to FTOM, UTOM and DN, samples were partitioned into coarse transported organic matter (> 1mm diameter) and colloidal dissolved organic matter (1 - 0.5 μm in diameter). Only FTOM and UTOM were separated using colloidal silica. A duplicate water sample was collected along each transect so that the isotopic ratio of whole FTOM and UTOM could be compared to values obtained in past studies. Other potential food sources collected from nearshore areas included: benthic algae, aquatic macrophytes, and terrestrial C_3 leaves from the floodplain forest floor. Benthic invertebrates were collected by hand-picking snags and rock. Insects were placed in aerated chambers for 2 d to allow clearance of their digestive tract. All samples were ground to a fine powder and sent to the University of Alaska-Fairbanks Isotope Ratio Mass Spectrometry Laboratory for determination of carbon and nitrogen stable isotope ratios and C/N mass ratio. Separation using colloidal silica revealed that FTOM consists of approximately 70% living phytoplankton and 30% detritus. Detailed analysis of actual isotopic ratios allowed for a firmer association between phytoplankton component of available organic and consumers, thus allowing for the creation of more realistic food web models.

Keywords: food web, trophic relations, stable isotope, riverine productivity model

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DETECTION OF TOTAL SUSPENDED SOLIDS AND TURBIDITY WITH SATELLITE REMOTE SENSING FOR POOLS 4, 8, 13 AND 26 OF THE UPPER MISSISSIPPI RIVER.

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Deposition and transportation of total suspended solids (TSS), particularly suspended sediment, have been topics of longstanding concern throughout the Upper Mississippi River (UMR). Problems associated with TSS include reductions in depth, productivity, habitat, and aquatic biomass along with loss of connectivity of the river from its floodplain. Satellite technology has been shown as a useful approach for estimating sediment concentrations in many aquatic environments. Satellites offer a larger field of view and increased spatial variability than aerial photographs or individual field sampling techniques. This study evaluates the feasibility of satellite remote sensing for detecting and quantifying TSS and turbidity throughout the UMR. Point source water quality parameters (TSS, turbidity, chlorophyll-a) for stratified random sampling (SRS) sites were obtained from the Long Term Resource Monitoring Program (LTRMP). Satellite images were obtained from the Earth Resources Observation Systems (EROS) data center. Initial results of a supervised classification indicate, for TSS, an overall detection accuracy of 79% (Pool 4), 38% (Pool 8), 0% (Pool 13), and 44% (Pool 26), with a total accuracy for all pools of 49%. Results for Pool 13 can be mainly attributed to a lack of sampling sites. Overall accuracy for turbidity was 93% (Pool 4), 86% (Pool 8), 50% (Pool 13), and 33% (Pool 26), with a total accuracy of 74%. These findings suggest that satellite remote sensing is limited in its ability to detect TSS and turbidity; however, potential exists, as evidenced by detection of spatial patterns. Future analysis should concentrate on increased sampling throughout the entire pool, especially during satellite flyover, thus allowing for better image analysis and greater control over changing river conditions.

Keywords: satellites, remote sensing, Mississippi River, sediment, water quality

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OSPREY (*Pandion haliaëtus*) NIGHT ROOSTING AT LOCK AND DAM 19, MISSISSIPPI RIVER.

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During the fall migration period of 2001, osprey, *Pandion haliaëtus,* population size, night roost entry and exit times, and related behavior were studied at Lock and Dam 19, Mississippi River. Data were gathered weekly (Friday evenings and Saturday mornings) on eight occasions from Aug 31 to Sep 21, 2001. This study used ground observation surveys to document the number of ospreys foraging, resting and night roosting in the subject area along on the Illinois riverbank area. The counts of ospreys varied between one to 36 ospreys per observation period. Data on foraging activity as related to night roost morning exit and evening entry times were analyzed and plotted in relation to official sunrise and sunset times, respectively. The locations for night roosting within the river ecosystem were identified, and the relative use of landscape was analyzed via Chi-Square and Simpson's Diversity analyses. The study area is a multiple use area for fish-eating avian species and this pilot study provides information for future research and applied management for ospreys using the area during both fall and spring migration.

Keywords: *Pandion haliaëtus*, osprey, migration, Mississippi River, night roosting

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CHARACTERIZATION OF MACROINVERTEBRATE ABUNDANCE AND BIOMASS ASSOCIATED WITH DIFFERING WATERFOWL MANAGEMENT TREATMENTS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY.

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Managers in the Lower Mississippi Alluvial Valley (LMAV) employ a variety of treatments to provide moist-soil seed crops and vegetation as food resources for migratory waterfowl. Little is known about macroinvertebrate communities associated with these management treatments, which may provide a secondarily important food resource for migrating waterfowl. We characterized benthic community abundance and biomass in four types of management treatments: permanent deep water (DE), fall flooded duck potato (DP), fall flooded millet (ML), and re-flooded shorebird management areas (SB). Aquatic worms (Oligochaeta) dominated abundance in all treatments, while biomass consisted primarily of oligochaetes, snails, midge larvae (Chironomidae), and aquatic larvae of the beetle *Berosus*. Abundance was significantly greatest under DE management (128,000/m^2), followed by ML (58,000/m^2) and SB (52,000/m^2), and significantly least in DP (12,000/m^2) areas. Standing stock biomass was very high in DE, ML, and SB treatments, with mean ash-free dry mass exceeding 10g/m^2. Standing stocks noted in DP treatment areas still exceeded 4 g/m^2. These results indicate that substantially large communities of macroinvertebrates are associated with waterfowl management areas in the LMAV. These communities represent a potentially important food resource, which, if not utilized during the fall waterfowl migration, may be available as a protein resource during the spring migration to the breeding grounds.

Keywords: aquatic macroinvertebrates, benthic communities, community composition, migratory waterfowl, Mississippi delta

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TEMPORAL AND SPATIAL VARIATION IN ZOOPLANKTON FLUX RATES IN THE OHIO RIVER.

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We conducted a 3-year survey in the lower Ohio River (RKM 854-1500) assessing physiochemical and biological parameters such as zooplankton flux rates. The portion of the Ohio River in the study receives inputs from five major tributaries which have unique chemical and biological properties reflective of their watersheds. For 1998-2000, zooplankton species richness was inversely correlated with discharge and the tributaries differed in zooplankton species structure. Zooplankton flux rates (as individuals second^{-1} or grams carbon second^{-1}) also varied with discharge. Budgets of zooplankton carbon provided input contribution of zooplankton from the upper Ohio River and tributaries. Inputs from the upper Ohio River provided 38% of zooplankton carbon and were not correlated with discharge. Tributaries provided 63% of zooplankton inputs; the importance of which varied seasonally and temporally. The most important tributaries contributing zooplankton carbon to the Ohio River were those draining reservoirs (Cumberland and Tennessee Rivers). Zooplankton showed no relationship with chlorophyll *a* or POC. The Ohio River acted as a net source of zooplankton carbon during 4 of our sampling times for groups such as *Ceriodaphnia*, *Diphanosoma*, and rotifers and often acted as a sink for *Bosmina*. Zooplankton flux differed depending on position in the basin; the upstream portion of the study area was a 'source' of zooplankton, while the downstream area upstream of the Ohio River's confluence with the Mississippi River acted as a 'sink' to zooplankton.

Keywords: zooplankton, Ohio River, budget, flux rates, discharge

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EVIDENCE FOR HABITAT LIMITATION OF CENTRARCHID FISHES OVER A BROAD SPATIAL SCALE IN THE UPPER MISSISSIPPI RIVER SYSTEM.

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Habitat rehabilitation efforts are typically costly, and will be ineffective if habitat is not limiting. Therefore, it is important to assess habitat limitation wherever habitat rehabilitation projects are considered. Catch-count data from the Long Term Resource Monitoring Program were used to identify evidence for backwater habitat limitation by centrarchid fishes in the Upper Mississippi River System. The data were collected using a probability-based stratified-random sampling design. The design enabled fitting statistical models of the association between mean catch at the spatial scale of tens of river kilometers and the percentage of contiguous aquatic area in backwater of various minimum depths by maximizing a stratum-area weighted negative binomial log likelihood function. The results were consistent with the hypothesis that backwaters limit the abundance of centrarchids in this large river system, but only when backwaters composed very small percentages of the total contiguous aquatic area. This suggests that habitat restoration projects designed to increase the area of backwaters suitable for winter survival of centrarchids in the Upper Mississippi River System will be likely to produce measurable benefits only in the lower reaches of that system where backwaters are presently uncommon. Predictions from these statistical models can be validated in situ if backwater areas are changed by habitat restoration and sedimentation, and if the resulting changes in bathymetry can be updated at appropriate time intervals.

Keywords: centrarchid fishes, backwaters, habitat, limitation, model

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A COMPARATIVE STUDY OF MISSISSIPPI RIVER UNIONOID SURVEYS, ST. PAUL, MINNESOTA, TO CAIRO, ILLINOIS.

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Prior to agency sponsored unionoid studies started in the 1970's, most Upper Mississippi River (UMR) researchers were aware of mollusk surveys by Utterback, Grier, and Ellis. Almost unknown is a survey done in 1907 by Dr. Paul W. Bartsch, from Mississippi River Mile 838.5-0.0. The Bartsch locations have been converted to present day Mississippi River Miles. In 1907, unionoids were found at 88 of 140 sites. Bartsch recorded 15 negative mainstem sites upstream of the Missouri River, and 17 negative sites downstream of the Missouri River. Overall, four species, *Quadrula pustulosa* (Lea 1831), *Amblema plicata* (Say 1817), *Lampsilis cardium* (Rafinesque 1820), and *Leptodea fragilis* (Rafinesque 1820), were found more frequently than *Fusconaia ebena* (Lea 1831), although the latter was apparently the most abundant species. *Lampsilis higginsi* (Lea 1857) were retained from 39 sites, *Potamilus capax* (Green 1832) from 13 sites, and *Cumberlandia monodonta* (Say 1829) from eight sites, but *Leptodea leptodon* (Rafinesque 1820), was only retained from a single site. Three species common today, *Utterbackia imbecillis* (Say 1829), *Toxolasma parvus* (Barnes 1823), and *Anodonta suborbiculata* (Say 1831), and several rare species including *Quadrula fragosa* (Conrad 1835), *Epioblasma triquetra* (Rafinesque 1820), and *Simpsonaias ambigua* (Say 1825), were either not found, or else not retained. Even in 1907, five to10 species appeared to be extralimital including *Ligumia subrostrata* (Say 1831), *Potamilus purpuratus* (Lamarck 1819), *Uniomerus tetralasmus* (Say 1831), *Alasmidonta viridis* (Rafinesque 1820), and *Lasmigona compressa* (Lea 1829). The 1907 areas with the highest species diversity continue to have the highest diversity today: Pools 10 (36 species), Pool 3 and 13 (35 species), Pool 8 and 9 (34 species), and Pool 14 and 15 (33 species). No more than two species were retained at 28 of the 140 sites.

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A recent summary of archeological records reported 39 species from Pools 4-16. The 1907 survey retained 39 unionoid species, and the 1930 Ellis survey also reported 39 unionoid species. Havlik and Sauer (2000) reported that 51 unionoid species have been recorded from the Upper Mississippi River since the 1870's. Forty-four of these species have been recorded since 1968, with at least 38 species being reported alive since 1991. All of the rare species in the UMR today were rare even in 1907, but all of those rare species still survive today in tributaries within 100 miles of the Upper Mississippi River. I compare early Mississippi River unionoid distributions, rank, and frequency of occurrence, with present day UMR records, by Pool. Over the past century, the total fauna has remained stable, but some species have become more abundant, while others have become rare, or locally extirpated.

Keywords: Mississippi River, unionoids, unionoid surveys, unionoid species, Mississippi River mussels

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THE EFFECTS OF PURPLE LOOSESTRIFE BIOLOGICAL CONTROL BEETLES (*GALERUCELLA SPP.*) ON PURPLE LOOSESTRIFE PLOTS ON THE UPPER MISSISSIPPI RIVER NATIONAL WILDLIFE AND FISH REFUGE.

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Purple loosestrife (L*ythrum salicaria*) is an invasive exotic plant in North American wetlands. It displaces native vegetation, forms dense monocultural stands, and eliminates natural food and cover plants essential to many wildlife species. Purple loosestrife is a large aggressive plant with deep roots that produces millions of seeds each year. It spans across 26 states and an estimated 400,000 acres, making control by herbicides, hand pulling, mechanical manipulation, burning, and water manipulations ineffective and infeasible. In 1994, the U.S. Department of Agriculture approved the release of two biological control insects for purple loosestrife. Researchers discovered the insects in the plant's native range of Europe and demonstrated that the insects were safe and effective in reducing purple loosestrife. The leaf and stem-eating beetle G*alerucella spp*. has been released on six sites of the Upper Mississippi River National Wildlife and Fish Refuge – La Crosse District (Refuge). The root-eating weevil *Hylobius tanversoviattauus*, has been released on 2 sites. In addition, two *Galerucella spp.* field insectary sites were created on Trempeleau National Wildlife Refuge. Many factors contribute to the success of the beetles in reducing purple loosestrife. Monitoring has shown a decrease in plant densities and vigor at several of the sites.

Keywords: purple loosestrife, biological control, *galerucella spp.*

WHITE PERCH DISTRIBUTIONS IN THE ILLINOIS RIVER: DETECTING AN INVASIVE SPECIES WITH THE LONG TERM RESOURCE MONITORING PROGRAM.

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White perch *Morone americana* are native to the Atlantic coast of the United States and first gained access to the Great Lakes in the early 1900's with the construction of canals connecting these water bodies. White perch have since spread throughout the Great Lakes and are now invading the Upper Mississippi River System through a connection between the Illinois River and Lake Michigan. We have collected white perch along the La Grange Reach of the Illinois River since 1991, through the Long Term Resource Monitoring Program (LTRMP). Since 1991, we have observed a growing white perch population with total abundance in our standardized collections rising to over 50 fish per year (1999). Initial negative impacts with the native fauna include collections of yellow bass x white perch hybrids in the Illinois River. It is important to understand the detrimental effects this invasion may have on the Illinois River and other ecosystems as this species expands its range.

Keywords: White perch, *Morone americana*, Illinois River, invasive species, hybrids, Long Term Resource Monitoring Program

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EFFECTS OF AGRICULTURAL POND WATER ON THE SURVIVAL OF ANURANS IN THE UPPER MIDWEST.

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Global declines in amphibian populations are due, in part, to loss of habitat. Consequently, artificially constructed habitats, such as farm ponds, may be important for maintaining regional populations of amphibians. The objective of our study was to assess the potential toxicity of water from agricultural ponds to anurans. We placed mesocosms in 6 ponds located in row crops (primarily corn and soybeans) and in 4 ponds located in natural wetlands. Mesocosms were stocked with embryos of the northern leopard frog (*Rana pipiens*), which were then allowed to develop through metamorphosis. We assessed differences in mortality of leopard frogs between ponds located in row crops and natural wetlands. Concurrently, laboratory studies were conducted with water from these ponds. The Frog Embryo Teratogenesis Assay *Xenopus* (FETAX) was used to assess the effects of pond water on the development and survival of the African clawed frog (*Xenopus laevis*). In addition, concentrations of total nitrogen, total phosphorus, ammonia, and pesticides were measured in ponds and compared to survival of *X. laevis*. There was no significant difference in the survival of anurans between agricultural and natural wetlands, and water quality had no biologically significant effect on anuran survival. Results of this study will be used to help determine the suitability of farm ponds as habitats for amphibians.

Key Words: amphibians, mortality, agriculture, mesocosms, FETAX

FRESHWATER MUSSEL SURVEY OF THE UPPER MISSISSIPPI (DAYTON, MN. TO LOCK AND DAM 3), LOWER ST. CROIX, AND LOWER MINNESOTA RIVERS, 2000-01.

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In 1999, a survey was begun to determine the distribution and abundance of unionoid mussels in Minnesota. During 2000 and 2001, as part of this effort, 167 sites were sampled along an 83 mile (134 km) stretch of the Upper Mississippi River (UMR) that extends from approximately 20 miles (32 km) north of the Twin Cities near Dayton, MN. (RM 880), through the Twin Cities to Lock and Dam 3 near Red Wing, MN. (RM 797). Five pools or reaches were surveyed within this stretch and include from upstream to downstream; Coon Rapids Pool (above Coon Rapids Dam), St. Anthony Falls Pool (above St. Anthony Falls [SAF]), and Pools 1, 2, and 3. During 2001, 20 sites along a 24 mile (39 km) reach of the lower St. Croix River (LSCR) from Stillwater, MN to its confluence with the UMR at Prescott, WI, and 13 sites along a 4 mile (6 km) reach of the lower Minnesota River (LMNR) to its confluence with the UMR were also surveyed. Sample methods were consistent throughout the study and consisted of timed searches and hand collection of mussels while wading, snorkeling, and diving. One-person hour/site was targeted as the search time and sites were typically spaced no more than 1 mile (1.6 km) apart. Quantitative samples were also collected and mussel bed boundaries mapped at five sites within the UMR. Zebra mussel (*Dreissena polymorpha*) density was determined from quantitative samples and zebra mussels attached to unionids collected from timed searches were counted.

Over 25,000 live mussels representing 30 species were collected with an additional 11 species collected as empty shells. A total of 27 live species were collected in the UMR proper, 25 in the LSCR, and 9 in the LMNR. Mussels in the LSCR were more abundant and the assemblage appeared to more closely support its historic compliment of mussel species as compared to the UMR and LMNR. Exclusive to the LSCR mussel assemblage was the federally endangered *Lampsilis higginsi*. The mussel fauna of UMR Pools 1, 2, 3 appear to be recolonizing since its reported decimation by pollution during the first half of the 1900's. The survey provided clear evidence of recent and ongoing recruitment; many of the individuals collected were less than 10 years old. Several state listed species were collected including two listed as endangered in Minnesota in fairly high numbers (*Arcidens confragosus* and *Quadrula nodulata*). Neither of these two species were collected in the LSCR or LMNR. Recolonization is probably due to improved water quality conditions over the past 15-20 years. Furthermore, mussels may be expanding their range above SAF, which historically served as a faunal barrier to upstream dispersal but now are circumnavigated by locks. A total of 16 live species were collected from the St. Anthony Falls Pool including 10 species previously not reported above SAF, and the community very closely resembles the communities of Pool 1 and upper Pool 2 in species composition. Zebra mussels were absent above SAF and nearly absent from UMR Pools 1-3 and LMNR (<0.1% unionids infested and density < 0.1/m^2). Nearly 1% of the unionids in the LSCR were infested with zebra mussels, many of which were <10mm in length. These UMR pools differ from those downstream (Pool 4 and below) where zebra mussels are extremely abundant and are decimating the native mussel communities and from the LSCR where zebra mussels have recently invaded and appear to be reproducing. Ironically, this reach of the Mississippi River between the Twin Cities and Red Wing, MN., once nearly a dead zone, may now constitute one of the last big river mussel refuges in the Midwestern United States.

Keywords: freshwater mussel, Missisippi River drainage, unionidae, Minnesota, *Dreissena polymorpha*

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

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In an effort to enhance aquatic plant production and habitat diversity on the Upper Mississippi River (UMR), the U.S. Army Corps of Engineers St. Paul District conducted a pilot water level reduction on Navigation Pool 8 of the UMR during summer 2001. The water level reduction was expected to dry and consolidate bottom sediments and, thereby, increase the area of emergent and submersed aquatic vegetation by natural seed germination. We assessed vegetation response to the water level reduction during the drawdown through (1) use of high-resolution aerial photography and land cover data generated from that photography, (2) field measures of the distribution and biomass of submersed aquatic vegetation (SAV), and (3) field measures of the composition and productivity of moist soil and emergent perennial vegetation on exposed substrates.

The actual drawdown was delayed from a target date of 15 June due to spring flooding and protracted high river flows. Consequently, the pool elevation at Lock and Dam 8 did not reach normal pool elevation until 30 June and the drawdown was not effectively completed (1.5' reduction at L&D 8) until 6 July. The drawdown was maintained near the target level at L&D 8 for 40 days, until 14 August, or about 47% of the prescribed 85-day period. The drawdown effectively persisted throughout the mid portion of the pool through 15 September. The extent of substrate exposed on 21 July was determined to be 1,954 acres (8.2% of the 23,721 acres that were evaluated).

We detected a reduction in the distribution and biomass of SAV during 2000 and 2001 relative to 1999, and expect that drawdown-related effects on SAV will not be measurable until 1-2 years post-drawdown. We identified 43 taxa of moist soil (26), emergent (6), rooted floating aquatic (2), submersed aquatic (1), non-rooted aquatic (4), and tree species (4) growing on substrates exposed during the drawdown. Rice cut grass (*Leersia orizoides*), broadleaf arrowhead (*Sagittaria latifolia*), water stargrass *(Heteranthera dubia*), nodding smartweed (*Polygonum lapathifolium*), chufa flatsedge (*Cyperus esculentus*), false pimpernel (*Lindernia dubia*), and teal love grass *(Eragrostis hypnoides*) were the dominant species that developed on exposed substrates. Growth progressed well, despite the later-than-scheduled water level reduction and hot, dry conditions during much of July. Plant density was related to the duration of substrate exposure, with higher plant densities and more plant development occurring on substrates exposed for a good portion of the growing season (i.e., mid-pool sites that remained exposed through mid-September) and low plant density on those substrates that were re-inundated in mid-August.

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

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ASSESSING AND RESTORING MISSISSIPPI RIVER BLUFFLAND OAK SAVANNAH USING GIS.

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We worked with the Iowa Natural Heritage Foundation and the Four Mounds Foundation to plan, carry out, and assess the restoration of prairie remnants in a historic oak savannah on the Mississippi River bluff land north of Dubuque. We obtained vegetation databases from the Iowa Dept. of Natural Resources that allowed us to determine the past history of land use on approximately 15 acres of land overlooking Lock and Dam No. 11. Our goals were to remove the invasive native and non-native tree species in an attempt to open up the forest canopy to its original savannah condition. Prairie grasses and forbs would be encouraged by this management scheme. We also desired to connect four isolated patches of nearby prairie remnants within the savannah. The final goal was to manage the remaining oak, hickory, and walnut populations. To begin restoration efforts that would result in a more native, presettlement vegetation cover, we first sampled the savannah to obtain tree diversity, density, and size. The data were transcribed into GIS databases to provide a spatially referenced view of the area. We then conducted selective tree thinning and prescribed burns during 2001. Following these management practices, we re-sampled the area to assess the success of restoration efforts. The oaks and hickories were our main species to manage for, and their dbh values were 16.7 and 20.6cm, which were third and fifth largest respectively. Several species were reduced in their occurrences within transects of the study area. Red cedars were reduced from 75 down to 8 percent, buckthorn from 78 to 16 percent, black cherry from 31 to 18.6 percent, and elm species from 52 to 26 percent. Black locusts remained on the site, but 100% were girdled and treated with herbicide. Walnuts were thinned from a 50 percent occurrence rate to 33 percent. This thinning and removal should allow the release of younger oaks as competition for resources decreases. The available space will also in time release forbes and grasses from the seed bank for further habitat improvement.

Keywords: Oak Savannah, Mississippi River Bluff, Historical Land Use, Land Management, GIS/Arcview applications

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RESOURCE LIMITATION IN RIVERINE BACTERIOPLANKTON: INTERACTIONS OF TEMPERATURE AND DISCHARGE.

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The flux of nutrients and organic matter from riverine systems is largely influenced by production and respiration of heterotrophic bacteria, yet the factors regulating riverine bacteria are poorly understood. We used dilution bioassays to assess the interactions of temperature, carbon and nutrient availability on bacterial growth and respiration across a range of hydrological conditions in the Ohio River and two tributary reservoirs, Kentucky Lake and Lake Barkley. Bacterial growth rates under ambient field conditions ranged from 0.02 to 1.1 d^{-1} and were 5 to 90% of maximal rates found in resource- amended treatments. Temperature was the main factor limiting bacterial growth when water temperatures were below 20^{o}C. At temperatures >20^{o}C, inorganic nutrients were especially important in the low nutrient environment of the reservoirs, while carbon most frequently limited bacterial growth in the Ohio River. Respiratory rates were generally higher in the Ohio River (mean 350 μg O_2 L^{-1} d^{-1}) than in the reservoirs (150 μg O_2 L^{-1} d^{-1}), suggesting use of lower quality organic matter by riverine bacteria. Bacterial respiration responded mainly to glucose additions, but N and P were intermittently important co-variables. Respiration rates were directly correlated with temperature, which caused bacterial growth efficiencies to decrease with rising temperatures. Our findings indicate that multiple factors regulate phytoplankton and bacterioplankton and that spatial complexity may arise from differences in discharge.

Keywords: heterotrophic bacteria, bacterial production, bacterial respiration, resource limitation, regulated rivers

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MONITORING INVASIVE SUBMERSED AND FLOATING-LEAF PLANTS IN THE UPPER MISSISSIPPI RIVER SYSTEM - WHAT SHOULD WE WATCH FOR?

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Invasive species are a serious problem throughout the world. An invasive is any species that is introduced into a habitat where it is not native. Because there are few predators, parasites, or pathogens to keep invasive species in check, they often explode in number and crowd out native species. Two invasive submersed plant species, Eurasian watermilfoil (*Myriophyllum spicatum* L.) and curly pondweed (*Potamogeton crispus* L.) occur commonly in the Upper Mississippi River System (UMRS) and have caused problems inland in Minnesota and Wisconsin. From 1998 through 2001, 550 to 670 sites were sampled for submersed and floating-leaf plants in each of three pools (4, 8, and 13) of the UMRS through the Long Term Resource Monitoring Program. Although both Eurasian watermilfoil and curly pondweed have been recorded in all three pools, so far neither species has dominated the submersed plant community. Other invasive species have the potential to spread to the UMRS. Submersed species include hydrilla (*Hydrilla verticillata* [L.] Royle) and fanwort (*Cabomba caroliniana* Gray). Floating-leaf species include European frogbit (*Hydrocharis morsus-ranae* L.) and water chestnut (*Trapa natans* L.). Hydrilla is listed on the Federal noxious weed list and has caused infestation problems in Washington State. Hydrilla has been recorded as far north as Massachusetts in eastern United States. Fanwort is listed on Washington State's noxious weed list and has been found in Michigan, Illinois, and at nuisance levels in Canada. European frogbit is listed as one of Canada's principal invasive aliens and has been found along Michigan's eastern coast as well as in New York State. The Wisconsin Department of Natural Resources has listed water chestnut as a potential problem species and it is on New York State's top twenty invasive plants list. Aquatic and Wetland Plants of Northeastern North America (G.E. Crow and C.B. Hellquist 2000) list several other species with the potential to become a nuisance in northeastern United States. Submersed species include two milfoils (*Myriophyllum heterophyllum* Michx. and *M. aquaticum* [Vell.] Verdc.), Brazillian waterweed (*Egeria densa* Planch.), and minor naiad (*Najas minor* All.). Floating-leaf species include water fern (*Marsilea quadrifolia* L.) and yellow floating heart (*Nymphoides peltata* [Gmel.] Kuntze). These species have a more southern range and are not as likely to grow to nuisance levels in the UMRS or have not been reported at nuisance levels in northern United States or Canada.

Keywords: invasive plants, submersed plants, floating-leaf plants, monitoring

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UTILIZATION OF THE EXOTIC CLADOCERAN, *DAPHNIA LUMHOLTZI*, BY YOUNG-OF-YEAR FISH WITHIN AN ILLINOS RIVER FLOODPLAIN LAKE.

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Lake Chautauqua is a floodplain lake on the Illinois River managed by the U.S. Fish and Wildlife Service for migrating waterfowl and shorebirds. Researchers at the Illinois River Biological Station have conducted a long-term study since 1996 designed to assess the suitability of Lake Chautauqua as habitat for larval fish production. One component of this study is the analysis of young-of-year (YOY) fish diet composition in relation to zooplankton prey availability.

A particular aspect of the diet composition study focused on the utilization of the non-native cladoceran, *Daphnia lumholtzi*, as a food resource by YOY fish. Previous reports from Lake Chautauqua have shown that native *Daphnia* species typically attain maximum abundances during late spring and are replaced by *D. lumholtzi* during early to mid summer. High abundances of *D. lumholtzi* during late summer increase their potential importance to zooplanktivorous fish; however, the large spines produced by this cladoceran may preclude its value as forage for certain YOY fish species or size classes. Our objective was to quantify the relative importance of *D. lumholtzi* as a food resource to various larval and juvenile fish species in Lake Chautauqua.

Diet compositions were analyzed for YOY fish species collected from escapement sampling during late summer of 2000 and 2001. *Daphnia lumholtzi* were consumed by bluegill juveniles 8-50 mm in size, but comprised the largest proportion of diet items for bluegill 21-40 mm (20-30%, 2001) and 41-63 mm (47%, 2000). Similarly, *D. lumholtzi* comprised 23-34% of the items consumed by white bass 31-60 mm (2001) and 60-140 mm (2000). *Daphnia lumholtzi* were consumed by white and black crappie juveniles 9-70 mm in size (2-40% of diet), but were utilized primarily by juveniles 50-70 mm (22-40% of diet). Several additional species utilized *D. lumholtzi* (e.g., largemouth bass, emerald shiner), however data for these species were not consistent between years.

Our results indicate *D. lumholtzi* are an important food resource for juvenile fish, especially white bass, bluegill, and crappie, during late summer periods when native zooplankton abundances are lowest in Lake Chautauqua.

MEASURES OF RIVER-FLOODPLAIN CONNECTIVITY: ISOLATED BACKWATERS IN SELECTED REACHES OF THE UPPER MISSISSIPPI RIVER.

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River-floodplain connectivity has been reported as influencing material transport and loading, animal movements, plant colonization, biodiversity, and production within many large river ecosystems, and consequently was recently described as one of six important criteria for evaluating Upper Mississippi River ecosystem health. Surprisingly little attention, however, has been devoted to developing quantitative methods for measuring river-floodplain connectivity, or correlating resultant values to physical, hydrologic or biological conditions. To initiate a long-term science strategy on the ecological relevance of river-floodplain connectivity, and in the absence of detailed floodplain elevation information, we focused first on describing present and past spatial characteristics of isolated backwaters. The number, area, and location of isolated backwaters, by size class, in five river reaches were quantified from maps representing conditions that existed in 1989 and 1890's. In 1989, isolated backwaters comprised between 1.9 and 3.8% of total mapped water in the reaches. In all reaches, the largest numbers of isolated backwater fell within the smallest (less than 1 ha) size classes. Cumulative area curves, however, indicated that isolated backwaters less than 2.9 ha in size made up less that 40, 31, 28, 27, and 18 percent of the total area of isolated water in Navigation Pools 4, 8, 13, 26, and the Open River, respectively. In Navigation Pools 4, 8, and 13, size frequency curves of isolated backwaters in 1890 were similar in pattern, but consistently lower, than those in 1989. In Navigation Pool 26 and the Open River, isolated backwaters in 1890 were too rare to support a general characterization of number or total area by size class. The lack of isolated backwaters in these reaches was likely related to the early conversion of floodplain land to agriculture. Patterns of size frequency and cumulative area by size class among the reaches suggest that these spatial variables may be consistent among other river reaches as well. However, the inverse relationship backwater number and size may present a potential dilemma for pool-scale water level management strategies that seek to affect a maximum number of isolated backwaters, versus those that seek to affect the greatest total area.

Keywords: connectivity, Mississippi River, isolated backwaters, floodplain, ecosystem health

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THE IMPACT OF SHOREBIRD FORAGING ON MACROINVERTEBRATES IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY.

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Studies of macroinvertebrate communities of along the eastern coast of North America indicate migrating shorebirds significantly impact benthic community composition. However, studies from the upper Midwest indicate no similar impact by shorebirds on those benthic communities. No such studies have been conducted in the Lower Mississippi Alluvial Valley (LMAV) portion of the flyway. Using an exclosure study design, we quantitatively sampled macroinvertebrate abundance and biomass in shorebird management areas at Bald Knob (AR) National Wildlife Refuge during the peak of the fall migration. Aquatic worms (Oligochaeta) dominated benthic abundance and biomass inside and outside of the exclosures, which resulted in a high community similarity between exclosure and open sites (% similarity = 88). Chironomidae (Diptera) abundance was significantly greater inside of the exclosures ($p= 0.03$), but total macroinvertebrate abundance did not differ significantly between treatments ($p = 0.34$). Likewise, chironomid biomass was significantly greater in the exclosures ($p = 0.03$), as was overall benthic biomass ($p = 0.05$). These results indicate that foraging shorebirds do have some effect on benthic community composition and suggest that shorebirds may be selectively feeding on chironomid larvae in managed habitats of the LMAV.

Keywords: biomass, exclosure, Lower Mississippi Alluvial Valley, macroinvertebrates, shorebirds

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COMPARISON OF SEDIMENTATION AND LEAF LITTER DECOMPOSITION RATES AMONG MODIFIED RIVER FLOODPLAIN SYSTEMS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY.

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River floodplain systems of the lower Mississippi Alluvial Valley (LMAV) have been modified extensively through channelization and levee construction to facilitate human activities. These impacts potentially influence floodplain ecosystem functions such as leaf litter decomposition. Sediment accumulation and leaf litter decomposition rates were determined in floodplain habitats along six differentially impacted river systems (two "unimpacted," two channelized, and two channelized/leveed) in western Tennessee. Decomposition rates varied significantly with litter type (Drummond's red maple>site-specific leaf litter>water oak). Sediment accumulation rates differed among treatments, with highest accumulation occurring in "unimpacted" systems and lowest in channelized/leveed systems. Depressional areas of the floodplain exhibited significantly lower sedimentation rates than non-depressional areas, suggesting depressional sites are maintained by scouring. Additionally, decomposition rates were significantly and negatively correlated to sediment accumulation rates. These results indicate that sedimentation is a controlling factor of leaf litter decomposition in floodplains of the LMAV, regardless of source or type of anthropogenic modification.

Keywords: Drummond's red maple, water oak, channelized and leveed, lower Mississippi Alluvial Valley, leaf litter decomposition

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HISTORY OF THE CHICAGO SANITARY AND SHIP CANAL AND CREATION OF AN AQUATIC NUISANCE SPECIES DISPERSAL BARRIER.

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Though historically separated, the Great Lakes and Mississippi River drainage basins were occasionally joined by a wetland called Mud Lake. During wet periods of the year, the lake was navigable by canoe. Explorers in the 17th century recognized the value of a water connection between the Great Lakes and Des Plaines River. Like other canals built around the Great Lakes, the Sanitary and Ship Canal began on a much smaller scale and was expanded to what we see today.

The Illinois and Michigan Canal, built in 1858, joined Lake Michigan to the Illinois River at LaSalle-Peru. This small canal followed a course essentially parallel to the present-day route of the Sanitary and Ship Canal. Unlike the present day canal, it was narrow and shallow, requiring the use of small barges to move people and goods east to Chicago or west to the frontier. Pumps lifted water about 15 feet from the Chicago River into the Canal; the water then flowed by gravity to the Illinois River.

Pumping the water into the canal had the indirect effect of improving water quality in the Chicago River. Sewage-laden water pumped from the river was replaced by lake water. This improvement in water quality planted the idea for a larger, free-flowing canal that would improve the undesirable conditions of the Chicago River.

Construction of the Chicago Sanitary and Ship Canal was completed in 1910. The larger, deeper canal could accommodate full-size vessels and allowed free-flow of the Chicago River into the canal. This essentially reversed the flow of the Chicago River and flushed Chicago's sewage downstream. Today, this century-old, man-made canal is the only aquatic link between the Mississippi River and the Great Lakes drainage and forms a two-way avenue for invasive species dispersal. The canal is used for transportation of freight between Lake Michigan and the Illinois Waterway, and to carry wastewater away from Lake Michigan, Chicago's drinking water supply. Recreational vessels frequent the canal, but it is not used for water skiing or swimming.

The National Invasive Species Act (NISA) of 1996 authorized the U.S. Army Corps of Engineers to carry out a demonstration study of an aquatic nuisance species dispersal barrier in the Chicago Sanitary and Ship Canal. The objective of the study is to slow or prevent the dispersal of invasive species via the canal. No migratory species traverse this man-made canal, but the barrier is expected to affect native as well as invasive species. A multi-agency advisory panel ensures representation of the myriad interests in the canal and development of the barrier. The panel members identified potential methods and recommended an initial approach. Due to the commercial uses of the canal and its importance to Chicago's drinking water, physical barriers and canal closure are not practical short-term alternatives.

The demonstration study will begin with installation of a micro-pulsed DC electric barrier designed to deter fish, rather than stun them. The study will add methods to target other species as funding allows. Monitoring of the barrier performance will help determine effectiveness of each method. Conceptually, the full-scale barrier will consist of a two-barrier, redundant system in a restricted reach of the canal. Construction of the electric barrier was completed in December 2001; the barrier is expected to be operational in early spring of 2002.

DEVELOPMENT OF MISSISSIPPI RIVERSIDE ENVIRONMENTAL RESEARCH STATION (MRERS) AT IOWA DNR'S FISH HATCHERY SITE IN FAIRPORT, IOWA.

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The Upper Mississippi River reach encompasses one of the world's largest river-floodplain ecosystems. Researchers at the University of Iowa saw a real need to establish a multidisciplinary experimental and collaborative research program that comprehensively responds to the critical issues affecting management and restoration of riverine ecosystems of the Upper Mississippi River. IIHR-Hydroscience and Engineering (formerly Iowa Institute of Hydraulic Research) of the University of Iowa's College of Engineering is leading in establishing a Mississippi Riverside Environmental Research Station (MRERS) to provide opportunities for researchers and educators around the world to study river ecosystems in a multidisciplinary setting. MRERS will provide state-of-the-art facilities to study diverse facets of the Upper Mississippi River to better understand river ecosystems and their response to natural events and human activities. It will also provide students at all levels with hands-on experience. In light of the Great Flood of '93 and recent flooding in the region last spring, establishment of MRERS is timely. IIHR is ideally positioned to develop MRERS because it has long been recognized as a leader in various aspects of river research. The institute has in-house expertise in diverse areas of river morphology, including sedimentation, bank erosion, and ice formation. Its expertise also extends to lock and dam structures, marine biology, chemical transport, thermal pollution, flood forecasting, and geomorphology. IIHR's mobile laboratories, which study hydrometeorology with advanced instrumentation for rainfall and atmospheric interface measurements, have been engaged in experiments around the globe.

IIHR is building MRERS along the Mississippi River in Fairport, Iowa, because of its proximity to the University of Iowa community and its central location relative to the Iowa portion of the Upper Mississippi River. Fairport is also a good site for locating MRERS due to technical considerations. The river reach between Lock and Dam 15 in Rock Island, Illinois, and Lock and Dam 16 in Muscatine, Iowa, provides a variety of challenging river environments, including sloughs, backwaters, and small islands along Andalusia Island. Investigations can be easily focused upstream and downstream of Lock and Dam 16, which is located only about 6 miles downstream from Fairport. The effect of extensive commercial and recreational interactions on the river ecosystem near Davenport near Lock and Dam 15 and Muscatine can also be readily investigated. MRERS will be located with the Iowa Department of Natural Resources' fish hatchery on 2.9 acres of land leased to the Iowa Board of Regents. The facility will be built on the same location where a U.S. Bureau of Fisheries research station once stood in the early 1900s. Construction of MRERS began on May 15, 2001, and will be completed in March 2002. MRERS will be managed by IIHR. A scientific advisory council drawn from the federal government, the state of Iowa, academic institutions, the University of Iowa, and industry will provide guidance.

Keywords: Mississippi River, Field Station, Multidisciplinary Research and Education, Water Quality, Sediment

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STATUS OF BIGHEAD CARP AND SILVER CARP ON THE LA GRANGE REACH, ILLINOIS RIVER AND POSSIBLE IMPACTS TO THE COMMERCIAL FISHERY.

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The La Grange Reach of the Illinois River has historically been a very important area for commercial fishing in Illinois. However, over the past one hundred years significant changes have occurred in the commercial harvest throughout the Illinois River. The intentional introduction of common carp C*yprinus carpio* in the 1800's drastically changed the commercial fishery by replacing the native buffalo as the main catch on the Illinois River. In 1908, commercial fishing reached its peak when 11 million kilograms of fish were taken with common carp comprising nearly two thirds of the catch. More recently two Asian carp species, bighead carp H*ypopthalmichthys nobilis* and silver carp H*ypopthalmichthys molitrix,* have spread into the Illinois River from the Mississippi River basin. This may again prompt a significant change in commercial species composition. Reported bighead and silver carp annual commercial harvest has increased markedly from 600 kilograms prior to1992 to greater than 50,000 kilograms since 1997. The Long Term Resource Monitoring Program (LTRMP) has been monitoring fish on the La Grange Reach since 1990, allowing us to detect the presence of these exotic species and follow their abundances through time. Catch per unit effort for bighead and silver carp has dramatically increased beginning in 2000, exhibiting a similar trend to common carp when they were introduced over a century ago. The size structure of these exotic fish has also shifted in the past two years from smaller individuals that are not preferred commercially to larger individuals that are of some value. Over this same time period buffalo catch rates and population structure were monitored for potential negative trends that may occur. These data and potential ecological and economic impacts to the Illinois River commercial fishery will be presented and discussed.

Keywords: bighead carp, silver carp, Illinois River, commercial fishing, Long Term Resource Monitoring Program

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TRENDS OF *VALLISNERIA AMERICANA* ON THE UPPER MISSISSIPPI RIVER, POOL 7, LAKE ONALASKA CLOSED AREA.

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Vallisneria Americana, commonly called wildcelery, is submersed aquatic vegetation that serves as an important food source for migrating canvasback. Collected samples from the early 1980's indicate that *Vallisneria* was abundant throughout Lake Onalaska. Wildcelery and other aquatic vegetation densities dropped severely following the 1988 drought. Since 1989, wildcelery populations have slowly regained vigor on Lake Onalaska, a historical migratory point for canvasback. This study analyzes the trends of the wildcelery within a closed hunting zone on Lake Onalaska from 1980 to 2001, excluding a few years not sampled in the late 1980's. Water depth, percent vegetation cover and wildcelery density were monitored on twelve 800-meter transects, each comprised of 10 sample points. In addition to the field-evaluation, vegetation on infrared aerial photographs was also used in the analysis. Submersed vegetation from photos was delineated and converted into a usable GIS form. The results for the field samples and the interpreted photos were overlaid to compare and identify the locations of the wildcelery. Additional comparisons were made between the 1998-bathometric data and the water depth recorded from the annual surveys. Preliminary results indicate that the extent of wildcelery on Lake Onalaska can be predicted from the water depth/density relationships. Of course other factors such as water chemistry greatly affect the presence of submersed vegetation.

Keywords: *Vallisneria americana*, wildcelery, canvasback duck, *Aythya valisineria*, Lake Onalaska

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RATES OF BACKWATER SEDIMENTATION BETWEEN 1997 AND 2002 IN POOLS 4, 8, AND 13 OF THE UPPER MISSIPPIPPI RIVER.

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Net rates of sediment accumulation were measured annually between 1997 and 2002 as changes in bed elevation along randomly selected backwater transects. Weighted mean accumulation rates (centimeters per year) in aquatic portions of the transects were -0.01, 0.22, and 0.76 for Pools 4, 8, and 13, respectively. Near-shore, terrestrial portions of the transects accumulated sediment at rates of 0.59, 0.51, and 1.09 for Pools 4, 8, and 13, respectively. Rates differed for the 4-year period prior to the severe flood in 2001. Rates of accumulation were higher in the aquatic portions and lower in the terrestrial portions of the transects during 1997-2000. Regardless of the time period, the rates observed in the aquatic portions of the transects were much lower than previously reported for backwaters of the Upper Mississippi River. The lower rates perhaps can be explained by the high variability along and among transects observed, which can provide highly biased results depending on the sampling design. It is also likely that accumulation rates have decreased as trapping efficiency in the backwaters has diminished. Although prediction of future backwater configuration in the Upper Mississippi River System is difficult, the documentation of the rates over this 5-year period, and the better understanding of causal mechanisms, can be used to better predict future conditions.

Keywords: sedimentation, erosion, Mississippi River, backwaters, sediment transport

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A ROLE FOR MRRC IN EXPANSION OF LARGE RIVER RESEARCH: LESSONS FROM OCEANOGRAPHY.

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Compared to lakes, reservoirs, and streams, the structure and function of large floodplain rivers is relatively poorly understood because of the logistical difficulties of working on them. The equipment and effort required to document the population size and dynamics of even a single group of organisms, such as fish, is many times greater in a large river than in a small stream or lake. Understanding the linkages between structure and function in these large, complex, and dynamic systems is even more challenging, and current conceptual models consequently remain largely untested. Despite some early multi-investigator, cooperative efforts on the Upper Mississippi and Illinois rivers, and more recent contributions from the Long Term Resource Monitoring Program on the Upper Mississippi System, our ability to understand large rivers has lagged far behind our ability to alter them. Now public interest in preserving and restoring large river systems worldwide is on the increase, stimulated by a new appreciation of the multiple values of these systems, an awareness of how few remain unaltered, and an understanding that the altered rivers of the world increasingly contribute to harmful algal blooms, hypoxic zones, and other undesirable changes in the oceans and coastal areas.

A major investment in large river research is needed to support river restoration and conservation, comparable to the investment made in ocean sciences, first by the U.S. Office of Naval Research after World War II, then by the National Science Foundation (NSF), starting in a major way with the International Geophysical Year of 1957-1958, and continuing with the International Decade of Ocean Exploration (IDOE), which began in 1970. The National Sea Grant College Program began about the same time, in 1967. In his review of 50 years of ocean research, John Knauss attributed its current strength and vitality to two policies: (1) NSF support of ships at individual academic institutions starting in 1963 (the first ships specifically designed for ocean-going research), and (2) NSF development of a support structure that encouraged large, multi-investigator, multi-institutional programs. An encouraging outcome of the second policy, that bodes well for a similar program on rivers, is that once started, the multi-investigator programs continued on long after their original funding ended. This happened because the participants overcame dangers and difficulties to do exciting science together, and developed a deeper understanding of their colleagues and of cooperative ways to achieve their own goals. In contrast to the situation in ocean sciences, the scale of investment in large river research in the U.S. is much less, less even than in some countries with much smaller economies, and multi-investigator projects involving academic researchers are rare (Water Environment Research Foundation, Large Rivers Workshop, 2000). The National Science Board identified large river research as an area needing enhancement in the current NSF environment portfolio in its recent report (NSB 2000: p. 44).

The large river research community needs to foster a policy approach and level of investment appropriate to the size, importance, and complexity of the systems under investigation, similar to what our marine brethren did 50 years ago. A logical first step would be to hold one or two workshops of river program directors, to develop and forward consensus recommendations on programs and investment needs to NSF, and to other federal agencies that support and utilize river research. The Mississippi River Research Consortium might form a steering committee that would organize the first workshop.

Keywords: large rivers, science policy, research, support, infrastructure

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THE MISSISSIPPI RIVER UNIONOID SURVEY OF 1907.

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There have been several unionoid surveys of the Upper Mississippi River since the development, near the end of the last century, of commercial uses of the North American river shell. These studies provided a database for at least some understanding of which species were present and in what numbers at linear sites along the river over the last hundred years of human modification. One of the earliest efforts was that of the United States Bureau of Fisheries conducted by Dr. Paul Bartsch during July and August of 1907. The voucher specimens of this survey were, for the most part, deposited in the Smithsonian Institution's United States National Museum of Natural History.

The length of the Mississippi sampled extended from just below St. Paul, downstream to the mouth of the Ohio at Cairo. Several Mississippi tributaries as well as the lowermost Ohio and Tennessee Rivers were also included in the survey. Material was obtained from both commercial shellers and the personal collecting of Dr. Bartsch and his crew. The value of the unionoid of the Mississippi River revealed by the survey was instrumental in the construction of the Bureau of Fisheries Laboratory at Fairport, Iowa, to study this natural resource. Perhaps incidentally, it also provided for the evaluation of the fauna on into the future.

Keywords: Mississippi River, unionoids, unionoid survey, P. W. Bartsch, Smithsonian Institution, U.S. Bureau of Fisheries, Fairport Iowa Laboratory

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ROLE OF LAKE PEPIN IN SUSTAINING ZEBRA MUSSEL POPULATIONS IN THE UPPER MISSISSIPPI RIVER.

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Because zebra mussel larvae are planktonic, persistence of adult zebra mussel populations at a given location within a river system is highly dependent upon a reliable supply of larvae drifting down from upriver source populations. Unlike the Illinois River, the Mississippi River does not have a large infested lake at it's headwaters to serve as a constant source of new recruits, yet populations in portions of the Upper Mississippi River (UMR) persisted for many years at high abundances. The sustainability of adult zebra mussel populations in the UMR has been variously attributed to upriver transport of zebra mussels by commercial barge traffic and/or the ability of Lake Pepin (a natural riverine lake in Pool 4 of the Mississippi River) to host self-sustaining populations independent of upriver source populations.

In 1998, the Wisconsin DNR (in cooperation with the Iowa DNR and the Illinois Natural History Survey) initiated a monitoring program to examine zebra mussel veliger dynamics in the Upper Mississippi River (UMR). Zooplankton samples were collected at various sites from Lock and Dam (LD) 2 - 12 from 1998 - 2000. Veliger abundance and flux were consistently low to absent above Lake Pepin and increased dramatically below Lake Pepin, with abundance/flux peaking near LD 7 during all three years of this study. Estimates of veliger flux below lock and dams 6-8 frequently exceeded 100 million veligers/second with a maximum flux of 1.5 trillion veligers/second estimated below LD 8 on July 2, 1998. Random sampling of various habitat types within Pool 8 in 1998 and 1999 provided no evidence of higher larval abundances in backwater as opposed to main channel sites. Sampling of four main tributary rivers located within the sampling area of this study provided no evidence that tributaries are an important source of veligers to the UMR although some live veligers were found in the St. Croix River in 1999 and 2000.

Data from this study suggest that Lake Pepin plays a critical role in maintaining zebra mussel populations in the UMR. Lake Pepin is the first infested section of the UMR that exhibits adequate retention times for local populations to maintain themselves via self-recruitment. It is unlikely that spawning of adults attached to barges could have produced the consistent, extremely high flux of veligers observed below Lake Pepin. No evidence was found for large numbers of veligers entering the main-stem river from backwaters or tributaries below Lake Pepin. At this time, it is unknown whether the large numbers of veligers observed below Lake Pepin were produced within the lake itself, or downriver by populations founded and maintained by self-sustaining populations within the lake. Efforts are currently underway to model veliger drift in the UMR and determine the importance of various parameters likely to produce the consistent longitudinal abundance pattern observed in this study.

Keywords: zebra mussel, Mississippi River, veliger, Lake Pepin

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EFFECT OF WATER LEVEL DRAWDOWN ON NITROGEN CYCLING PROCESSES IN UPPER MISSISSIPPI RIVER POOL 8.

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A water level drawdown was conducted in Navigation Pool 8 of the Upper Mississippi River for the primary purpose of stimulating vegetation growth along the river margins. We used this water level manipulation to investigate the effect of a drawdown on nitrogen cycling processes. Since spring 2000 we have seasonally monitored nitrogen cycling processes and sediment chemistry at approximately 25 backwater sites in Pool 8 and sediments at 5 of these sites were desiccated during the drawdown. Neither nitrification or denitrification rates varied significantly among the sites prior or during the drawdown ($P > 0.05$, t-tests). However, nitrification rates did differ in the fall of 2001 after the dried sediments were re-flooded. Previoiusly dry sediments had lower nitrification rates ($P = 0.035$) than those that remained saturated throughout the drawdown event. The delayed nitrification response was likely due to the decrease in exchangeable ammonium at the dried sites during ($P = 0.037$) and after ($P = 0.19$) the drawdown. The drawdown did not appear to have a significant effect on denitrification rates. Our data demonstrates that nitrogen cycling processes may respond to river drawdown management, but responses are likely mild and probably temporary.

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

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MULTIPLE QUANTITATIVE UNIONIDAE SURVEYS OF THE SAME TRANSECT WITH SPECIMEN REMOVAL BETWEEN SURVEYS; CHIPPEWA RIVER, WISCONSIN.

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During the summer of 2001 we conducted 4 consecutive unionid surveys along the same transect on the Chippewa River, Wisconsin. We relocated all unionids after each survey. Our purposes in this study were to determine 1) if there was any vertical movement by unionids during normal water levels, 2) if smaller individuals would be recovered in later swim-over surveys, and 3) if there were differences in the sizes or species collected by swim-over versus digging surveys.

From the 4 consecutive surveys of the same transect there were a total of 18 species found and 542 live unionids were counted (density of approximately 2.8 unionids/m^2). Among the unionids collected were two Wisconsin Threatened and Endangered species, *Plethobasis cyphyus* and *Tritigonia verrucosa*. The dominant species were *Potamilus alatus* and *Fusconaia flava*, comprising nearly 57.4% of all the unionids.

The data from this study provide some indication that within a 46-day period unionids may move vertically within the substrate. The data also show there is a significant difference in the mean standardized lengths for the 3 consecutive surveys ($R^2 = 0.9984$, $P < 0.05$). While there are only 3 data points and the range in size is slight, the data indicate swim-over surveys have a bias for larger unionids.

Overall we found smaller unionids and a greater number during the digging survey than the swim-over survey. Additionally, some species and some sizes were under-represented during the swim-over survey compared to the digging survey. These findings indicate surveys intending to obtain community and population structure should use digging.

AN ESTIMATE OF LIGHT AVAILABILITY FOR AQUATIC VEGETATION IN POOLS 4, 8, 13, AND 26 OF THE UPPER MISSISSIPPI RIVER FROM 1993 to 1999.

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Dramatic fluctuations in abundance of submersed aquatic vegetation across the Upper Mississippi River System (UMRS) from the late 1980's to present have been the subject of several studies and wide speculation. Management actions have been proposed and implemented (e.g. large-scale water level reductions in Pool 8) in an attempt to enhance aquatic and semi-aquatic vegetation in the system, but the underlying causes for long-term changes in aquatic vegetation in the UMRS are not established. Light availability from May through September, the primary growing season, is one factor that often limits the growth of submersed vegetation. This is especially true in turbid river systems such as the UMRS where concentrations of plant nutrients appear to be present in excess, but light penetration is restricted by suspended materials in the water. Detailed information on water clarity or light availability in broad areas of the UMRS was not collected prior to the implementation of the Long Term Resource Monitoring Program (LTRMP, ca 1990) and statistically reliable, pool-scale information on aquatic plant abundance across the system was not collected prior to1999. Nonetheless, we believed that it might be possible to use existing information to estimate (model) the light regime in the UMRS for the past 10 – 20 years.

We used data from LTRMP stratified random sampling, LTRMP bathymetric surveys, and long-term stage and discharge records from the U.S. Army Corps of Engineers to estimate the areal extent of illuminated substrate for Pools 4, 8, 13 and 26 of the UMRS. Our estimates suggest an increase from 1993 to 1999 when aquatic plants were also increasing. Among pools we found substantial differences in substrate illumination that were driven by differences in pool morphology and a general downstream increase in turbidity within the UMRS. These differences in illumination seem to correspond well with among-pool differences in aquatic vegetation. We found weak relations in the UMRS between water clarity and factors such as month, river stage, and tributary discharge and the relations among these variables may not be helpful for broad scale modeling of light availability in this system.

Keywords: Mississippi River, submersed vegetation, turbidity, light, secchi depth

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AQUATIC VEGETATION COMMUNITIES OF POOL 13 OF THE UPPER MISSISSIPPI RIVER SYSTEM.

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During the summer of 2001, a study was conducted on pool 13 of the Upper Mississippi River System to evaluate the aquatic plant diversity, and to correlate diversity with various parameters including Secchi disc transparency, substrate type, and amount of detritus. This study focused on the composition of the plant community, utilizing methods employed by the Long Term Resource Monitoring Program. There were five strata types that were sampled which varied in substrate type and current velocity: main channel border, side channel, impounded, backwater contiguous, and backwater isolated. All strata types contained some aquatic plants. As the current decreased, and the sites became more isolated, the percent of vegetated sites within a stratum increased. Substrates such as silt/clay and mostly silt with some sand contained the most diverse groups of plants. Specifically mentioned in this study is *Myriophyllum spicatum,* otherwise commonly known as Eurasian watermilfoil. This species was found in three of the five strata types. As current diminished and Secchi disc transparency increased, plant diversity increased. Each stratum had a unique plant community.

Keywords: Mississippi River, aquatic vegetation, Eurasian watermilfoil, *Myriophyllum spicatum*, plant diversity

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AQUATIC VEGETATION IN NAVIGATION POOL 11 OF THE UPPER MISSISSIPPI RIVER SYSTEM.

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Our primary objective was to collect baseline data on the aquatic vegetation in Pool 11 of the Upper Mississippi River System (UMRS) using current Long Term Resource Monitoring Program (LTRMP) protocol. During the summer of 2001, aquatic vegetation data was collected at 568 randomly selected sites distributed in five separate aquatic habitat types, including main channel border, side channel, contiguous backwaters, isolated backwaters, and impounded. Data collection was based upon both visual observation and rake sampling. Stratified random sampling facilitated a stratum-wide as well as pool-wide assessment of aquatic vegetation composition and distribution.

A total of thirteen species of submersed aquatic vegetation (SAV) were recorded during our sampling efforts. Sago pondweed (*Potamogeton pectinatus* L.*)* was the most abundant submersed aquatic plant overall based on frequency (recorded in 9% of total sites), followed by coontail (*Ceratophyllum demersum* L.) and wild celery (*Vallisneria americana* Michx.). Coontail dominated the side channel, backwater contiguous, and backwater isolated habitats while sago pondweed was most abundant in main channel border and impounded areas. Isolated backwaters contained the highest frequency of submersed and rooted floating leaf aquatic vegetation (73% and 47%, respectively). Impounded areas accounted for the highest species richness of submersed aquatic vegetation (8), despite moderate frequencies (12%). These results differed from the two nearest target pools (8 & 13), where backwater contiguous areas contained the highest number of species (12 and 11, respectively). Contiguous and isolated backwaters accounted for the highest frequencies of rooted floating leaf species (23% and 46%, respectively). The American lotus (*Nelumbo lutea*) was the most common rooted floating leaf species recorded (6%). In pool 13, the American lotus was also the dominant rooted floating aquatic (9%), whereas the white waterlily (*Nymphaea odorata*) was most frequent in pool 8.

Keywords: submersed vegetation, aquatic plants, Mississippi River, trend analysis, stratified random sample

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SHOREBIRD USE ON MISSISSIPPI RIVER POOL 8 DURING THE 2001 EXPERIMENTAL WATER LEVEL REDUCTION.

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A weekly shorebird monitoring survey was conducted on lower Pool 8 between June 11th and September 26th, 2001. The survey was to determine the migratory shorebird use of new habitats created during the drawdown. Shorebird monitoring took place one day per week for 15 weeks. Twenty-two species of shorebirds and 1,211 individual shorebirds were observed during this time. Due to weather conditions and water flows, the target level drawdown of 1.5 feet was achieved for only about 6 weeks, from July 10 through August 14. During these six surveys, 921 (73.3%) of the 1,225 total individual shorebirds were observed, and the average number of species observed was 8.3. The other nine surveys contributed only 26.7% of the total shorebird observations, and the average number of species observed was 4.8. Even though there are no other surveys for comparison, the 2001 data suggests that the water level reduction in Pool 8 created vital feeding habitat for migrating shorebirds. This had a positive impact on the number of shorebirds, and increased species diversity.

Keywords: shorebirds, drawdown, Mississippi River

EFFECTS OF AMMONIA ENRICHMENT ON SURVIVAL AND GROWTH OF JUVENILE MUSSELS IN THE ST. CROIX RIVERWAY.

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The St. Croix Riverway contains an extremely rich fauna of unionid mussels. This group, which is highly sensitive to habitat changes, is one of the Riverways's most significant natural resources. As the metropolitan area of Minneapolis-St. Paul expands into the basin, there is an increased threat of contamination to water and sediment quality and its associated biota. We performed a series of tests to examine existing concentrations of sedimentary ammonia, and to determine what effects these concentrations were having on survival and growth of juvenile mussels. We conducted a combination of 4, 10, and 28 day *in situ* toxicity tests with *Lampsilis cardium* at 8 sites in the Riverway. At each site, we deployed 6 chambers in the sediment, each containing 20 juveniles, and randomly removed 2 chambers to evaluate survival and growth of juveniles at each exposure duration. Sedimentary ammonia was characterized using core and *in situ* pump samples, with concentrations ranging from 0.1 to 122.4 ug/L and 0.9 to 46.0 ug/L, respectively. Ammonia was also measured in individual chambers and ranged from 0.8 to 80.6 ug/L. Survival of mussels was highly variable (mean, 45% at 4d, 28% at 10d, and 41% at 28d) and our ability to predict survival based on sedimentary ammonia was generally poor. The growth rate was highly variable (range, 0 to 45 um/day), but in general, was positively correlated with ammonia. Although we were able to culture, deploy, retrieve, and measure survival and growth of juveniles in the 300-1,000 um size range, correlating survival or growth to sedimentary ammonia concentrations was problematic.

Keywords: mussels, ammonia, St. Croix River, sediments, *Lampsilis cardium*

SCIENCE SUPPORT FOR REGIONAL AND REFUGE BIRD CONSERVATION PLANNING.

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The North American Bird Conservation Initiative (NABCI) is a new bird conservation effort that seeks to integrate various bird conservation plans and "deliver the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships" (http://www.dodpif.org/nabci/index.htm). This study will provide science support for the NABCI initiative in Region 3 of the USFWS, which includes the Upper Mississippi River Fish and Wildlife Refuge. We will develop GIS data layers and GIS management tools within the Prairie-Hardwood Transition Ecoregion that will allow refuge managers to incorporate regional and local bird information into refuge-specific planning. These GIS data layers and tools will be combined with land bird point count information from National Wildlife Refuges, Wetland Management Districts, State agencies, and universities to develop habitat models for multiple bird species. This study is a collaborative effort between the U.S. Fish and Wildlife Service Region 3, the USGS Upper Midwest Environmental Sciences Center, and the USGS Patuxent Wildlife Research Center.

As a first step in the process, we worked with multiple wildlife refuges and the USGS Patuxent Wildlife Research Center to integrate point count data collected from USFWS Refuges into a MS Access database. The database mirrors the national Bird Point Count Database being developed at Patuxent. The database records the data and metadata needed for future use of the point count databases in modeling efforts. Incorporating data from multiple sources into a unified Access database without re-entering the data proved to be a major challenge. Problems included ambiguous mapping of point locations, bird names that didn't match the master list, loss of metadata necessary for full understanding of the data, and differences in data collection methods and recording. Once completed, the Prairie-Hardwood database will be useful for conservation planning at the refuge and regional scale, and the data will be available for use in modeling work. The database will also provide a template for future recording of point count data.

Keywords: NABCI, USFWS Region 3, GIS, bird point count, National Wildlife Refuge

FLOW CYTOMETRY AS A TOOL FOR DETECTING GENOTOXIC EFFECTS IN AMPHIBIANS BREEDING IN SOUTHEASTERN MINNESOTA FARM PONDS.

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High rates of amphibian malformations have been observed in Minnesota and several other states. Flow cytometry is a laboratory test that measures genetic damage based on blood samples and may be useful in evaluating sites with amphibian malformations. We conducted a pilot study of farm ponds in southeastern Minnesota to assess the feasibility of using flow cytometry to assess genetic damage in native amphibians. We tested associations between the type of agricultural land use surrounding a pond and DNA integrity. Amphibians from four reference (one natural wetland, three non-grazed ponds), and five exposed (three grazed ponds, and two agricultural ponds) were examined in the field for deformities and blood samples were collected for testing with flow cytometry. We assumed that the exposed ponds had higher inputs of agricultural contaminants (fertilizers, pesticides, and animal wastes) than the reference ponds.

We found no significant differences in DNA profiles between the reference and exposed ponds. However, several specimens from three different ponds produced aneuploid peaks, which is indicative of DNA damage. We found low correlation between amphibian deformities and the coefficient of variation of DNA; deformities were rarely observed and they occurred in both the reference and exposed ponds. We found no evidence that surrounding agricultural land use affected amphibian DNA integrity or malformation rates in southeastern Minnesota. We demonstrated that flow cytometry could be used to detect and quantify DNA damage in native amphibian communities. It may be useful for evaluating amphibian-breeding sites exposed to contaminants or other potential genetic stressors.

Keywords: amphibian malformations, flow cytometry, DNA, agricultural contaminants, genetics

AMPHIBIAN RESEARCH AND MONITORING INITIATIVE (ARMI) IN THE MIDWEST.

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In 2000 President Clinton and members of the United States Congress directed the Department of the Interior (DOI) to develop and implement a plan to determine the status of populations of amphibians on the vast lands managed by DOI, to monitor populations, and to conduct research on the causes of any declines observed in these populations. As the science and research bureau of DOI, the U.S. Geological Survey (USGS) was given the lead responsibility to develop and implement ARMI in cooperation with the National Park Service, the U.S. Fish and Wildlife Service, and the Bureau of Land Management. This overall effort was called the Amphibian Research and Monitoring Initiative (ARMI).

The USGS divided the continental United States into seven regions to be studied under ARMI, with each region under the management of scientists from regional science centers of the USGS. Scientists from the Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, were given responsibility for implementing ARMI in the Upper Mississippi Region, an area that includes 13 states.

Monitoring efforts for the Upper Mississippi Region of ARMI during 2001 were focused on developing products of general application to amphibian monitoring in the Upper Mississippi region based on our experiences with research on small farm ponds, and pilot monitoring efforts on federal land (U.S. Fish and Wildlife Service and the National Park Service). Drafts of two documents: "Monitoring amphibians in farm ponds", and "Managing farm ponds as wildlife habitat" are in preparation. These papers are joint products of the farm pond research project (externally funded by the Legislative Commission on Minnesota Resources) and the Upper Mississippi Region of ARMI. In addition, Melinda Knutson participated in the task force that drafted the implementation plan for the National ARMI program.

During 2002, in cooperation with partners from the U.S. Fish and Wildlife Service and the National Park Service, UMESC intends to further implement ARMI in the Upper Mississippi Region by studying populations of amphibians within the Upper Mississippi National Wildlife Refuge, the St. Croix National Scenic Riverway, Voyageurs National Park, and other smaller areas of habitat in the region. We will also be working to broaden and coordinate our research efforts with Federal and State agencies and nongovernmental organizations in these and other Midwestern states. Ultimately, we hope to be a part of a larger web of standardized sampling and monitoring efforts within the region that will also work in close concert with other regions of the ARMI program to produce valuable information about the status of amphibians throughout the various regions of the United States. This information will be made available to land managers, regulators, and other decision makers, as well as to the scientific community and the general public, so that they can make informed decisions regarding natural resources.

Keywords: ARMI, Upper Mississippi Region, USGS, Upper Midwest Environmental Sciences Center, amphibian monitoring, amphibian declines

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WATER LEVEL DRAWDOWN: IMPACTS ON SEDIMENT CHARACTERISTICS AND POREWATER NITROGEN IN MISSISSIPPI RIVER POOL 8.

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Pool 8 of the Mississippi River was drawn down in July of 2001 to stimulate aquatic plant growth and compact sediments. Sediment and sediment porewater characteristics (i.e. sediment moisture content, bulk density, ammonia, and ammonium) may be affected by water level fluctuation and duration of dry periods. We examined these variables at 25 backwater sites before, during, and after the water level drawdown to observe changes resulting from desiccation and re-wetting of sediments. Sediment moisture content, bulk density, ammonium, exchangeable ammonium, and ammonia did not vary among the sites prior to the drawdown ($p>0.1$). Some of the sites dried during the drawdown, resulting in lower sediment moisture content and greater sediment bulk density. There was also a decrease in ammonium, exchangeable ammonium, and ammonia in sediment porewater at the dry sites. This could be due to a decrease in mineralization of organic nitrogen and assimilation, while nitrification rates remain constant. When sites were re-wetted, these variables again do not vary among sites ($p>0.05$), and appear to be returning to pre-drawdown conditions. These results suggest that desiccation of sediments has an immediate impact on sediment and porewater nitrogen, with rapid return to pre-dried conditions.

FEEDING ECOLOGY OF LARVAL BLUE SUCKER (*CYCLEPTUS ELONGATUS*) IN MISSISSIPPI RIVER BACKWATERS.

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Blue suckers (*Cycleptus elongatus*) primarily occupy swift currents in the main channel of large rivers within the Mississippi River basin, but the ecology of early life stages is not well documented. Over 230 larval blue suckers were captured by seining in backwaters of Pool 25 in the Upper Mississippi River in spring 2000 and 2001. We examined the diet of larval blue suckers (16-27mm total length) to document much needed life history information and to evaluate the importance of riverine backwaters as fish nursery habitat and areas of high invertebrate production. A total of 18 invertebrate taxa were identified in the fish guts with representatives from benthic (e.g., Chironomidae larvae, Oligochaeta), nektonic (e.g., Cladocera, Copepoda, Chaoboridae), and neustonic (e.g., Chironomidae adults, Bryozoa, Thripidae, Homoptera, Carabidae) habitats. Chironomidae (88%), Cyclopoida (77%), and Cladocera (5%) were found in the majority of fish examined. These groups accounted for 60%, 30%, and 5%, of the total gut content biomass, respectively. Feeding in backwaters by larval blue suckers demonstrates the importance of invertebrate communities in these habitats, even to a main channel fish, and is an example of the energetic link between riverine backwaters and the main channel.

Keywords: macroinvertebrate, feeding ecology, larval fish, Mississippi River backwater, diet

USING TELEMETRY AND DNA ANALYSES TO DETERMINE NATAL DISPERSAL RATES OF WOOD THRUSHES.

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Natal dispersal of excess juveniles from growing, or "source" populations can be critical for the support of declining, or "sink" populations. The distance of, and habitat used for, natal dispersal is unknown for most birds, and conservation efforts to preserve critical habitats can be enhanced by such knowledge. We studied wood thrushes (*Hylocichla mustelina*), a neotropical migrant, in the Mines of Spain Recreation Area near Dubuque, IA. We monitored nests and activity during the summer of 2001. Nest were found by visual observation and by radio-marking adult female wood thrushes, captured in mist nets. We tracked juveniles using radio transmitters during their natal dispersal. DNA analyses were used to determine the gender of the wood thrush fledglings. Seventy percent of the nests (n=10) were parasitized by brown-headed cowbirds (*Molothrus ater*), including 2 nests with no host eggs. The daily nest success rate was 0.9612 (SE=0.0189), and daily juvenile survival was 0.9703 (SE=0.0169). Three successful juveniles dispersed 270 m, 980 m and 746 m. High predation rates, combined with high parasitism rates indicate that our study area was a region of low productivity for wood thrushes, reinforcing the need for further information on natal dispersal of successful fledglings. Our analyses of dispersal during the summer of 2001 will be helpful to managers of critical habitat for the wood thrush species.

Keywords: dispersal, survival, nest success, wood thrush, *Hylocichla mustelina*

PATTERNS OF SECONDARY PRODUCTION OF HEPTAGENIID MAYFLIES IN MAIN AND SIDE CHANNEL HABITATS.

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Rivers possess heterogeneous habitats even when a river seems to have a similar outward appearance. Since there are structural differences in a river system, there also may be differences in functional aspects of these habitats. Two structurally similar habitats, side channel and main channel, actually differ in some physical and chemical properties. Side channels have a lower current velocity, higher temperature, low turbidity, and are shallower than main channels. Side channels may also be more productive than the main channel. Secondary production is a measure of energy flow in an ecosystem. This study examined the patterns of secondary production of heptageniid mayflies in main and side channel habitats. Samples of woody debris (snags) were collected along the shoreline of the main and side channel. Snags were collected from Reaches 5, 6, and 8 of the Upper Mississippi River. Snags had to be submerged at least 10 cm deep and could not be in contact with the bottom sediments for the portion of the snag that was sampled. A DTH snag sampler was placed around the snag to ensure capture of all invertebrates and the snag was cut to appropriate size. Snags were placed in a bag and preserved in 70% ethanol for later analysis. Physical and chemical properties including, dissolved oxygen, temperature, turbidity, current velocity and conductivity, were measured for each sample. Samples were cleaned and sorted in the laboratory to remove invertebrates. Densities of heptageniid mayflies were low in both habitats and did not differ significantly. Low densities prevented the calculation of reliable secondary production estimates with the increment-summation method. However, it appears that production rates between main and side channel habitats were similar. Our findings suggest that resources available on nearshore snags are similar between main and side channel habitats.

Keywords: invertebrate, Heptageniidae, mayfly, secondary production, main channel, side channel, snags

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SPATIAL AND TEMPORAL VARIABILITY IN FOOD QUALITY OF TRANSPORT ORGANIC MATTER.

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Patterns of chlorophyll *a* and particulate organic matter (POM) in the water column determine food quality, which can be a driving force in system energetics. An increase in the chlorophyll *a*/POM ratio indicates an increase in food quality. Additionally, food quality is likely to change as a function of habitat type and time of the year; the results of which could influence consumer productivity. Chlorophyll *a* and POM concentrations were examined monthly for main and side channel habitats to ascertain spatial and temporal patterns of food quality. One-liter samples were collected from main channel and side channel habitats in Reaches 5, 6, and 8 of the upper Mississippi River from July through September 2001. Samples were collected from near shore areas in association with snags. From each sample, 500 mL were vacuum filtered through two separate 1.0-µm glass fiber filters. One filter was used to determine chlorophyll *a* concentration using spectrophotometric techniques and the other filter was used to determine biomass of POM. Biomass was measured by placing filters in oven at 60º C for 48 hr, sampled was weighed and placed in a muffle furnace at 550º C for 4 hr to determine ash free dry mass. There was no significant difference in chlorophyll *a* concentration, POM biomass or in chlorophyll *a*/POM ratio. The ratio remained unchanged seasonally in the main channel but reached a peak of 22.5 in late July before returning in September to a level similar to that of early July. This response was not observed in side channels, but that may be due to high concentrations of POM resulting from the abundance of dying macrophytes we observed during this period.

Keywords: chlorophyll *a*, particulate organic matter, food quality, main channel, side channel

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PREDICTING BIOMASS OF SUBMERSED AQUATIC VEGETATION USING THE LTRMP AQUATIC VEGETATION RAKE METHOD.

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We assessed the distribution and biomass of submersed aquatic vegetation in the lower end of Navigation Pool 8 at about 200 randomly selected sites annually, during 1999 through 2001. Trained personnel conducted vegetation sampling per the established Long Term Resources Monitoring Program procedures and at the same time harvested all vegetation present in four 1/3-m^2 quadrats. Rake index values and biomass data were summarized by site and the resulting data used to model the relationship between rake indices and vegetation biomass (both total and for individual species). We constructed linear regression models using log-transfomed biomass data for sites visited in 1999 and 2000. Data collected in 2001 was used to validate the resulting models by assessing the predictive capability of each model. The coefficient of determinations (R^2) for predicting total biomass was 0.84 and for individual species ranged from 0.60 for water milfoil (*Myriophyllum spicatum*) to 0.89 for coontail (*Ceratophyllum demersum*). The accuracy and precision of models tested using independent data indicate that the LTRMP aquatic vegetation rake method data can be used to reliably predict total vegetation biomass and biomass of selected species.

Keywords: biomass, LTRMP, Navigation Pool 8, sampling, submersed aquatic vegetation

SUBMERSED VEGETATION AND WATER QUALITY IN POOL 8, UPPER MISSISSIPPI RIVER, DURING THE DRAWDOWN OF 2001.

Heidi A. Langrehr, **James R. Fischer,** J. Therese Dukerschein.
Wisconsin Department of Natural Resources Onalaska Field Station
575 Lester Avenue Onalaska, WI 54650.

To re-establish emergent vegetation in areas where it has been declining, Pool 8 of the upper Mississippi River was drawn down through a cooperative, multi-agency effort (USACE, USFWS, USGS, MNDNR, WIDNR) between July 6 and August 14, 2001. While experimental, small-scale drawdowns had been conducted in other areas of the Mississippi River prior to 2001, the effect of a large-scale drawdown on non-targeted environmental components was still unknown. It was possible that the increased area of shallow water would result in unusually warm water, decreased clarity from wind-induced sediment re-suspension, and a negative response in the submersed vegetation community. Since 1998, we have collected submersed vegetation data from 550-670 randomly selected sites per year in Pool 8 following standard procedures of the Long Term Resource Monitoring Program (LTRMP). Preliminary analysis of the data suggests little net change occurred in the submersed plant community of Pool 8 from 2000 to 2001. Likewise, water quality data from three selected LTRMP fixed monitoring sites (upper-, mid-, and lower-pool) indicated that water quality conditions during the drawdown were consistent with trends during the past 11-14 years. Water temperature, dissolved oxygen, turbidity, and suspended solids were not unusually different from previous summers with similar weather conditions. Over all, the drawdown did not appear to have immediate adverse effects on submersed vegetation, water clarity, water temperature, or dissolved oxygen in Pool 8.

Keywords: Submersed vegetation, water quality, drawdown, Pool 8 upper Mississippi River, water clarity

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SUBMERSED AQUATIC VEGETATION MONITORING IN LAWRENCE LAKE, POOL 8, UPPER MISSISSIPPI RIVER SYSTEM, 1992-2001.

Heidi A. Langrehr, James R. Fischer, and J. Therese Dukerschein.
Wisconsin Department of Natural Resources, Onalaska Field Station, Onalaska, WI 54650.

Submersed aquatic vegetation (SAV) was monitored from 1992 to 2001 in Lawrence Lake, a contiguous 83-ha backwater in Pool 8, Upper Mississippi River System, as part of the Long Term Resource Monitoring Program. Ten transects were established at 200-m intervals throughout the lake. SAV was sampled at 15-m intervals along the permanent transects. Physical and chemical water quality parameters were measured at one site every two weeks. Fifteen species of SAV were recorded over the 10 years. The five most common species recorded were coontail (*Ceratophyllum demersum* L.), Canadian waterweed (*Elodea canadensis* Michx.), Eurasian watermilfoil (*Myriophyllum spicatum* L.), curly pondweed (*Potamogeton crispus* L.), and sago pondweed (*Potamogeton pectinatus* L.). In general, the frequency of sites that supported SAV increased from 1992 to 2000 then decreased in 2001. Although SAV declined in 1993 and 2001, both years of high water levels throughout June, different species contributed to the decline. Curly and sago pondweeds declined from 1992 to 1993 by 26% and 29% respectively while coontail, Canadian waterweed, and Eurasian watermilfoil increased by 26%, 3%, and 12% respectively. The opposite occurred from 2000 to 2001 when coontail, Canadian waterweed, and Eurasian watermilfoil declined by over 40% while curly and sago pondweeds increased by 10% and 16% respectively. The highest percentage of vegetated sites occurred in 1998 (88%), 1999 (91%), and 2000 (95%). Volatile suspended solids and turbidity were at their lowest values in these three years indicating good water clarity. Volatile suspended solids, turbidity, chlorophyll a, and total nitrogen all showed an overall downward trend from 1991 to 2000 then increased in 2001. It is unknown whether the change in water quality parameters influenced the decline in the submersed plant community in 2001 or the decline in the submersed plant community influenced the water quality parameters.

Keywords: submersed aquatic vegetation, water quality, Mississippi River, transect monitoring

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A STUDY OF BAT HABITAT AND ACTIVITY AT TWO SITES IN DUBUQUE COUNTY, IOWA: MINES OF SPAIN AND WHITE PINE HOLLOW.

Brian Lex and Laura Cady.
Environmental Science Program, Biology Department,University of Dubuque, Dubuque, IA 52001.

A study of bat activity at two sites in eastern Dubuque County, IA was conducted to determine species diversity, habitat suitability and effects due to human disturbances. Mist netting for this experiment compared habitats at Mines of Spain along Catfish creek located near the Mississippi River, and along the Little Turkey River in White Pine Hollow. Human disturbance, temperature, and rainfall effects were evaluated as they may have influenced bat inhabitation of the sites and activity levels. Greater species diversity was observed at White Pine Hollow, where four different species were captured. These included the little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivangans*), and the endangered Indiana bat (*Myotis sodalis*). Only the big brown bat was captured at the Mines of Spain site. White Pine Hollow is a preserve with few human disturbances, and Mines of Spain is a recreational area visited frequently by humans. Greater numbers of bats were observed following the wet spring than in the drier summer months.

Keywords: Chiropterans, bats, White Pine Hollow, Mines of Spain

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ANALYSIS OF HISTORICAL SEDIMENTATION TRANSECT DATA FOR SIX PERMANENTLY MARKED RIVER MILE TRANSECTS IN POOL 22 OF THE UPPER MISSISSIPPI RIVER.

Joseph S. Lundh, Gary V. Swenson.
US Army Corps of Engineers, Mississippi River Project, PO Box 534, Pleasant Valley , IA 52767.

Sedimentation transects were established by the survey branch of the Rock Island District of the Army Corps of Engineers at or near most whole numbered river miles on the Upper Mississippi River from Lock and Dam 10 to Lock and Dam 22. The first transects were established in the 1890's in Pool 19. The six transects studied (river mile 315, 316, 320.4, 321.5, 323.1, 324.1) were established in 1955 and resurveyed in 1974 to 1975. The permanently marked transects crossed the river perpendicular to flow extending from levee to levee. Elevation and bathymetric measurements to the nearest tenth of a foot were collected at roughly 50 foot increments along the transects and also at major features (ridges, bank-line, water's edge). Comparing the 1955 data to 1975 values showed significant changes. Even though the overall change in elevation for the transects was an average increase of 0.2 feet, summing changes by different geomorphic features provided varying results. Features that increased in elevation include sloughs by an average of 2.8 feet, chutes by 1.4 feet, islands by 0.6 feet, and mainland by 0.7 feet. The main channel and main channel border were the only features that decreased on average. The portion of the transects that were land in 1955 that continued to be land in 1975 raised by an average of 0.9 feet. Due to the dynamic nature of the river, these results can best be applied to the upper part of Pool 22. Resurveying these and other transects in the future would provide better trend data. Comparing more comprehensive sedimentation data to hydrologic trend data will help in understanding the fate of the river's backwaters and floodplain.

Keywords: sediment range, sediment transect, sedimentation, Mississippi River, land survey

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EFFECTS OF UN-IONIZED AMMONIA ON JUVENILE UNIONIDS IN SEDIMENT TOXICITY TESTS.

Teresa Newton[1], Jon O'Donnell[2], Michelle Bartsch[1], LeeAnne Thorson[2], and Bill Richardson[1].
[1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI,
[2]University of Wisconsin-La Crosse, River Studies Center, La Crosse, WI.

The National Park Service has identified ammonia as one of the primary threats to biota in the St. Croix Riverway. Ammonia is a relatively toxic compound generated in water and sediments by heterotrophic bacteria as a by-product of organic matter decomposition. Ammonia and other contaminants preferentially accumulate in sediments and porewater. Recent data suggests that unionids are sensitive to un-ionized ammonia (NH_3), relative to other organisms. We conducted two 96-hour and two 10-day sediment toxicity tests. Ammonium chloride was delivered to each of 36 experimental units (6 replicates of 6 concentrations) by peristaltic pump and diffused from an airstone beneath test (reference) sediments into the overlying water. Twenty *Lampsilis cardium* juveniles were placed in cages that were buried 2.5 cm into test sediments to facilitate porewater exposure and juvenile recovery. Survival, growth, the stressed:alive ratio (stressed defined as no evidence of foot movement but ciliary activity present), and NH_3 concentrations in porewater were measured at the end of each test. In all tests, survival exceeded 95% in the controls. The LC_{50s} were 127 and 165 ug/L in the 96-hour tests and 99 and 137 ug/L in the 10-day tests. The EC_{50s} (based on the stressed:alive ratio) were 73 and 119 ug/L in the 96-hour tests and 77 and 98 ug/L in the 10-day tests. Growth was substantially reduced, relative to controls, between 32 and 91 ug/L in all tests. A companion study measuring concentrations of NH_3 in porewater over a 150 km reach of the Riverway, found concentrations ranging from 0.1-141 ug/L. These data suggest that in some locations and under certain conditions (low flow and high temperature), sedimentary ammonia concentrations in the Riverway approach, and sometimes exceed, concentrations shown to cause lethal and sublethal effects in laboratory tests.

Keywords: mussels, ammonia, sediment porewater, toxicity, St. Croix

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EFFECTS OF AGRICULTURAL AND URBAN LAND USES ON MOVEMENT AND HABITAT SELECTI0N BY NORTHERN LEOPARD FROGS (*Rana pipiens*).

Brian C. Pember[1], Melinda G. Knutson[2], Brent Knights[2] and Shawn Weick[2].
[1]River Studies Center, University Wisconsin-La Crosse, La Crosse, WI 54601, [2]U. S. Geological Survey, Midwest Environmental Sciences Center, La Crosse, WI 54602.

Agriculture is suspected as a factor in possible recent declines in amphibian populations in many parts of the USA. We studied post-breeding habitat use by northern leopard frogs (*Rana pipiens*) in ponds surrounded by 3 different types of land use in southeastern Minnesota in 2000 and 2001. Pond types included a natural wetland in an agricultural setting, a constructed farm pond in an agricultural setting, and a large natural wetland complex adjacent to an urban industrial park. Our objectives were 1) develop methods for attaching radio transmitters to leopard frogs, and 2) quantify post-breeding habitat use by leopard frogs in southeastern Minnesota.

Several external attachment methods were investigated from August through October 2000. These external belt materials did not allow us to track the frogs for extended periods due to the frog's ability to slip out of the harness and the formation of sores around the belt. Surgical implantation techniques were refined during winter 2001. Based on successful laboratory experiments, transmitters were implanted into the peritoneal cavity to study post-breeding habitat use during 2001 breeding season. Frogs weighing more than 37g received a Holohil BD-2GHX transmitter weighing 1.85g. Forty-four field surgeries were conducted at the three study sites from May – July 2001. Implanted frogs were released several hours after the procedure. Mean tracking time for surgically implanted frogs was 52 days during 2001; 5 frogs were still located as of 10 November 2001. Movement distances and rates varied between the sites. The greatest distance traveled from the release site was 1006m at the natural site. Frogs at the agricultural site had the largest mean distance traveled while urban frogs recorded the smallest mean distance. Agricultural frogs also had the highest mean daily speed and total distance traveled. Four frogs crossed roads while migrating from the breeding pond. In three instances frogs migrated to new ponds for over-wintering. Habitat selection varied between the ponds. At the natural site 39% of the observations were in natural grass followed by aquatic emergents (29%) and wet meadow (15%). Agricultural crops used by the frogs included alfalfa (11%) and soybeans (1%). A mower struck 4 of 8 frogs using alfalfa during routine farming practices. Habitats used at the agricultural site were natural grass (35%), clover (21%) and trees/shrubs (24%). Crops utilized included alfalfa (8%), corn (4%), soybeans (2%) and oats (1%). Aquatic emergents (57%) were the most observed habitat at the urban site followed by natural grass (16%) and roadside grass (15%). Three frogs utilized natural grass located across a road within an urban setting. The results of this study will help managers evaluate land uses surrounding important amphibian breeding areas for risks during the post-breeding season.

Keywords: Northern leopard frog, radio-telemetry, *Rana pipiens*, habitat selection, farm pond, movement

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INVERTEBRATE COMMUNITY STRUCTURE ON SNAGS IN MAIN CHANNEL AND SIDE CHANNEL HABITATS OF THE UPPER MISSISSIPPI RIVER.

Beth Rycyzyn and Michael Delong.
Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

Habitat assessment of large river ecosystems is of importance in evaluating the health of a river. Large rivers are heterogeneous systems, which contain main and side channels, in addition to other types of habitats. Main channel and side channels are both lotic habitats, but exhibit many physical and chemical differences. For example, the main channel is deep and wide, which may produce higher current velocity. Side channels are shallow and narrow, with generally lower current velocities. Physical and chemical differences have the potential to create biological differences between main channel and side channel habitats. One biological difference researchers might be interested in is in the number of invertebrate species and the abundance of those species in the main channel compared to the side channels. We measured and compared system dynamics by determining the number of invertebrate species present and the abundance of invertebrates in main channel and side channel habitats. Samples were taken from main channel and side channel habitats at three different locations; Reaches 5, 6, and 8 of the Upper Mississippi River. Woody debris (snags) were randomly selected at each site. Samples had to be at least 10 cm. below the surface of the water, and the part of the snag sampled could not be in contact with bottom sediments. Snags were placed in the DTH snag sampler to catch any invertebrates that may fall off in the cutting process. Samples were cut to size, put in a sample bag, and preserved with 70% ethanol. Physical and chemical characteristics, including pH, temperature, current velocity, DO, turbidity, salinity, and conductivity were measured for each sample. Snags were then cleaned in the laboratory to remove invertebrates and measured for surface area. Invertebrates were sorted and identified to the lowest taxonomic level. Total number of taxa and total number of individuals did not differ significantly between habitats. It was hypothesized that differences in current velocity and suspended sediment concentrations would result in greater abundance and diversity in side channels. It appears, however, the nearshore zones of the main channel and side channels are structurally similar, leading to similar invertebrate communities and probably similar functional dynamics.

Keywords: invertebrate, community structure, diversity, main channel, side channel, snags

VALLISNERIA AMERICANA MICHX DISTRIBUTION AND ABUNDANCE WITH A FEW CHEMICAL AND PHYSICAL PARAMETERS.

Rebecca M. Thums [1], and Yao Yin[2].
[1]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, Onalaska, WI 54650.

We conducted a field study of *Vallisneria americana* in August 2001 in an effort to better understand the distribution and abundance of this species in relation to a few selected chemical and physical parameters in Navigation Pool 8 of the Upper Mississippi River. Our study plan was to investigate fifty-six sites, but we ended up with seventy-three sites investigated instead. The seventeen extra sites were a result of an error of having selected a wrong navigation datum in the setting of the global position receiver used to locate sites during the earlier part of the investigation. In selecting the fifty-six sites, we divided the sites that were sampled by the Long Term Resource Monitoring Program between 1998 and 2001 into eight abundance categories of *Vallisneria americana* and randomly picked seven sites from each category. At each site, we measured the velocity, turbidity, and water depth. Six 1.5 x 0.32 m aluminum quadrats were strategically placed around the boat and the above-ground live biomass inside each quadrat was harvested and placed and sealed in plastic bags. The harvested biomass were stored in a refrigerator until they were separated by species, oven-dried for 48 hours at 80^0 C, and weighed. One sediment sample was collected from inside each quadrat using a 5-cm diameter Wilco sediment core sampler. The top fifteen centimeters of the sediment core was extruded and placed in a plastic bag. Within 24 hours after the collection of sediments, two solutions were prepared in laboratory using the sediments in the bags which were later analyzed for the concentrations of pore water ammonia, pore water nitrate and nitrite, extracted ammonia, and extracted nitrate and nitrite. A portion of the remainder sediments was analyzed for moisture and organic contents. The rest of the sediments is stored in a refrigerator and is being analyzed for particle size distribution.

We conducted a preliminary data analysis to correlate the biomass with the selected chemical and physical variables. Our data reveal that *Vallisneria americana* was distributed within a narrow range of depth, flow velocity, and turbidity physical conditions, despite that the depth and velocity ranges of our data are larger than the ranges reported in literature. The majority of the biomass was collected between a depth of 0.3 to 1.1 m, a velocity of 0 to 0.08 m/s, and a turbidity reading of 2 to 18 Nephelometric Turbidity Units. These readings are possibly more variable due to the atypical fluctuation in water level seen in 2001. Both biomass displayed bell-shaped curves over carbon and moisture content gradients of the sediments, with concentration found between 20 and 35% of moisture content and 0.5 and 4.5% of carbon content.

Keywords: aquatic macrophyte, *Vallisneria americana*, Upper Mississippi River, macrophyte distribution, abundance

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FARM PONDS AS CRITICAL HABITATS FOR NATIVE AMPHIBIANS.

Shawn Weick[1], Melinda G. Knutson[1], William Richardson[1], Mark Sandheinrich[2], Dan Sutherland[2], Brent Knights[1], Jeff Parmelee[3].
[1]USGS Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, WI 54603, [2]Department of Biology and River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601, [3]Simpson College, 701 N. C. Street, Indianola, IA 50125.

We studied constructed farm ponds in the Driftless Area Ecoregion of southeastern Minnesota, western Wisconsin, and northeastern Iowa. We collected amphibian, wildlife, invertebrate, and water quality data from 40 randomly selected farm ponds in southeastern Minnesota during 2000 and 2001. We selected 10 ponds in each of 4 surrounding land use classes: row crop agriculture, grazed grassland, ungrazed grassland, and natural wetlands. We collected data on amphibians, birds, mammals, invertebrates, water quality, vegetation, and land use/cover surrounding the ponds.

We identified 10 species of amphibians at the ponds, including the tiger salamander (*Ambystoma triginum)*, American toad (*Bufo americanus)*, eastern gray treefrog (*Hyla versicolor)*, chorus frog (*Pseudacris triseriata)*, spring peeper (*Pseudacris crucifer)*, green frog (*Rana clamitans)*, wood frog (*Rana sylvatica)*, leopard frog (*Rana pipiens)*, and pickerel frog (*Rana palustris)*. The blue-spotted salamander (*Ambystoma laterale)* was identified at one pond in both years. Water quality in the ponds ranged from very clear, stream-fed ponds (natural wetlands) to very nutrient-rich, stagnant waters.

Besides the usual scientific papers resulting from the study, we are developing technical documents based on results of the study. We are writing a technical leaflet on design and management of farm ponds as wildlife habitat, suitable for use by biologists or district conservationists in working with landowners. This is intended for a national audience and will eventually be posted on the USDA NRCS Wildlife Habitat Management Institute website http://www.ms.nrcs.usda.gov/whmi/. We also are developing a monitoring manual and field key to eggs and larvae for Midwestern amphibians. The manual will be used by researchers with the USGS Amphibian Research and Monitoring Initiative in cooperation with biologists monitoring amphibians on federal land. Three graduate students have been involved with the project and are studying farm pond toxicology, invertebrates, and post-breeding habitat use of ponds by northern leopard frogs. Details and updates on study products are available at the project website: http://www.umesc.usgs.gov/terrestrial/amphibians/mknutson_5003869.html.

The study was undertaken in collaboration with the University of Wisconsin, La Crosse, the USDA Natural Resources Conservation Service, Simpson College, Indianola, IA, and the US Fish and Wildlife Service. The project was funded by Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative Commission on Minnesota Resources and the USGS Upper Midwest Environmental Sciences Center.

Keywords: farm ponds, amphibians, Driftless Area, wildlife, monitoring

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HABITAT RELATED DIFFERENCES IN SECONDARY PRODUCTION OF HYDROPSYCHID CADDISFLY LARVAE IN THE UPPER MISSISSIPPI RIVER.

Paige Wein and Michael Delong.
Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

Rivers are heterogeneous systems in which structural and functional differences affect secondary production. An example of this habitat heterogeneity is evident in comparing main and side channel habitats. Both systems are lotic habitats in large river ecosystems, however, several factors, including current velocity, depth, and nutrient dynamics, may cause the two habitats to function differently. One approach to assessing ecosystem function is to measure secondary production. Bioenergetics deals with the capture and fate (or flow) of energy in biological systems, whether dealing at organism, population, or ecosystem level. The objective of this study is to assess spatial and temporal changes in secondary production of hydropsychid caddisfly larvae in main and side channel habitats of the upper Mississippi River. The two prominent larvae studied were *Hydropsyche* and *Cheumatopsyche*, but production was estimated only for *H. orris.* Samples were taken from three sites on the Upper Mississippi River at Reaches 5, 6, and 8. Woody debris (snags) were collected from main channel and side channel habitats of the river. Snags collected were at least 10 cm below surface and not completely on the bottom sediments. Snags were placed in a DTH sampler to catch any lose invertebrates, cut to size, bagged, and preserved with 70% ethanol for later analysis. Physical and chemical characteristics, including pH, temperature, current velocity, dissolved oxygen, turbidity, and conductivity were measured for each sample. Snags were cleaned in the laboratory to remove invertebrates, and were then sorted and later counted and identified to the lowest possible taxonomic level. Secondary production of *H. orris* was estimated using the increment-summation method. Because secondary production is an indicator of energy flow, production by *H. orris* should reflect differences in food quality and availability in these lotic habitats. We found no significant differences in densities or rates of secondary production. It would appear, therefore, that main channel and side channels, while appearing to differ structurally at a macrohabitat scale, function similarly at least for nearshore mesohabitats.

Keywords: invertebrate, Hydropsychidae, caddisfly, secondary production, main channel, side channel, snags

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MINUTES OF THE 2001 BUSINESS MEETING
ANNUAL MEETING OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

27 April 2001
The meeting was called to order at 12:07 pm by Yao Yin (President), Brent Knights (Vice-president), Mike Romano (secretary), and about 50 other members were present. Neal Mundahl (Treasurer) was not present at the meeting.

Student Awards
Awards were made before Consortium business to accommodate high school participants who had to leave. Mike Dewey presented awards individually to student participants from Longfellow Middle School and Central High School. Each student received shirts and wildlife prints.

Brent Knights made the Best Student Platform and Best Student Poster Presentations. This year=s award of Best Student Platform went to **Laura L. Nash** from Western Illinois University, Macomb, IL for her paper entitled AEffect of small water craft on basking activity of Mississippi River turtles@. The paper was co-authored by Richard V. Anderson also from Western Illinois University.

This year=s award for Best Student Poster Presentation went to **Sharon Loebner** from Winona State University, Winona, MN for her paper entitled AEffect of location in a navigation reach on secondary production of hydropsychidae larvae@. The paper was co-authored by Michael Delong also from Winona State.

President=s Report
President Yin announced that this year=s meeting had 132 participants which was comparable to the previous year.

President Yin called for a motion to approve 2000 minutes as printed in the Proceedings. After a spelling correction to one member=s name, Marion Havlik moved that the minutes be approved as corrected. Richard Anderson seconded the motion.

President Yin acknowledged the efforts of other Consortium officers in organizing this year's annual meeting. He thank many of the members for their help in making this year's meeting a success including, Georginia Ardinger and Mike Dewey who helped with registration; Rob Tyser and the students from the River Studies Center at UWL for their help with AV and lights; Mike Caucutt for help with our web page; Terry Dukerschein and Randy Hines for photography; and the fantastic session moderators and student paper judges.

Treasurer=s Report
Treasurer Neal Mundahl was not present at the Annual Meeting, so President Yin gave the report on his behalf. The report was published on page 67 of the Proceedings. Yao indicated that there was $10,911 currently on account so the Consortium was in good financial shape. The amount of money is not too much for non-profit status. Mike Delong moved that the Treasurer=s Report be approved as published in the Proceedings and Rick Anderson seconded the motion.

Old Business

Education Committee Report. Mike Dewey discussed the School Action Committee=s progress on encouraging high school participation in research and the student interaction with scientists on river issues. The progress was evident in the posters presented by the local middle and high schools for which awards were presented earlier in the business meeting.

Upper Mississippi River Basin Conservation Act 2000. Mike Romano indicated that letters had been mailed to appropriate legislatures in support of the Conservation Act.

Credit Card Report. The use of credit cards for registration and Consortium business was not recommended because of the additional accounting problems regarding fees that would ensue.

New Business

Nominations. The Board nominated Neal Mundahl for the Treasurer=s position again. Jeff Arnold was presented as a nominee for Vice-president by Rick Anderson. Jeff was unanimously approved. Brent was elected President and Yao turned the meeting over to the new President. The officers for the following year were then set as Brent Knights (President), Jeff Arnold (Vice-president), Neal Mundahl (Treasurer) and Mike Romano (Secretary). President Knights thanked Yao Yin for his leadership and presented Yao with two plaques for his exceptional service! (Two had been mistakenly ordered.)

Other new business. Carol Jefferson suggested that an attempt be made to recruit more Army Corps of Engineers ecologists for future meetings. Rick Anderson suggested Chuck Theiling be designated to carry out that recruitment effort. Further discussion gave support for this effort.

Marian Havlik suggested that we use email more to reach out to the membership and to obtain Power Point presentations ahead of time for the Annual Meeting. As discussion continued on the Power Point issue, Terry Dukerschein proposed that at least two computers be available to speed up sessions. She also suggested that such presentations could then be made available on the Consortium web page. However, Rip Sparks argued that it would be bad policy to put unpublished material on the web site. The potential for misuse would be high, so a majority agreed this would not be done.

Suggestions for dates of 2003 meeting were discussed. Suggestions were that the meeting be held on April 3rd and 4th. Marian Havlik proposed that the meeting be held on April 24th and 25th instead. Marian's suggestion was unanimously agreed upon.

Additional discussion focused on pursuing a joint meeting between MRRC and UMRCC. Brent will explore this possibility with Ron Benjamin.

Marian Havlik brought up the topic of having a keynote speaker. Marian suggested Dr. Stansbury for a presentation about historical freshwater mussel surveys. Several other people were suggested as well, including Stan Trimble or Cal Fremling. Doug Blodgett was reluctant to have a keynote speaker displace paper presentations. Bill Richardson suggested the keynote address could be made at the banquet. The Board will pursue the issue further.

Bill Richardson spoke on behalf of the June 3-8 NABS meeting to be held in La Crosse.

Bill Richardson moved to adjourn the Annual Meeting at 12:46 pm. Mike Delong seconded the motion and the meeting was adjourned.

MISSISSIPPI RIVER RESEARCH CONSORTIUM
TREASURER'S REPORT – SUBMITTED BY NEAL D. MUNDAHL
1 MARCH 2002

Accounts as of 30 June 1999	$ 8,730.84
Accounts as of 30 June 2000	$11,068.19

Transactions, 1 July 2000 to 30 June 2001

INCOME	
2001 Registration and dues	$ 7,212.00
2001 Raffle proceeds	$ 732.00
T-shirt sales	$ 612.00
Interest	$ 67.59
Total	$ 8,623.59
EXPENSES	
Radisson Hotel – 2001 meeting	$ 5,489.25
2001 Proceedings	$ 773.40
2001 Raffle prizes	$ 365.10
2001 Best paper/poster awards	$ 176.00
T-shirts	$ 945.00
Postage, mailing, supplies	$ 581.17
Motel for officer – winter meeting	$ 77.30
Corporation fee	$ 10.00
Total	$ 8,417.22
Accounts as of 30 June 2001	$11,274.56

Transactions, 1 July 2001 to 1 March 2002

INCOME	
Interest	$ 27.19
Total	$ 27.19
EXPENSES	
Mailing costs	$ 119.00
Supplies	$ 26.29
Corporation fee	$ 10.00
Total	$ 155.29
Accounts as of 1 March 2002	$11,146.46
Accounts	
Checking account	$ 4,035.85
Savings account	$ 7,110.61
Total	$11,146.46

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.
BUSINESS MEETING AGENDA

26 April 2002, 12:30 PM
Radisson Hotel, La Crosse, Wisconsin

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1. Call to Order
2. President's Report
    - Approval of 2001 minutes
    - Acknowledgments
3. Treasurer's Report
4. Old Business
    - MRRC-UMRCC joint meeting
    - Recruitment of more USACOE folks
5. New Business
    - Executive board nomination
    - Election of officers
    - Volunteer sign-up sheets
6. Adjournment

Business Meeting Notes

Dr. Richard E. Sparks

Recipient of the 2001 MRRC "**Friend of the River**" Award
Presented by Douglas Blogett

I am very honored to represent the Mississippi River Research Consortium board and membership, dedicated researchers, managers, and river folks who love and cherish the Mississippi River (and its tributaries such as the Illinois River). I really appreciate this opportunity to present the "Friend of the River Award." I think it's important to note this award is not necessarily given annually. It is given only when deemed appropriate by the MRRC board of directors. And the past recipients (five in the last ten years) have caused the bar to be set quite high. I am pleased to announce that the Board of Directors for the Mississippi River Research Consortium has selected Dr. Richard E. Sparks to receive the "Friend of the River Award." I'll share with you that a couple of folks reminded me Rip no longer signs my paycheck, and they encouraged me that this is my opportunity to roast him good.

I think some background on Rip is appropriate. Richard E. Sparks was born in Pennsylvania and grew up in Vermont. In 1964 he received his bachelor's degree in biology from Amherst College. From 1964 through 1966 he served in the Peace Corps in Nigeria, where he was a teacher at the Methodist Higher Elementary Teacher Training College and an instructor at the University of Nigeria. In 1966, he returned to the states and studied at the University of Kansas, receiving his Master of Science degree in 1968. An encouraging note was that his thesis research involved channel catfish. Rip moved on to Virginia Polytechnic Institute and State University where he earned his PhD in 1971.

Rip joined the Illinois Natural History Survey in 1972, and was stationed at the Survey field station along the Illinois River near Havana, IL. There he served as director of the Survey's River Research Laboratory and their Large River Research Program. In 1998, after 26 years with the Survey, Rip left the Survey and his twice daily commute over the Illinois River at Havana, and he migrated 100 miles across Illinois' corn and bean prairie to the University of Illinois at Urbana-Champaign, where he is currently director of the Illinois Water Resources Center. Rip also serves as Research Coordinator for the Illinois-Indiana Sea Grant Program and he has a staff appointment in the Department of Natural Resources and Environmental Sciences at the U of I.

During the first 10 years of his career on the UMR, much of Rip's effort was directed at learning the ecology of the large floodplain river system in which he worked. He got his feet wet during field and laboratory research on riverine fishes, benthic organisms, and water and sediment toxicity. But over the past twenty years, much of Rip's effort has been focused on developing and actually applying large river science to the management of these imperiled ecosystems. Examples include the following:

- From 1980 to 1981, Rip served as the Master Coordinator for the Upper Mississippi River Basin Commission's Study to Evaluate Impacts of Navigation and Navigation Project Operation and Maintenance Procedures on Selected Environmental Parameters of the Upper Mississippi River System.

- From 1981 through 1989, he was project director of the NSF-funded research project "Ecological Structure and Function of Large Rivers in Illinois, or the Large Rivers LTER.

- Following the record flood of 1993, he participated in Administration and Capital Hill briefings on sustainable redevelopment of the flood region and in the review of national flood management policy.

- Currently Rip is the Project Director for the NSF-project looking at the ecology, hydrology, and economics of floodplain management.

Rip has served and continues to serve on numerous committees, advisory councils, etc. including the Lieutenant Governor's Planning Committee for Development of the Illinois River Ecosystem Management Plan, Science Advisory Committee for the Illinois River Coordinating Council, and a member of the most prestigious Science Advisory Council for the Illinois Chapter of The Nature Conservancy. Rip served on two National Research Council Committees-- one to review the water resources planning activities of the U.S. ACOE, and a second which resulted in the book Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy.

Here are a few other important publications he authored or co-authored over the last 20 years:

1982 At the 15th annual meeting of the MRRC, Rip presented the paper "The role of contaminants in the decline of the Illinois River: implications for the Upper Mississippi."
1989 The floodpulse concept in river-floodplain systems--*Canadian Special Publication of Fisheries and Aquatic Sciences*
1990 Disturbance and recovery of large floodplain rivers--*Environmental Management*
1991 Risks of altering the hydrologic regime of large rivers--*Advances in Modern Environmental Toxicology*
1995 Value and need for ecological management of large river-floodplain ecosystems--*BioScience*
1996 The natural flow regime--*BioScience*
1997 Nutrient dynamics of large river floodplains--*Regulated Rivers*
1998 Disturbance, succession, and ecosystem processes in rivers and estuaries: effects of extreme hydrologic events.
1999 Naturalization of the flood regime in regulated rivers: the case of the upper Mississippi River--*Bioscience*
2000 River restoration in developed economies.

To summarize, over the last 30 years Rip has authored or coauthored over 300 published articles, reviews, and reports including 6 book chapters. Nearly all of these have dealt with river science--mostly on the UMRS. He has also been involved in procuring well over $15 million for his research on the UMRS as well as significant dollars to support the research of other scientists.

My wife would remind me of the old adage that behind every good man there's a good woman--actually my wife would says it's a fact. This evening, I'll take this opportunity to acknowledge Rip's wife Ruth who I know first hand has made significant contributions to Rip's success and the successes of most if not all of those of us who have worked for Rip. Ruth has been a critical member of the team, providing assistance with fieldwork, editing, and general moral support.

Today, the UMR ecosystem is certainly a multi-use river with a multitude of complex forces trying to push and pull it in many directions. While an individual can be successful in his or her career and may independently make a significant contribution to conserving the Upper Miss, I believe that ultimately natural attributes of the river will be best conserved only if we as a research community invest in the synergies that can result when we work together--I know Rip Sparks has done and continues to do an excellent job of pulling together the right people and making a difference.

There's another old adage that says "if you want it done right, do it yourself." I think that statement is a bit self-righteous--it's probably more accurate to say, "If you want it done your way, do it yourself." However, in large complex systems, such as large floodplain river ecosystems, I believe it more constructive to adhere to the tenet that "if you want it done right, get the best qualified people." But getting the best-qualified people together can take a lot of time and energy in and of itself. While it may be the best for the resource, it's not necessarily best for one's career.

Two weeks ago The Nature Conservancy convened a group of 40 scientists to help us with planning for the restoration and management of our recently acquired, 7600-acre Emiquon property. I don't know how many times I heard the phrase "herding cats." It was often a difficult and laborious task, but pulling together the right folks seems to be what it takes to get it done right. In my mind, among the most important accomplishments of Rip Sparks is that he has been extremely successful at herding cats (but note that he's also had quality cats to work with on the UMR), and I think his persistent efforts not only as a scientist, but also as someone who works hard to bring the right scientists and decision makers to the table (or to the river as the case may be) will continue to pay dividends for the river's natural resources.

I think it fortuitously appropriate that this award is presented to Rip as the complex, large-floodplain river ecosystem just outside the back door is experiencing its ecologically important spring flood pulse. So, on behalf of the Mississippi River Research Consortium ... In recognition of his distinguished career advancing the science of river ecology and its application to the restoration, management, and conservation of large-floodplain river ecosystems, I'm pleased to present Rip Sparks with the "Friend of the River Award."

“Friend of the River” Recipients

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
Richard Sparks	University of Illinois	2001	33rd	Doug Blogett

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 bylaws.

2. The bylaws 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 bylaws of the MRRC may be amended by an affirmative vote of two-thirds of the eligible voting members present at the annual meeting.

BY-LAWS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I: NAME, PURPOSES, AND DUTIES

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

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

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

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

1.02 The purposes of the organization shall be as follows:

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

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

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

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

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

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

ARTICLE 2: OFFICES

2.01 Principal and Business Offices.

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

2.02 Registered Office.

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

ARTICLE 3: OFFICERS AND BOARD OF DIRECTORS

3.01 General Powers, Responsibility, and Number.

The business and affairs of the corporation shall be managed by its Board of Directors. It shall be the responsibility of the Board to carry out the objectives of the organization and to jointly organize, hold, and preside 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 a 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 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 those 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 of 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, compensate, and give directives to an executive officer. Said executive director shall not be considered as a member of the Board of Directors.

3.10 Duties of Officers.

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

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

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

The vice-president shall:

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

The secretary shall:

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

The treasurer shall:

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

3.11 Other Assistance to Acting Officers.

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

ARTICLE 4: MEMBERSHIP AND DUES

4.01 Membership and Eligibility.

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

4.02 Membership and Dues.

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

ARTICLE 5: COMMITTEES

5.01 Nominating Committee.

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

5.02 Other Committees.

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

ARTICLE 6: MEETING OF MEMBERSHIP

6.01 Annual Meeting.

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

6.02 Special Meetings.

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

6.03 Quorum.

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

ARTICLE 7: AMENDMENTS

7.01 By The Membership.

These By-Laws may also be altered, amended or repealed and new By-Laws may be adopted by the Board of Directors by affirmative vote of two-thirds ($^2/_3$) of the members present at a meeting at which a quorum is in attendance.

Updated April 1999

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

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

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

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

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

Notes

Acknowledgements 2002

The following persons or institutions have contributed substantially to the planning, execution, support, and ultimately, the success of the 34rd Annual Meeting of the Mississippi River Research Consortium. The 2001-2002 Board of Directors and Consortium members gratefully acknowledge their efforts.

Local Meeting Arrangements, Meeting Announcements, And Mailings

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

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

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

Jeff Arnold, U.S. National Park Service, Yellowstone National Park, Yellowstone Park, Wyoming

Program and Proceedings

Jeff Arnold, U.S. National Park Service, Yellowstone National Park, Yellowstone Park, Wyoming

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

Registration Table

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

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

T-shirt Logo Design

Heidi Imker

Visual Aids and Poster Arrangements

Ginny Stefanez, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Amy Annen, University of Wisconsin-La Crosse, La Crosse, Wisconsin

Shannon McStrack, University of Wisconsin-La Crosse, La Crosse, Wisconsin

Kelly Williams, University of Wisconsin-La Crosse, La Crosse, Wisconsin

Sean Bailey, University of Wisconsin-La Crosse, La Crosse, Wisconsin

Roger Haro, River Studies Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin

Mark Sandheinrich, River Studies Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin

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

Jeff Yankee, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Jon Vallazza, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Sales and Arrangements (Raffle and T-shirt)

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

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

Georginia Ardinger, 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

Platform Session Moderators

Pam Thiel, U.S. Fish and Wildlife Service, La Crosse Fisheries Resources Office, La Crosse, Wisconsin

Jeff Arnold, National Park Service, Yellowstone National Park, Yellowstone Park WY

Michael Delong, Large River Studies Center, Biology Department, Winona State University, Winona, MN

Thomas Dunstan, Department of Biological Sciences, Western Illinois University, Macomb, Illinois

Gretchen Benjamin, Wisconsin Department of Natural Resources, La Crosse, Wisconsin

Michelle Bartsch, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

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

Kevin Kenow, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin

Judges for Student Presentations

Mark Pegg, Illinois Natural History Survey, Illinois River Biological Station, Havana, IL 62644.

Maria Lemke, Illinois Natural History Survey, Illinois River Biological Station, Havana, IL 62644.

Tom Dunstan, Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

Sean Jenkins, Department of Biological Sciences, Western Illinois University, Macomb, IL 61455

Bob Connour, Department of Math, Life, and Natural Sciences, Owens Community College, Findlay, OH 45840

Jack Grubaugh, University of Memphis, Department of Biology, Ellington Hall, Memphis, TN 38152

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

Raffle Prizes

See our website for a list of contributors
http://www.umesc.usgs.gov/mrrc/sup_agns.html

Photography

Terry Dukerschein, Wisconsin Department of Natural Resources, Onalaska, Wisconsin

Poster Session and School Outreach

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

Mike Johnson, Longfellow Middle School, La Crosse, WI

Barb Thompson, West Salem School District, West Salem, WI

Kevin Callen, Logan High School La Crosse, WI

Notes