PROCEEDINGS OF THE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

VOLUME 54

19-21 April 2023

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PROCEEDINGS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM
Volume 54
April 19 - April 21, 2023
The Radisson Center, La Crosse,
Wisconsin

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Contents:

2022 Raffle Donor Recognition & 2023 Pint Glass Design	4
Acknowledgements	77
Wednesday Opening Event	6
Keynote Speaker	7
Invited Speakers	8
Meeting Agenda	9
Thursday Platform Program	11
Friday Platform Program	14
Wednesday Poster Session Program	18
Thursday Poster Session Program	20
Platform Presentation Abstracts	22
Poster Presentation Abstracts	40
2023 Business Meeting Agenda	61
2023 Treasurer's Report	62
2022 Business Meeting Minutes	63
Past Recipients of the Friend of the River Award	68
Past Meetings and Officers	69

The board would like to express its sincere appreciation for all of the donors for the 2022 raffle! The funds go to support our student scholarships each year and will carry over to support additional scholarships next year! Thank you for your generosity and support of our annual raffle!

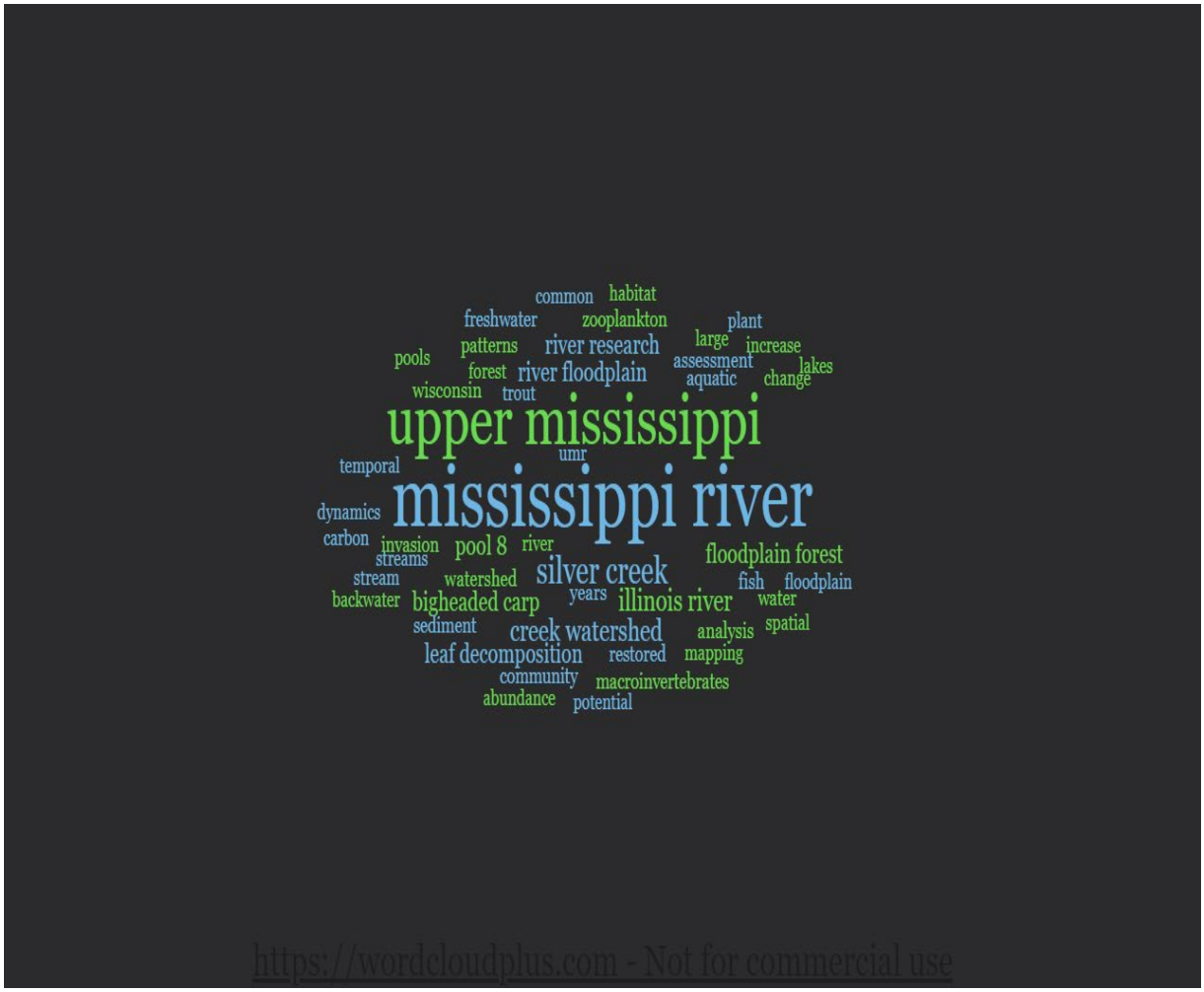
2023 MRRC Commemorative Pint Glass

This year the board decided to have a contest and accept submission of artwork for the pint glass design, and our winning submission was by Alicia Carhart.

We had a lot of really great submissions and will likely use the same designs to hold a vote for future year's glasses! Thank you to all who participated and submitted a design!

Word Cloud

2023



MRRC MEETING AGENDA

Wednesday, 19 April 2023

2:00–5:00 PM	STUDENT WORKSHOP (UWL)
5:00–9:30 PM	REGISTRATION TABLE (Radisson Center Foyer)
5:00–6:00 PM	SETUP FOR POSTER SESSION I (Radisson Center Foyer)
6:00–7:30 PM	WELCOMING ADDRESS (Radisson Center Ballroom) UMRCC-UWL LIBRARY PRESENTATION: "READING THE RIVER: BUILDING, ENHANCING, AND PRESERVING RIVER-RELATED COLLECTIONS AT THE UWL MURPHY LIBRARY" **KEYNOTE PRESENTATION:** "WHAT IS CLEAN WATER WORTH? ECONOMICS, ENVIRONMENTAL JUSTICE, AND THE PURSUIT OF MORE EFFECTIVE AND EQUITABLE WATER POLICY"
7:30–9:30 PM	POSTER SESSION I (Radisson Center Foyer)
7:30–10:00 PM	RECEPTION AND MIXER (Radisson Center Foyer)

DR. BONNIE KEELER
MRRC 2023 KEYNOTE SPEAKER

Bonnie Keeler is an associate professor and Charles M. Denny Chair of environmental policy at the Humphrey School of Public Affairs at the University of Minnesota. Keeler's research evaluates the equity implications of environmental policies at state and regional levels, with a focus on water resources science and management. Keeler co-directs the Center for Science, Technology and Environmental Policy at the University of Minnesota and serves as a subcommittee member of the Environmental Protection Agencies Board of Scientific Counselors. Keeler also directs the Beyond the Academy Network - a coalition of academic leaders seeking to reform university structures to promote more action-oriented engaged scholarship on sustainability.

Keeler is the lead PI on an-EPA funded project investigating the social, economic, and cultural values of the Mississippi River. The research uses a combination of economic valuation methods, community science, and environmental justice-focused site visits and qualitative research to improve evaluation of state and federal environmental policy. Keeler is also the lead of a new $10 million dollar technical assistance center based at the University of Minnesota designed to serve rural, remote, and disadvantaged communities across EPA Region 5 access federal energy and environmental improvement funding.

INVITED SPEAKERS

David Mindel, Associate Professor, Murphy Library
Digital Collections Librarian, University of Wisconsin La Crosse

David Lindel has an MA in Library and Information Studies from the University of Wisconsin-Madison, and subsequently served as a Digital Conversion Specialist at the Library of Congress. His research interests include digitization with a focus on quality and affordability, image manipulation related to digital image restoration, and the relationship between digital access and digital preservation of cultural heritage materials. He will discuss his work to curate a diverse collection at the UWL Murphy Library focused on the Mississippi River.

Judson Steinback, 2023 Team Member
Mississippi Speed Record
La Crosse, WI

Judson Steinback is part of a canoe team of five planning to launch a Guinness World Record attempt on May 3rd at the Mississippi headwaters at Itasca State Park in northern Minnesota. Steinback spends hundreds of hours annually training on the Upper Mississippi River and its tributaries near his hometown of La Crosse, WI and has competed in and won numerous paddling races throughout the Midwest. Judson is currently the Master's Class Men's and Mixed USCA C-2 National Champion. He has competed in International Professional Canoe Races, placing 14th in the Ruta Maya Belize River Challenge with Mississippi Speed Record teammate Joe Mann and 29th (1st in the Rookie Class) in the AuSable River Canoe Marathon.. Steinback will discuss the ecological and logistical considerations, planning, and luck that go into setting the Mississippi River paddling speed record.

MRRC MEETING AGENDA

Thursday, 20 April 2023

7:30 AM – 6:30 PM	REGISTRATION TABLE (Radisson Center Foyer)
8:00–9:50 AM	WELCOME, ANNOUNCEMENTS, AND **SESSION I** (Radisson Center Ballroom)
9:50-10:10 AM	BREAK (Radisson Center Foyer)
10:10–11:30 AM	**SESSION II** (Radisson Center Ballroom)
11:30 AM–1:30 PM	LUNCH (on your own)
12:30–3:30 PM	SETUP FOR POSTER SESSION II (Radisson Center Foyer)
1:30–2:50 PM	**SESSION III** (Radisson Center Ballroom)
2:50–3:20 PM	BREAK (Radisson Center Foyer)
3:20–5:00 PM	**SESSION IV** (Radisson Center Ballroom)
5:00–6:30 PM	POSTER SESSION II (Radisson Center Foyer)
5:00–6:30 PM	MIXER (Radisson Center Foyer)
6:30–9:00 PM	BANQUET (Radisson Center Ballroom) PRESENTATION - Friend of the River Award

Friday, 21 April 2023

8:00-9:30 AM	WELCOME, ANNOUNCEMENTS, AND **SESSION V** (Radisson Center Ballroom)
9:30–9:50 AM	BREAK (Radisson Center Foyer)
9:50–10:50 AM	**SESSION VI** (Radisson Center Ballroom)
11AM – 12PM	PRESENTATION OF STUDENT AWARDS AND BUSINESS MEETING (Radisson Center Ballroom)

12:00–2:00 PM LUNCH AND RAFFLE (Radisson Center Ballroom)

MRRC Meeting Agenda
Thursday, 20 April 2023
Oral Presentations - Radisson Center Ballroom
(*Student Presenters)

8:00-8:15 AM: Welcome and Announcements
Eric Hine, MRRC President

SESSION I (Moderator: John Chick)

8:15–8:35 USING SATELLITE AND DRONE IMAGERY TO ASSESS THE DISTRIBUTION OF COLDWATER STREAMS IN THE IOWA DRIFTLESS REGION
Niti B. Mishra[1,2], Michael Siepker[3], Gregory Simmions[3], and Eric Strauss[2,4]
[1]Department of Geography & Earth Science, UW La Crosse
[2]River Studies Center, UW La Crosse. [3]Iowa Department of Natural Resources.
[4]Biology Department, UW La Crosse.

8:35– 8:55 A SURVEY OF SHORELINE LARGE WOOD IN UMR POOL 8: HOW'D IT GET THERE?
***Matthew Chen[1]** and Eric Strauss[1].
[1]UW La Crosse, Department of Biology and the River Studies Center

8:55–9:15 SPATIAL AND TEMPORAL SHIFTS IN THE INUNDATION REGIME OF THE UPPER MISSISSIPPI RIVER FLOODPLAIN OVER 83 YEARS
Molly Van Appledorn[1], Nathan De Jager[1], and Jason Rohweder[1].
[1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center

9:15–9:35 MAPPING POTENTIAL SENSITIVITY TO HYDROGEOMORPHIC CHANGE IN THE UMRS RIVERSCAPE
Angus A. Vaughan[1], Faith A. Fitzpatrick[2], Jayme M. Strange[1], and Molly Van Appledorn[1].
[1]U.S. Geological Survey Upper Midwest Environmental Sciences Center. [2]U.S. Geological Survey Upper Midwest Water Science Center

9:35-9:50 BROWN TROUT SPAWNING REDDS DURING HABITAT DEVELOPMENT IN A MINNESOTA TROUT STREAM: ABUNDANCE, COVER USE, AND CLUSTERING
Neal D. Mundahl[1] and Avery C. Schnaser[1].
[1]Department of Biology and Southeastern Minnesota Water Resources Center, Winona State University

9:50-10:10 AM: BREAK (Radisson Center Foyer)

SESSION II (Moderator: Molly Van Appeldorn)

10:10-10:30 INTEGRATING MACHINE LEARNING AND ECOSYSTEM STATE TRANSITION CONCEPTS: MODELING SUBMERSED PLANT VULNERABILITY AND RESTORATION POTENTIAL
Danelle M. Larson[1] and John T. Delaney[1].
[1]U.S. Geological Survey Upper Midwest Environmental Sciences Center

10:30-10:50 PREDICTING PHALARIS ARUNDINACEA (REED CANARYGRASS) INVASION IN FOREST UNDERSTORIES OF NAVIGATION POOLS 3-13
John T. Delaney[1], Molly Van Appledorn[1], Nathan R. De Jager[1], Kristen L. Bouska[1], Jason J. Rohweder[1].
[1]U.S. Geological Survey Upper Midwest Environmental Sciences Center

10:50–11:10 22 YEARS OF AQUATIC PLANT SPATIOTEMPORAL DYNAMICS IN THE UPPER MISSISSIPPI RIVER
Alicia Carhart[1], Jason Rohweder[2], Danelle Larson[2].
[1]Wisconsin Department of Natural Resources, La Crosse Field Station. [2]U.S. Geological Survey Upper Midwest Environmental Sciences Center.

11:10–11:30 ATTRIBUTES OF UPPER MISSISSIPPI RIVER SYSTEM CONTIGUOUS FOREST AREAS
Jason J. Rohweder[1], Nathan R. De Jager[1].
[1]U.S. Geological Survey Upper Midwest Environmental Sciences Center.

11:30 AM - 1:30 PM: LUNCH (on your own)

SESSION III (Moderator: Danelle Larson)

1:30–1:50 BREEDING BIRDS IN UMR FLOODPLAIN FOREST: 20 YEARS OF CHANGE
Eileen M. Kirsch[1], Michael J. Wellik[1].
[1]U.S. Geological Survey Upper Midwest Environmental Sciences Center.

1:50–2:10 ZOOPLANKTON PRODUCTION IN A RESTORED ILLINOIS RIVER BACKWATER AND ITS CONTRIBUTION TO MAINSTEM RIVER ZOOPLANKTON
***Kara Phelps[1]**, Kristopher Maxson[1], Carley Capon[1], Sally McClure[3], Maria Lemke[3], Tih-Fin Ting[2], and James T. Lamer[1].
[1]Illinois River Biological Station, [2]University of Illinois at Springfield, [3]The Nature Conservancy

2:10–2:30 DESICCATION-RESISTANT PHYTOPLANKTON, ZOOPLANKTON, AND MACROINVERTEBRATES: IMPLICATIONS FOR TRANSPORTING DREDGED SEDIMENTS FROM THE UPPER MISSISSIPPI RIVER.
Ross Vander Vorste[1], Sarah Henkhaus[1], and Sara Strassman[2].
[1]UW La Crosse and UW-L Rivers Studies Center, [2]Trout Unlimited

2:30–2:50 THE IDENTIFICATION OF A NEPHROBLASTOMA IN A COMMON MUDPUPPY IN THE UPPER MISSISSIPPI RIVER
Isaac Standish[1], **Eric Leis[1]**, Sara Erickson[1], Ryan Katona[1], Wes Baumgartner[2], Kevin Hanson[3], Iman Ibrahim[4], and Tony Goldberg[5].
[1]U.S. Fish and Wildlife Service, La Crosse Fish Health Center, [2]College of Veterinary Medicine, University of Illinois, [3]Iowa Department of Natural Resources, [4]Department of Pathology, College of Veterinary Medicine Mansoura University, [5]Department of Pathobiological Sciences, University of Wisconsin Madison

2:50-3:20 PM: BREAK (Hotel Foyer)

SESSION IV (Moderator: Becky Kreiling)

3:20–3:40 NUTRIENT DEPOSITION AND PROCESSING WITH THE DOGTOOTH BEND FLOODPLAIN ALONG THE LOWER MOST UPPER MISSISSIPPI RIVER
Jonathan W.F. Remo[1], Stony Samberg[2], Marjorie Brooks[2], Ty H Genz[1], Liliana Lefticariu[1], Garion Leamon[2], and Scott D. Hamilton-Brehm[2], Tara L. Giri[1].
[1]School of Earth Systems and Sustainability, [2]School of Biological Sciences, Southern Illinois University

3:40–4:00 SURFACE CONCENTRATIONS OF METHANE AND NITROUS OXIDE INCREASE WITH GREATER NITROGEN LOADS IN HYPEREUTROPHIC MESOCOSMS
Patrick T. Kelly[1], Jason M. Taylor[2], Isabelle M. Andersen[3], J. Thad Scott[3], Meredith A. Holgerson[4], Nicholas E. Ray[4].
[1]Rhodes College, [2]US Department of Agriculture ARS, [3]Baylor University. [4]Cornell University

4:00–4:20 DISSOLVED ORGANIC CARBON DYNAMICS IN LAKES AND STREAMS IN NORTHERN WISCONSIN
***Vanessa M. Czeszynski[1]** and Eric A. Strauss[1]
[1]UW La Crosse River Studies Department

4:20–4:50 HOW DO YOU SET THE MISSISSIPPI SPEED RECORD?

Judson Steinbeck
Coulee Region Ecoscapes and Mississippi Speed Record

5:00-6:30 POSTER SESSION I (Radisson Center Foyer)

5:00-6:30 MIXER (Radisson Center Foyer)

6:30-9:00 BANQUET(Radisson Ballroom)

MRRC Meeting Agenda
Friday, 21 April 2023
Oral Presentations - Radisson Center Ballroom
(*Student Presenters)

8:00-8:10 AM: Welcome and Announcements
Eric Hine, MRRC President

SESSION V (Moderator: Kristen Bouska)

8:10–8:30 CENTRARCHID RESPONSE TO HABITAT ENHANCEMENT IN POOL 12 BACKWATERS (MISSISSIPPI RIVER)
Seth J. Fopma[1], Kirk A. Hansen[1], Ryan N. Hupfeld[1], Travis G. Kueter[1], and Ashley Johnson[1].
[1]Iowa Department of Natural Resources.

8:30–8:50 INVESTIGATIONS OF BLUEGILL AGE AND SIZE STRUCTURE DIFFERENCE FROM THREE DIFFERENT MISSISSIPPI RIVER OVERWINTERING SITES NEAR LA CROSSE, WISCONSIN
Jeff Janvrin[1], Troy Clement (retired)[1], Kristina Pechacek[2], Andrew Schneyer[3], Trevor Raatz[1].
[1]Wisconsin Department of Natural Resources, La Crosse, [2]Wisconsin Department of Natural Resources, Horicon, [3]Wisconsin Department of Natural Resources, Eau Claire.

8:50–9:10 UNLOCKING GENOMES FROM FORMALIN-FIXED FISH SPECIMENS COMPARING TWO DNA EXTRACTION TECHNIQUES
***Erin E. Brino[1]**, Todd W. Osmundson[1], David A. Schumann[1], Calvin Rezac[2], and Robbie Ellwanger[2].
[1]Department of Biology and River Studies Center, UW La Crosse, [2]Mississippi Department of Wildlife, Fisheries, & Parks.

9:10–9:30 CHARACTERIZATION OF MICROPLASTIC POLLUTION IN THREE FISH SPECIES FROM POOLS FOUR AND EIGHT OF THE UPPER MISSISSIPPI RIVER
***Samuel S. Munk[1]** and Eric Strauss[1].
[1]UW La Crosse River Studies Center.

9:30–9:50 AM: BREAK (Radisson Center Foyer)

SESSION VI – (Moderator: Seth Fopma)

9:50–10:10 THE 50th ANNIVERSARY: RIVER RESEARCH LAB - ILLINOIS RIVER BIOLOGICAL STATION & MRRC 1972-2022.
129 YEARS OF ONGOING RIVER RESEARCH
April M. Burgett[1], James T. Lamer[1] and Levi Solomon[1].
[1]Illinois River Biological Station, Illinois Natural History Survey

10:10–10:30 NATIVE PISCIVORES SHOW LOW OVERLAP WITH JUVENILE BIGHEADED CARP IN A LARGE FLOODPLAIN RIVER
Dan Gibson-Reinemer[1], Jason DeBoer[2], Kristopher Maxson[2], Levi Solomon[2], Andrya Whitten[2], Cory Anderson[3], Eli Lampo[4], and James Lamer[2].
[1]United States Geological Survey, Upper Midwest Environmental Sciences Center, [2]Illinois River Biological Station, Illinois Natural History Survey, [3]Midewin National Tallgrass Prairie, Forest Service, United States Department of Agriculture, [4]Illinois Department of Natural Resources.

10:30–10:50 BEHAVIORAL RESPONSES OF COMMON CARP (CYPRINUS CARPIO) TO A CARBON DIOXIDE DETERRENT IN A NAVIGATIONAL LOCK
Maggie Raboin[1], John M. Plumb[2], Matthew D. Sholtis[2], David L. Smith[3], P. Ryan Jackson[4], Jose M. Rivera[1], Cory D. Suski[5], Aaron R. Cupp[4].
[1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, [2]U.S. Geological Survey, Columbia River Research Laboratory, [3]U.S. Army Corps of Engineers, Engineer Research and Development Center. [4]U.S. Geological Survey Central Midwest Water Science Center, [5]Department of Natural Resources and Environmental Sciences, University of Illinois.

10:50-11:00 AM: BREAK (Radisson Center Foyer)

11:00 AM-12:00 PM: PRESENTATION OF STUDENT AWARDS AND BUSINESS MEETING (Radisson Center Ballroom)

12:00 PM-2:00 PM: LUNCH AND RAFFLE (Radisson Center Ballroom)

Poster Session I
Wednesday, 19 April 2023
Radisson Center Foyer

Poster set-up 5:00 to 6:00 PM
Authors present at posters 7:30 to 9:30 PM
(*Student presenters)

1) CHARCOAL ANALYSIS OF A SEDIMENT CORE FROM MUD LAKE, WISCONSIN, A LAKE LOCATED IN THE UPPER MISSISSIPPI RIVER WATERSHED
   ***Samantha Baumgartner[1]**, *Jaydin Romalia[1], *Jackie Oetterer[1], and Joan Bunbury[1].
   [1]Department of Geography and Earth Science and River Studies Center, University of Wisconsin-La Crosse

2) REAL-TIME REMOTE MONITORING OF WATER LEVELS AND MICROCLIMATE VARIABLES - THE IMPACT OF RAINFALL IN AN URBAN WETLAND
   ***Madison L. Davee[1]** and Roger C. Viadero[2].
   [1]Department of Biological Sciences, Western Illinois University. [2]Institute for Environmental Sciences, Western Illinois University.

3) HISTORICAL FLOODPLAIN SEDIMENT MAPPING ALONG PLUM CREEK IN SOUTHWEST WISCONSIN
   ***Travis Key[1],** Colin Belby[1], and John Kelly[1].
   [1]Department of Geography and Earth Science and River Studies Center, University of Wisconsin-La Crosse

4) INFLUENCE OF SEDIMENT CHARACTERISTICS AND OXYGEN DEMAND ON WINTER HYPOXIA IN BACKWATER LAKES OF THE UPPER MISSISSIPPI RIVER
   ***Patrik M. Perner[1]**, Rebecca M. Kreiling[2], Kathi Jo Jankowski[2], Eric A. Strauss[1].
   [1]River Studies Center, University of Wisconsin-La Crosse. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center.

5) HOT SPOT ANALYSIS OF SANITARY SEWAGE CONTAMINATION OF AN URBAN WATERSHED VIA EXFILTRATION
   ***Adam P. Schumacher[1]** and Dr. Michael Reisner[1].
   [1]Upper Mississippi Center, Augustana College

6) ATTITUDES AND PERCEPTIONS OF WATERSHED MANAGEMENT
***Delaney Farwell[1]** and ***Peyton Heisch[1]**
[1]Augustana College Upper Mississippi Center

7) ECOLOGICAL ASSESSMENT OF PROSPECT AND HERITAGE PONDS IN MOLINE, IL.
***Zack Horve1,** *Jonathan Pape1, Michael Reisner1, Kevin Geedey1, and Jenny Arkle1.
[1]Augustana College Upper Mississippi Center

8) ASSESSMENT OF THE HEALTH OF RIPARIAN ZONES IN THE SILVER CREEK WATERSHED
***Holly Chesney[1]**, ***Paige Lundborg[1]** and Dr. Kevin Geedey[2].
[1]Augustana College

9) SENSE OF PLACE IN SILVER CREEK WATERSHED
Sarah Lashley[1], Kevin Geedey[1], Michael Reisner[1], *Delaney Farwell[1], *Mercedes Hantz[1], *Amanda Page[1], and *Lauren Pillion[1].
[1]Augustana College

10) STREAM ASSESSMENT OF MICROPLASTICS IN QUAD CITY WATERSHEDS
***Eulle Stann Casaquite[1], *Briana Reagan[1],** Jeffrey C. Strasser[1], Kevin Geedey[1], and Micheal Reisner[1].
[1]Augustana College

11) IMPACTS OF HERBIVORY AND COMPETITION ON SILVER MAPLE REGENERATION
***Tanner S. Ross[1]**, Lia E. Landowski[1,2], Andrew R. Meier[3], and Anita L. Davelos[1]
[1]Department of Biology and River Studies Center, University of Wisconsin-La Crosse, [2]Beaver Creek Reserve. 3US Army Corps of Engineers

12) EFFECTS OF VARYING AQUATIC VEGETATION ON YELLOW BULLHEAD (AMEIURUS NATALIS) POPULATIONS IN THE ILLINOIS AND MISSISSIPPI RIVERS
Anthony Sample[1] and Samuel Schaick[1].
[1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois

13) THE RECENT INVASION OF FLOWERING RUSH (BUTOMUS UMBELLATUS L.) ON THE UPPER MISSISSIPPI RIVER TRIGGERS MANAGEMENT ACTION & MONITORING

Stephanie Szura[1], Jennifer Froehly[2], Alicia Carhart[1], Eric Lund[3], and Danelle Larson[4].
[1]Wisconsin Department of Natural Resources, [2]U.S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge, [3]Minnesota Department of Natural Resources, [4]U.S. Geological Survey, Upper Midwest Environmental Sciences Center.

14) UPPER MISSISSIPPI RIVER FLOODPLAIN FOREST RESPONSE TO TWO LARGE-SCALE FLOOD EVENTS

Shelby A. Weiss[1], Lyle J. Guyon[1], Nathan R. DeJager[2], and Robert J. Cosgriff[3].
[1]National Great Rivers Research and Education Center, [2]USGS Upper Midwest Environmental Sciences Center, [3]U.S. Army Corps of Engineers.

15) HOT-SPOT WATER QUALITY ANALYSIS IN SILVER CREEK

***Samantha Exner**[1]
[1]Augustana College.

Poster Session II
Thursday, 20 April 2023
Radisson Center Foyer

Poster set-up 12:30 to 3:30 PM
Authors present at posters 5:00 to 6:30 PM
(*Student presenters)

1) MACROINVERTEBRATE ABUNDANCE AND COMPOSITION ACROSS TWENTY-SIX SIDE CHANNELS OF THE UPPER MISSISSIPPI RIVER
***Cheyana Bassham[1]**, Kristen L. Bouska[2], Molly Sobotka[3], and Ross Vander Vorste[1].
[1]University of Wisconsin La Crosse, River Studies Center, [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, [3]Missouri Department of Conservation, Big Rivers Field Station.

2) ASSESSMENT AND COMMUNITY COMPARISON OF ROLLINGSTONE PONDS
***Grace Ducosin[1]** and Abbie Perlinger[1].
[1]Winona State University

3) TEMPORAL AND SPATIAL PATTERNS OF AQUATIC INSECT EMERGENCE IN POOL 8 OF THE UPPER MISSISSIPPI RIVER
***Samuel Flaig[1],** *Aaron Murphy[1], and Ross Vander-Vorste[1].
[1]University of Wisconsin-La Crosse.

4) THE USAGE OF MACROINVERTEBRATES IN DETERMINING COMMUNITY INTEGRITY IN SILVER CREEK
***Jaaliyah Heard[1]**, Portia Carrera[1], and Tamara Day[1].
[1]Augustana College Aquatic Biology Division

5) ASSESSING THE IMPORTANCE OF MACROINVERTEBRATES AS BIOINDICATORS FOR FRESHWATER AND TERRESTRIAL ENVIRONMENTS IN MISSISSIPPI RIVER WATERSHEDS
***Dylan J. Link[1]** and Adam R. Hoffman[1].
[1]Department of Natural and Applied Sciences, University of Dubuque.

6) EFFECTS OF INCREASING WATER TEMPERATURE ON GROWTH, SURVIVAL, AND LEAF DECOMPOSITION RATES IN FRESHWATER AMPHIPODS
***Kourtney Walter[1]**, *Tyler Hall[1], Cheyana Bassham[1], Brandon Thill[1], and Ross Vander Vorste[1].
[1]University of Wisconsin La Crosse.

7) THE IMPACT OF SHREDDERS ON LEAF DECOMPOSITION IN THE SILVER CREEK WATERSHED
***Charlie Zielinski[1]** and Kevin Geedey[1].
[1]Augustana College, Upper Mississippi Center.

8) BUMBLEBEE DIVERSITY AND ECOLOGY IN UPPER MIDWEST RESTORED PRAIRIES ALONG THE MISSISSIPPI RIVER
***Jessica M. Dix[1],** Joseph R. Wohlers[1], Braydin D. Preston[1], Eric T. Nie[1], Gerald L. Zuercher[1].
[1]Wolter Woods and Prairies, University of Dubuque.

9) RAPID COLONIZATION BY FRESHWATER MUSSELS IN A RESTORED RIVER REACH
*Daniel Kelner[1], Bernard Sietman[2], Mike Davis[2], **David Potter[1]**, Zebulin Secrist[2], Jillian Fedarick[2], Alexie Horner[2], Hunter Poffinbarger[2], and Zoe Schroeder[2].
[1]US Army Corps of Engineers, [2]Minnesota Department of Natural Resources Center for Aquatic Mollusk Programs.

10) COLLABORATIVE APPROACH TO LOCATE SPECTACLECASE MUSSEL IN THE UPPER MISSISSIPPI RIVER USING EDNA
Theresa Schreier[1], Stephen Spear[1], Dan Kelner[2], Joe Jordan[2], Tariq Tajjioui[1], Chris Merkes[1], Trevor Cyphers[2], Colin Moratz[2], Bernard Sietman[3], and Diane Waller[1].
[1]US Geological Survey, Upper Midwest Environmental Sciences Center, [2]US Army Corps of Engineers, [3]Minnesota Department of Natural Resources.

11) CHARACTERIZATION OF SPECTACLECASE HOST FISH, HIODON SPP., MOVEMENT PATTERNS IN THE ST. CROIX NATIONAL SCENIC RIVERWAY
Michelle Bartsch[1], Matthew Meulemans[1], Diane Waller[1], Bernard Sietman[2], Zeb Secrist[2], Joel Strias[3], Marian Shaffer[4]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, [2]Minnesota Department of Natural Resources, Center for Aquatic Mollusk Programs, [3]Minnesota Department of Natural Resources, [4]National Park Service, St. Croix National Scenic Riverway.

12) OCCURRENCE PATTERNS OF NON-GAME FISHES IN THE COON VALLEY WATERSHED
Emma B Coltman[1], David A Schumann[1], and Tracy V Joe[1].
[1]UW La Crosse Department of Biology

13) BEARISH ON BULLHEAD? AN ANALYSIS OF DECLINE IN AN ANTHROPOGENIC RIVER
Gweniviere Miller[1] and Sam Schaick[1].
[1]Illinois River Biological Station, Illinois Natural History Survey.

14) UNFORESEEN FORTUNE? AN INCREASE IN DIVING DUCKS IN THE ILLINOIS RIVER POST BIGHEADED CARP INVASION
M. J. Oubre[1], Jason A. DeBoer[1],and Joshua M. Osborn[2].
[1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign, [2]Forbes Biological Station, Illinois Natural History Survey, Prairie Research Institute.

15) HOW DO HIGH- AND LOW-RIVER STAGES AFFECT FISH CATCH RATES AND COMMUNITY COMPOSITION?
***McKensie Vaske**[1], Rory Schmidt[1], Jason DeBoer[1], Wes Bouska[2].
[1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, [2]U.S. Fish and Wildlife Service, La Crosse Fish and Wildlife Conservation Office.

UNLOCKING GENOMES FROM FORMALIN-FIXED FISH SPECIMENS COMPARING TWO DNA EXTRACTION TECHNIQUES

*Erin E. Brino[1], Todd W. Osmundson[1], David A. Schumann[1], Calvin Rezac[2], and Robbie Ellwanger[2].
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Natural history museum collections maintain physical records of worldwide biodiversity that can be instrumental in resolving phylogenetic relationships, identifying previously undescribed species, characterizing biodiversity and biogeographical patterns, and clarifying ecological relationships. Unfortunately, genetic inquiries for many collections have been hampered by tissue fixation techniques using formalin, which can fragment, cross-link, and modify DNA. The advent of high-throughput sequencing techniques involving targeted capture of specific genes provides the opportunity to sequence fragmented DNA at sufficient depth to identify base modifications. Meaning the information stored in DNA from formalin-preserved specimens can be unlocked with sufficient quality of recovered DNA from specimens and removed crosslinks. Recently-developed protocols have achieved some level of success for extraction of suitable DNA for invertebrates, reptiles, and amphibians, but limited attempts reported for fishes compared to the others. Two previously-published protocols for extracting DNA from formalin-fixed specimens were tested for three fish species by examining the total amount of DNA (ng/mL) and DNA fragment length (bp) obtained. DNA was extracted from gill tissue of eight Southern Brook Lamprey (Ichthyomyzon gagei) museum specimens, examining the effect of extraction method and number of years preserved. DNA was extracted from newly-fixed specimens for eight Slimy Sculpin (Cottus cognatus) and eight Brown Trout (Salmo trutta) individuals, targeting two tissue types: fin and muscle tissue; the effect of extraction protocol and tissue type were examined. The two protocols used a heated alkali treatment followed by a phenol:chloroform extraction, with or without a series of additional buffer washes at the beginning of the protocol. Extracted DNA quantity and quality (fragment length) were measured using fluorometric quantification and automated microfluidic electrophoresis, respectively. A two-factor ANOVA was used to determine the degree of association between DNA quantity, quality, species, extraction protocol, and tissue type for the Slimy Sculpin and Brown Trout. A one-factor ANCOVA was used to determine the degree of association between DNA quantity quality, and extraction protocol with age of preservation as a covariate for the Southern Brook Lamprey. Results of this study will help to unlock the wealth of information in museum ichthyological collections, enabling their increased use for studies of fish evolution, ecology, and conservation.

Key Words: Formalin, Fish, Genetics, Evolution, Genetics

50TH ANNIVERSARY: RIVER RESEARCH LAB - ILLINOIS RIVER BIOLOGICAL STATION & MRRC 1972-2022. 129 YEARS OF ONGOING RIVER RESEARCH

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In 2022, The Illinois River Biological Station/River Research Laboratory (IRBS/RRL) celebrated its 50th year of river research and monitoring and involvement with the MRRC. It is impossible, however, to tell the story without reaching much farther back to unlock the timeline and tell the story of river research at Havana, Illinois from the very beginning over 129 years ago. In July of 1972, Richard E. (Rip) Sparks joined INHS and was stationed at Havana. At his suggestion and fortitude, the River Research Laboratory was founded as a unit of the Havana Station and a number of grant-supported studies accompanied its establishment. The River Research Lab's reputation as a leader in river science and preeminent scientific institution was quickly recognized due to Sparks and his investigations on the toxicity of contaminants to bivalves and fishes in the Mississippi and Illinois River. IRBS, under the University of Illinois Prairie Research Institute and INHS is one of six stations of the Upper Mississippi River Restoration (UMRR) Program's Long Term Resource Monitoring element (LTRM) and although long-term monitoring on the Illinois and Mississippi rivers has expanded and remains the core of the field station's operation, over the years, researchers have conducted a variety of important targeted ecological research ranging from mussel fleeting studies, large river fish telemetry, sediment toxicity, fish genetics, fish and mussel, mussel/fish host interactions, zebra mussel veliger work, to zooplankton, vegetation, and macroinvertebrate studies. The staff of the Illinois River Biological Station have been very instrumental in the Mississippi River Research Consortium organization and its leadership on the Executive Board over the years. We pay tribute to the 50 years of people and the research that have made IRBS what it is today and look forward to the future of the IRBS and involvement with the MRRC.

Key Words: Illinois, River, Field Station, Aquatic Research, River Research, Havan, 50th Anniversary

22 YEARS OF AQUATIC PLANT SPATIOTEMPORAL DYNAMICS IN THE UPPER MISSISSIPPI RIVER

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Macrophyte (aquatic plant) recovery has occurred in rivers worldwide, but assemblage patterns and habitat requirements are generally not well understood. We examined patterns of species composition and macrophyte abundance in the Upper Mississippi River (UMR) spanning 22 years of monitoring and a period of vegetation recovery. Non-metric multidimensional scaling (NMDS) ordination revealed a gradient of macrophyte abundance and diversity for 25 species, which were associated with water velocity, depth, wind fetch, and water clarity. Three taxa of ecological and restoration interest (*Zizania aquatica, Vallisneria americana, and Sagittaria*

spp.) occupied different ecological niches. Trends of NMDS values showed Z. aquatica first co-occurred in shallow areas with *Sagittaria* spp. but then expanded into deeper, lotic habitats where V. americana often resided. Curve Fit regression analysis identified large areas of significant increases in relative abundance of V. americana and percent cover of Z. aquatica in several reaches of the UMR from 1998-2019. *Sagittaria* spp. were more spatiotemporally dynamic than the other taxa, which may indicate sensitivity to environmental gradients. Our analyses showed that these three ecologically important taxa are spatiotemporally dynamic but have somewhat predictable habitat associations, which can guide macrophyte management and restoration in the UMR and other large, floodplain rivers.

Key words: aquatic plant diversity, aquatic vegetation assemblage, ecological community dynamics, large floodplain river, long term data

A SURVEY OF SHORELINE LARGE WOOD IN UMR POOL 8; HOW'D IT GET THERE?

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Woody debris is recognized as an important habitat structure within riverine ecosystems, yet we know very little about its role in large floodplain rivers such as the Upper Mississippi River. Wood is known to play a key role in biogeochemical cycling within rivers while also providing critical habitat to a wide array of aquatic and terrestrial organisms. Despite its ecological importance, wood has historically been removed from culturally significant bodies of water, such as the Upper Mississippi River, for navigational and recreation purposes. Defining the ecological role of wood in large floodplain rivers is an important step towards developing better conservation, restoration, and management practices for the future. The objective of this study is to identify patterns in the distribution of shoreline large woody debris in the upper UMR Pool 8; where is wood located and how did it get there? A probability survey of 47 shoreline sites, 23 main channel and 24 side channels, was conducted for wood larger than one meter in length. In total, 125 pieces of large wood were surveyed, occurring at a rate of 3.52 pieces per 100m in the main channel and 1.83 pieces per 100m in the side channels. Findings suggest that there is significantly more ‘transported’ wood within the main channel, and particularly across sites with forested riparian areas ($F(1, 42) = 11.77$, $p < 0.01$). Within the main channel it appears that significant downstream transportation of wood is occurring, while side channels may rely heavily on local deposition of wood. Results from this study offer insight into the accumulation of wood in the UMR. We provide recommended direction for future work, along with potential management implications of our findings.

Key Words: Wood, ecosystem, transport, habitat

DISSOLVED ORGANIC CARBON DYNAMICS IN LAKES AND STREAMS IN NORTHERN WISCONSIN

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Dissolved organic carbon (DOC) is a naturally occurring form of carbon; however, various aspects of global climate change have resulted in an increase in anthropogenic DOC in freshwater systems. DOC has unique properties that often stain the water within the system to appear yellow, brown, or even red in some cases. This phenomenon is known as “browning,” and can impact many biological and chemical processes within freshwater systems. Here we focus on lakes and streams in the Northern Lakes and Forests region of the Wisconsin, which has unique color signatures of DOC, i.e. DOC concentrations are tightly linked to colored material in these northern ecosystems more so than in other regions. This study aimed to 1) determine DOC concentration and composition in these systems, 2) compare DOC dynamics between system types and each month sampled, and 3) determine if relationships exist between DOC and nutrient quantities and microbial community production. This study found that DOC ranged from 2.62 - 61.35 mg/L, with no significant differences in DOC concentrations between the system types or months sampled. However, DOC composition differed greatly between system type and months, with lakes having more autochthonous carbon (microbial derived) and streams having more allochthonous carbon (terrestrially derived) ($p < 0.001$, ANOVA). There were significant differences in DOC composition between lake and stream sites at the beginning of summer (May) compared to the end (September) of summer ($p = 0.001$, ANOVA). While there were no significant differences in chlorophyll production between the two system types, there was a clear temporal trend throughout the summer with chlorophyll being the highest in May. Heterotrophic bacterial secondary production was significantly higher in streams compared to lakes during the months of May ($p = 0.023$, ANOVA) and July ($p = 0.021$, ANOVA), but not in September. While this study captures a small snapshot of the Northern Lakes and Forests region, it lays the foundation for further research to be conducted to better understand DOC dynamics and browning as climate change persists.

Key words: dissolved organic carbon, nutrient cycling, microbial communities

PREDICTING PHALARIS ARUNDINACEA (REED CANARYGRASS) INVASION IN FOREST UNDERSTORIES OF NAVIGATION POOLS 3-13

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Reed canarygrass (*Phalaris arundinacea L.*) is one of the most common invaders of floodplains, wetlands, and lakes in North America. In the Upper Mississippi River floodplain, invasion by reed canarygrass in forest understories can inhibit forest regeneration when gaps in the overstory form. Knowledge of where reed canarygrass is likely to occur in the forest understories could help inform management actions to limit its spread or identify areas where forest regeneration may be inhibited by reed canarygrass following forest loss. We used species distribution modeling to predict the occurrence of reed canarygrass in forest understories across the Upper Mississippi River floodplain (~41,000 ha). Data from forest inventory study plots with reed canarygrass presence and absence were combined with 10 hypothesized environmental predictors of reed canarygrass invasion. We tested three approaches to better understand and incorporate the influence of spatial autocorrelation among our predictor variables including: random cross-validation, spatial cross-validation, and spatial

cross-validation with Euclidean distance fields. For each approach models were created using Bayesian additive regression trees, boosted trees, and random forest algorithms. We calculated variable importance and explored how each of the predictors used in our analysis related to predictions of reed canarygrass presence using accumulated local effects plots. Flood frequency, distance to contiguous floodplain, distance to forest edge, distance to invaded wet meadow, and forest cover class, were among the most important variables across the three algorithms. Generally, mean probability of reed canarygrass presence decreased with increasing flood depth, distance to contiguous floodplain, distance to invaded wet meadow, forest cover, and forest height, while relationships with other predictors were more variable. The ensemble of the three models (i.e., the average prediction) was used to map and summarize invasions across the landscape. The maps quantify the probability of occurrence of reed canarygrass, along with the agreement among models, in forest understories across the floodplain. The predicted proportion of forest understories invaded with reed canarygrass differed among navigation pools with Navigation Pools 5, 8, and 9 showing the greatest and Navigation Pools 3, 6, and 10 showing the least area invaded. The information generated by the species distribution model can be used to better understand the extent of invasion, prioritize restoration efforts, and develop further research.

Keywords: species distribution modeling, floodplain forest, invasion, reed canarygrass

CENTRARCHID RESPONSE TO HABITAT ENHANCEMENT IN POOL 12 BACKWATERS (MISSISSIPPI RIVER)

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Suitable overwintering habitat is a limiting factor for centrarchids in the Upper Mississippi River (UMR). Lock and dam construction in the 1930's greatly increased total aquatic area of the UMR and provided deep backwater areas favorable to centrarchid populations; however, sediment deposition in backwaters has reduced the quantity of deep water habitats. The U.S. Army Corps of Engineers' Upper Mississippi River Restoration Program initiated a Habitat Rehabilitation and Enhancement Project (HREP) project on Pool 12 of the UMR in 2013. Project objectives included the development of approximately 63 acres of suitable overwintering habitat on four backwater lakes found throughout Pool 12, where insufficient overwintering habitat was thought to limit centrarchid survival. Pool 12 HREP, pre-construction monitoring was initiated in 2006 to assess temporal changes in fish abundance, physical condition, and biomass. Four HREP project lakes and four control lakes were surveyed using Long Term Resource Monitoring Program (LTRM) fyke-netting procedures at five randomly selected sites in each lake. Dynamic rate response of Bluegill (Lepomis macrochirus) and Black Crappie (*Pomoxis nigromaculatus*) was indexed using mean length at age within HREP and control lakes. Continued monitoring pre- and post-project will document changes that occur to the fish community as habitat is improved.

Keywords: Habitat, Population Dynamics, Backwater, Fish

NATIVE PISCIVORES SHOW LOW OVERLAP WITH JUVENILE BIGHEADED CARP IN A LARGE FLOODPLAIN RIVER

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Bigheaded carps (Silver Carp Hypophthalmichthys molitrix and Bighead Carp H. nobilis) have been linked with substantial ecosystem changes in their invaded range over the past several decades. Although high densities of large, adult bigheaded carp pose clear threats to ecosystems and boaters, pulses of juvenile bigheaded carp may offer native predators a valuable source of prey. We examined two decades of co-occurrence records in the La Grange Reach of the Illinois River for bigheaded carp and four native piscivores (Black Crappie Pomoxis nigromaculatus, Largemouth Bass Micropterus salmoides, Shortnose Gar Lepisosteus platostomus, and White Bass Morone chrysops). We also examined co-occurrence of these native piscivores with native prey (Bluegill *Lepomis macrochirus*, Emerald Shiner *Notropis atherinoides*, and Gizzard Shad *Dorosoma cepedianum*). After explicitly accounting for prey size relative to piscivore size, native prey species tended to co-occur with native piscivores at rates several times higher than that of bigheaded carp. Additionally, native prey species were typically more likely to be available across sites and over a longer period of the growing season. Even when adult bigheaded carp reach exceptional densities, the rapid growth and clustered distribution of juvenile bigheaded carp appear to limit their benefit to native piscivores.

Keywords: Invasive species, carp, predation, co-occurrence, long-term monitoring

INVESTIGATIONS OF BLUEGILL AGE AND SIZE STRUCTURE DIFFERENCE FROM THREE DIFFERENT MISSISSIPPI RIVER OVERWINTERING SITES NEAR LA CROSSE, WISCONSIN

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Annual Wisconsin Department of Natural Resources late fall electrofishing within Mississippi River centrarchid overwintering sites indicated differences in size structure were occurring among backwater lakes used by bluegill for overwintering. It was unclear if the size structure difference was due to differences in age structure of populations, growth rates, harvest or environmental variables affecting survival. Our 2020 pilot study focused on collecting otoliths for aging from ten bluegill/half inch group/site in late fall from three different known Mississippi River overwintering sites of different habitat quality within a 2-mile section of the Mississippi River near La Crosse, WI. The number of bluegill otoliths aged from Pile Lake, Broken Arrow, and Bluff Slough were 126, 93, and 128, respectively. Mean length at age 2 for Pile and Broken (152 mm (6.0 inches) and 150 mm (5.9 inches), respectively) were not significantly different, but both were significantly greater than Bluff Slough mean length at age

2 (142 mm (5.6 inches)). Maximum age observed for backwaters was 5 for Bluff and Broken, and 4 for Pile. Von Bertlanffy growth curves for the three sites were calculated using aged and assigned aged fish. Pile had a fit issue, it never plateaued, probably because no age 5 fish were picked up. The other two lakes had overlapping 95% CIs for parameter estimates (length at infinity – i.e., mean maximum length and k – i.e., the rate that growth reaches the plateau). Broken had higher mean maximum length (9.4 inches) than Bluff (8.9 inches). K was slightly greater for Broken (0.37) than Bluff (0.31). Our pilot study indicates population age and size structure may be partially influenced by overwintering site characteristics. Pile Lake and Broken Arrow are smaller backwater lakes < 1.5 m deep with surrounding landmasses that begin to become inundated when river stage is 1.2 meters above flat pool. These characteristics can contribute to cyclical bluegill winterkills due to mortality from anoxic conditions or inundation during winters with high discharge. Bluff Slough is a much larger off-channel area with greater depth diversity and maximum depth (approx. 9 meters) with a surrounding landmass > 1.2 meters above flat pool, making it more resilient to a variety of winter river discharge events. Our observed differences in length at age 2 may be reflecting observations from other studies of centrarchid growth differences in winterkill vs. non-winterkill lakes, where growth is faster in winterkill lakes.

Keywords: Bluegill, overwintering, Mississippi River, otolith, habitat

SURFACE CONCENTRATIONS OF METHANE AND NITROUS OXIDE INCREASE WITH GREATER NITROGEN LOADS IN HYPEREUTROPHIC MESOCOSMS

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Greenhouse gas (GHG) production in freshwater systems can be an important source of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) to the atmosphere, potentially equaling 20% of fossil fuel emissions globally. Eutrophication and warmer water temperatures may increase production, particularly from CH_4. Similarly, high nitrogen (N) loading from fertilizer may increase N_2O emissions due to high rates of incomplete denitrification of nitrate. Estimates of emissions to date have mostly come from surveys of natural systems in northern latitudes, yet we lack sufficient data on how freshwater GHG production responds to variable nutrient loading scenarios. We estimated surface concentration of GHGs in 17,000 L eutrophic pond mesocosms representing an experimental nitrogen-to-phosphorus ratio (N:P) loading gradient. Nutrient loading gradient was achieved by maintaining consistently high and identical P loads across treatments, while increasing N loads to achieve varying mesocosm N:P and to better isolate the impacts of N variability. We observed 4x greater concentrations of N_2O from mesocosms representing high N treatments relative to low N mesocosms, with surface water N_2O concentrations much above what has been observed elsewhere from eutrophic lakes. We also observed 3x greater CH_4 surface concentrations in the high N treatment compared to low N. Mesocosms with the lowest productivity had the greatest CO_2 concentrations. Concentrations of GHGs remained high throughout the two-year time series, despite an experimental reduction in N loading in year 2 of the experiment. These results suggest N fertilization is likely to contribute to significant increases in GHG concentrations

and emissions from freshwater systems worldwide, and reductions in eutrophication at large scales may benefit both water quality and climate regulation in the long term.

Keywords: greenhouse gases, eutrophication, nitrogen, nutrients, mesocosms

BREEDING BIRDS IN UMR FLOODPLAIN FOREST: 20 YEARS OF CHANGE

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"Kirsch (2020) provided historic information on breeding bird abundance and species richness in UMR floodplain forest from random sample locations in Pools 4, 8 and 13 from 1994-1997. Habitat changes noted by Corps of Engineers foresters since these surveys include blow-downs, death of young trees not getting enough light, death of older trees due to age, Emerald Ash Borer invasion, or persistent local high water. A large cohort of Silver Maples are now also considered “over-mature” with large dead branches. Tree death and loss of very large branches of mature trees have resulted in canopy gaps. In the upper impounded reach, tree regeneration in opened canopy is threatened by invasion of reed canary grass (Phalaris arundinacia). There are also subtle changes occurring including canopy maturation and a reduction of grape lianas. Since the 1990s many generations of birds breeding in these forests have come and gone. We were interested in documenting any changes in abundance and bird species composition between the 1990s and the 2010s.
Breeding bird surveys in the 1990’s were 10 minutes long, recording all birds seen and heard within 50m, excluding flyovers with 1 observer per survey per site each year. In the 2010s the same data were recorded but with 2+ independent observers conducting a simultaneous survey, and with 3 surveys at each site per year. Three surveys each year necessitated a smaller number of sample sites per pool than in the 1990s, and this subset of sites was chosen randomly. We wrote R code to simulate 100 seasons of surveys for each year-pool combination from the recent data. For each simulated season we randomly chose a single survey from one observer from each site and calculated averages from each run. We then calculated means and standard deviations of counts and average frequency of occurrence for each species over the 100 runs. These were compared with the single estimates for each pool and year in the 1990s. In all 3 pools, total numbers of birds/survey have decreased and the number of species/survey declined but less so. Although annual frequency of occurrence varied in both time periods, American Redstart occurrence and abundance have decreased greatly. Some species changed in only one or 2 pools. For example, Baltimore Oriole occurrence increased in Pools 4 and 8, Prothonotary Warbler occurrence increased in Pool 13, and House Wren occurrence decreased in Pool 4.

Keywords: breeding birds, floodplain forest

INTEGRATING MACHINE LEARNING AND ECOSYSTEM STATE TRANSITION CONCEPTS: MODELING SUBMERSED PLANT VULNERABILITY AND RESTORATION POTENTIAL

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Ecosystem state transitions occur in many ecosystems and can be ecologically devastating or indicate restoration success. Many aquatic ecosystems worldwide recently experienced state transitions following submersed aquatic vegetation (SAV) loss or rebound, including the Upper Mississippi River in the past two decades. The restoration and conservation of ecosystems may be guided by multi-scale assessments of state resilience and early warnings of transitions. We developed a habitat suitability model for SAV in the Upper Mississippi River using 10 environmental predictors of SAV. The contribution of each predictor was calculated using an interpretation algorithm to gain insights on possible environmental drivers and threshold or linear response types. We created a conceptual framework that integrated the modelâ€™s predictions with ecosystem state concepts. This conceptual framework can be used to identify areas where SAV is vulnerable and where to implement restoration project strategically. The results are also available via an online dashboard where model outputs can be interactively explored at many spatial scales to guide future research and restoration planning. The SAV model had greater than 90% prediction accuracy using only four environmental predictors, and predictions were accurate across many riverine reaches and habitat types (e.g., side channels, backwater lakes) of the Upper Mississippi River. The SAV displayed â€˜threshold responses to each of the four environmental predictors, indicating plants in the river are sensitive to the environment and that restoration may aim to target these thresholds for restoring SAV.

Keywords: aquatic plants, aquatic vegetation, habitat suitability model, ecosystem state transitions, restoration potential

THE IDENTIFICATION OF A NEPHROBLASTOMA IN A COMMON MUDPUPPY IN THE UPPER MISSISSIPPI RIVER

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In March of 2017, a mudpuppy (*Necturus maculosus*) from the Iowa portion of the upper Mississippi River was submitted for diagnostic testing due to the presence of an enlarged abdomen. Histopathology revealed the presence of a nephroblastoma, the first such case reported from a mudpuppy. Inoculation of a newly created toad cell line (BufoTad) with fluid from this neoplasm produced a distinct cytopathic effect. Routine molecular testing did not identify any viruses. However, Next Generation Sequencing revealed the presence of a bacteria

in the genus Acholeplasma which was confirmed to be present in the tumor through immunohistochemistry. The finding supports the possibility that this bacteria could be oncogenic.

Keywords: Mudpuppy; Nephroblasoma; Acholeplasma; Tissue Cell Culture; Next Generation Sequencing

Using Satellite and Drone Imagery to Assess the Distribution of Coldwater Streams in the Iowa Driftless Region

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Coldwater streams are crucial habitats for Salmonidae and Cottidae species that are unable to tolerate warmer temperature and climate change is projected to alter their prevalent thermal characteristics. To manage coldwater streams, we must first know where they exist on the landscape. During winter, coldwater streams with cooler groundwater input remain free from ice cover whereas warm water streams become ice covered. Based on this empirical observation, this study combined field data with satellite and drone remote sensing to: (i) examine the potential of high-resolution winter imagery for detecting coldwater streams and (ii) assess the accuracy of existing maps of coldwater reaches and understand the physical factors that contribute to inaccuracies in detecting coldwater habitat. Results showed that highest quality coldwater streams were in upper reaches of the watershed and the downstream areas showed more variability in temperatures but were still open water in winter imagery. Iowa's existing coldwater streams list does not include many coldwater segments and should be updated. Winter panchromatic imagery is better suited than winter multispectral imagery since considerable coldwater stream stretches are < 5 m wide. Coldwater stretches ~ 2m wide are even difficult to detect and would require drone imagery. Drone imagery will likely be limited in spatial footprint and should be used for validation.

Keywords: coldwater streams, satellite remote sensing, trout streams, driftless Iowa, winter imagery, drone imagery

BROWN TROUT SPAWNING REDDS DURING HABITAT DEVELOPMENT IN A MINNESOTA TROUT STREAM: ABUNDANCE, COVER USE, AND CLUSTERING

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Abundance, placement beneath cover, and clustering of Brown Trout spawning redds were monitored throughout five spawning seasons (2016â€“2020) in a 4.8-km reach of a Minnesota coldwater stream to assess the potential impacts of concurrent stream habitat rehabilitation projects. We anticipated that redd abundance (redds/100 m stream segments) and placement beneath cover (e.g., logs and branches, boulders, overhanging bank vegetation, aquatic macrophytes) would increase and redd clustering (placement within 1.5 m of other redds) would decline as stream sections were rehabilitated. Repeated redd counts were conducted for the entire stream reach during each of five spawning seasons, and redd cover and clustering

were documented. Before-after comparison of impact (BACI) tests were used to compare redd abundances in control versus rehabilitated stream sections, and before-after distributional tests compared redd placement beneath cover and redd clustering within rehabilitated sections. In total, 1,895 Brown Trout spawning redds were documented within the study reach during the five spawning seasons combined. Redd abundance increased nearly five-fold throughout the 5-year study period (from 3.5 to 15.5 redds/100 m), but no significant difference was detected in redd abundances between rehabilitated versus control stream sections. Redd placement beneath cover (63% beneath cover in total) also increased throughout the study, but at a rate nine to 45 X greater in stream sections rehabilitated during the study than in control or previously rehabilitated sections. Redd clustering remained unchanged (5-year means = 45â€“71% of all redds clustered) in rehabilitated, control, and previously rehabilitated sections. Stream habitat rehabilitation did not increase spawning redd abundance or reduce redd clustering in rehabilitated stream sections, but redd placement beneath cover increased after rehabilitation to levels present in other stream sections.

Keywords: brown trout, spawning redds, stream habitat development

CHARACTERIZATION OF MICROPLASTIC POLLUTION IN THREE FISH SPECIES FROM POOLS FOUR AND EIGHT OF THE UPPER MISSISSIPPI RIVER

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Microplastic pollution has been discovered in a variety of aquatic systems, including rivers, wetlands, lakes, and groundwater aquifers. Microplastics can cause a variety of negative health effects in the organisms that consume them, from changes in feeding habits to increased exposure to toxicants. Little is known about the ingestion of microplastics by fish in the Mississippi River. In this project, microplastic pollution was assessed in three fish species collected in 2019 from Pools 4 and 8 of the Upper Mississippi River. Digestive tracts of Emerald Shiners (Notropis atherinoides) (n=89), Yellow Perch (Perca flavescens) (n=97), and Shorthead Redhorse (Moxostoma macrolepidotum) (n=95) were removed for microplastic analysis. Tissue and contents were digested, density separated and filtered for enumeration. Microplastics were counted and identified, and subsamples were verified via Raman Spectroscopy at UW-Eau Claire. In total, 891 microplastic particles were found among the 281 fish individuals and ranged from 0-22 particles per fish. Within each species, there were no significant differences in microplastic content when comparing fish from pool 4 versus pool 8 (p>0.05). In addition, habitat strata (e.g., backwater, main-channel, side-channel, etc.) did not have a significant effect on microplastic content (p>0.05). Microplastic content of fish decreased as fish length (mm) increased (p<0.05). In addition, smaller fish tended to contain proportionately more microplastics than larger fish (microplastics per mm fish length) (p<0.05). Between the three species, Emerald Shiner contained significantly more microplastics per mm fish length than both Yellow Perch and Shorthead Redhorse (p<0.05). The most prevalent type of microplastic found across species was fibers. Common colors included blue, black, red and clear. Within the size range of microplastics collected (250µm-5mm), across all species microplastic particle prevalence decreased as size of particle increased. Raman verification was conducted on 115 randomly selected particles and revealed the most common microplastic polymers as rubber, polyester (PES), and acrylonitrile

butadiene styrene (ABS). This research confirms microplastic ingestion by UMR fish and identifies a need for microplastic monitoring and reducing plastic pollution.

Keywords: Microplastics, Upper Mississippi River, Pollution

ZOOPLANKTON PRODUCTION IN A RESTORED ILLINOIS RIVER BACKWATER AND ITS CONTRIBUTION TO MAINSTEM RIVER ZOOPLANKTON

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Zooplankton are an important basal resource for aquatic food webs. Diversity and abundance of plankton communities in the Illinois River have declined following the introduction of invasive silver and bighead carps in the 1990's. Through size selected feeding and direct competition, the river community is dominantly made up of smaller bodied rotifers and has fewer species of larger cladocerans and copepods. The Emiquon Nature Preserve is a restored backwater lake connected to the La Grange reach of the Illinois River through a water control structure (WCS). The Emiquon Preserve has a rich and dense community of zooplankton, including large bodied cladocerans and copepods most impacted by invasive carps. The WCS is used for water level management to compact sediments, increase moist soil plant production, and improve waterfowl habitat. When discharged into the adjacent Illinois River, the plankton-rich waters of Emiquon have the potential to benefit the depleted riverine plankton communities. To assess this potential benefit, zooplankton samples were collected before and during a water release event in June 2021. Samples were taken from the Emiquon Preserve and from the Illinois Rivers stretching from 0.5 km above the outflow to 42 km downstream. Preliminary analysis shows that abundance increased in the river adjacent to the WCS outflow during drawdown, along with an increase in species richness of cladocerans and copepods.

Keywords: Zooplankton, wetland restoration, natural experiment

BEHAVIORAL RESPONSES OF COMMON CARP (CYPRINUS CARPIO) TO A CARBON DIOXIDE DETERRENT IN A NAVIGATIONAL LOCK

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Management programs often seek to limit further range expansion of invasive fishes into new areas by reducing their risk of passage at critical control points or pinch-points on rivers and waterways. Locks and dams are locations where non-physical deterrents can be used to reduce unwanted fish passage without disrupting human use. Carbon dioxide (CO2) was recently registered in the United States as a deterrent to invasive carp movement. As part of a study to test a large-scale CO2 delivery system within a navigation lock (Fox River, WI), we

characterized the influence of elevated CO2 and forced water circulation in the lock chamber on movements and behavior of common carp (*Cyprinus carpio*). We tracked fish movement with acoustic telemetry and then used hidden Markov modelling (HMMs) to analyze variation in fish responses to treatments. Through time-to-event analyses, we described the responses of acoustic-tagged carp to experimental treatments including (1) CO2 injection in water with forced circulation, (3) forced circulation without CO2 and (3) no forced circulation or CO2. We then used HMMs to define fine-scale carp movement and evaluate the relationship between carp behavioral states and CO2 concentration, forced circulation, and temperature. Our findings illustrate the efficacy of CO2 injection with forced circulation at a navigation lock and the potential of forced water circulation, alone, as a non-physical deterrent to carp movement through the lock. Additionally, our results demonstrate how acoustic telemetry and HMMs in an experimental context can describe fish behavior and may inform management strategies along the Mississippi River.

Keywords: invasive species, hidden Markov models, fish ecology, acoustic telemetry, control

NUTRIENT DEPOSITION AND PROCESSING WITH THE DOGTOOTH BEND FLOODPLAIN ALONG THE LOWER MOST UPPER MISSISSIPPI RIVER

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A recent breach of the Len Small Levee at the Dogtooth Bend of the Mississippi River provides a unique opportunity to assess the impacts increased river-floodplain connectivity can have on the services floodplains provide to society. In this study, hydraulic models of the pre- and post- levee breach condition were constructed to assess changes in river-floodplain connectivity and its impact on nutrient storage and processing. To assess the amount of sediment and particulate nutrients deposited after the levee breach we undertook a geomorphic change assessment analysis using pre- and post- levee breach DEMs and sampling of river deposited sediments for TN, TOC, and TP to quantify both sediment and nutrient deposition. Sediment cores were collected from across the reconnected area and incubated in the lab with Mississippi River water to assess their denitrification potential. Denitrification was measured as N2 gas production using membrane inlet mass spectrometry. NO3 and other nutrients were analyzed from incubation and site waters to gain insights into the geochemical factors impacting denitrification. The microbiological contribution to floodplain denitrification was assessed by measuring microbial community structure using next generation sequencing of the 16S rRNA gene and PCR amplification to test for the presence of the nitrate, nitrite, nitric, and nitrous oxide reductase genes.

Differencing of high resolution DEMs from pre- and post- levee-breach conditions showed net deposition of ~24 million tons of sediment across the reconnected floodplain. Estimation of associated nutrient deposition for TOC, TN, and TP were 112,000, 8,100, and 6,200 tons, respectively. When compared to pre-breach conditions, inundation extents for floods ≤50% annual exceedance

probability decreased under the post-reconnection condition due to infilling of wetlands with sediment. Site averaged denitrification rates ranged from 4 up to 330 N mg/m2/day seasonally. Denitrification rates were the highest during the summer and at sites with an intermediate frequency of inundation. Microorganisms with both typical and atypical nitrous oxide reductase genes were detected across the study sites with wetter sites having different operational taxonomic units than drier sites.

The results from this study show the reconnected floodplain is a substantial sink for sediments and nutrients. Floodplain wetlands can potentially process substantial amounts of NO3. Increased sedimentation associated with the river-floodplain reconnection has reduced the inundation frequency for small floods and potentially reduced denitrification across substantial portions of the floodplain. These findings illustrate the challenges and tradeoffs in managing the services large river floodplains provide society.

Keywords: RIVER-FLOODPLAIN CONNECTIVITY, NURTIRENT DEPOSTION, NUTRIENT PROCESSING

ATTRIBUTES OF UPPER MISSISSIPPI RIVER SYSTEM CONTIGUOUS FOREST AREAS

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Floodplain forests are important features of river systems as they create habitat for a variety of wildlife species as well as influence water quality by sequestering nutrients. The ecological conditions found within forested areas can vary greatly from place to place, contributing to spatial variability in species diversity, animal use of the floodplain, and other ecological functions. For this reason, it is important for managers and researchers to identify and map existing forest conditions for use in restoration practices or research studies. To support floodplain forest research and management actions on the Upper Mississippi River System, we identified contiguous forested areas (i.e., areas of forest cover that were separated from each other by other land or water cover types) in the floodplain and then calculated a wide range of attributes that define basic ecosystem conditions within these forested areas. Attributes related to contiguous forest area size, shape, landscape position, community composition and physical structure were developed using 2020 land cover data (Upper Mississippi River Restoration, Long Term Resource Monitoring element) as the primary source and supplemented with spatial data describing floodplain inundation and historic land cover. For this study, contiguous forested areas and their associated metrics were developed for those pools that were currently available (navigation pools 4, 8, 13 and 26). The process follows similar methodologies previously employed to calculate metrics within aquatic areas mapped within the UMRS. The results for individual metrics were subsequently compared from pool to pool and instances of similarity and dissimilarity were identified and discussed. As the 2020 land cover for additional pools becomes available, the ability to compare the values of metrics across a broader area of the UMRS and better understand basic habitat and physical features of forests

in this system can occur. In addition, some metrics could be compared over time, both historically, and against future data collection efforts to examine change over time and space. This data set will provide researchers, managers, and stakeholders the ability to query the current forested landscape within the UMRS to identify forested areas meeting sets of conditions relevant for their species or ecological condition of concern. Additionally, researchers will be able to use this data set to test for associations between species distributions or other ecological conditions and different forest area attributes.

Keywords: Floodplain, Forest, Inundation, Land cover

SPATIAL AND TEMPORAL SHIFTS IN THE INUNDATION REGIME OF THE UPPER MISSISSIPPI RIVER FLOODPLAIN OVER 83 YEARS

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The hydrologic regime of the Upper Mississippi River (UMR) has become wetter, with greater discharges, seasonal shifts in peak flows, and high-flow conditions becoming more common and lasting longer in the past several decades. How these changes in discharge are expressed spatially as floodplain inundation frequency, depth, timing, and duration is not well understood. Here, we assessed changes in wetted area and floodplain inundation characteristics from 1940 – 2022 in Pools 3 – 10 using a geospatial model. All pools exhibited significant increases in the total floodplain area wetted over the period of analysis. The amount of increase varied by pool, ranging from 17% in Pool 6 to 97% in Pool 5. There was evidence of shifts in inundation characteristics across pools, but the direction and magnitude of change varied by pool and by metric. For example, total growing season duration, a metric commonly used to understand vegetation distributions in the UMRS, increased significantly in five of the nine pools analyzed. In pools where significant shifts were observed, total growing season durations were between 13 and 29 days longer in 2022 than in 1940, on average. Inundation characteristics also varied within pools, with some areas of the floodplain experiencing much greater shifts in flooding conditions than other areas even if pool-wide summaries of those characteristics did not significantly vary over time. Areas of greatest change in any pool tended to be associated with low relative elevations, though the range of flood-sensitive elevations varied by pool. Our study demonstrates that changes in river discharge over 83 years may have manifested across the UMR floodplain in ways that may have consequences for ecological patterns and processes. By mapping hydrologically sensitive areas of the UMR floodplain, we can anticipate which areas may be more or less susceptible to additional shifts in river discharge in a climatically uncertain future.

Keywords: flooding, hydrology, inundation

DESICCATION-RESISTANT PHYTOPLANKTON, ZOOPLANKTON, AND MACROINVERTEBRATES: IMPLICATIONS FOR TRANSPORTING DREDGED SEDIMENTS FROM THE UPPER MISSISSIPPI RIVER.

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Many freshwater phytoplankton, zooplankton and macroinvertebrates have desiccation-resistant forms that could enable individuals to survive in humid or dry sediments. However, prevalence of desiccation-resistant taxa may not be ubiquitous across all freshwater systems and may depend on local conditions, such as duration of sediment drying. In the Upper Mississippi River (UMR), dredging of sediments is widely used to maintain river navigation corridors and sediments are often stockpiled until beneficial uses, such as beach nourishment and wetland habitat enhancement, are found. Transporting dredged sediments to different waterbodies poses the risk of spreading new and potentially invasive species with desiccation-resistant forms. In this experiment, we assessed viability of aquatic organisms in dredged sediments from four stockpiles along the UMR. We artificially re-inundated sediments that had been dry for less than 1, 1–5, and 5–10 years and sampled phytoplankton, zooplankton, and macroinvertebrates over four weeks. We hypothesized that taxonomic richness and density of these organisms would be negatively affected by duration of drying. We found sediments dried for less than 1 year had the greatest richness and density of phytoplankton, zooplankton, and macroinvertebrates compared to sediments dried for 1–5 or 5–10 years, however, we found relatively few desiccation-resistant taxa overall. A total of 9 phytoplankton, 2 zooplankton, and 9 macroinvertebrate taxa was found. Of the taxa that remained viable in dredged river sediments, we found no invasive species known to the Upper Midwest. These results suggest transporting sediments from the UMR to other waterbodies for beneficial uses could be a feasible option to consider. In comparison to freshwater systems that experience frequent drying, such as floodplains and intermittent rivers, the few taxa within previously dried sediments of the UMR's main channel suggests the prevalence of desiccation-resistant taxa is correlated with water permanence. Future studies quantifying desiccation resistance of aquatic organisms collected throughout floodplain habitats of the UMR with varying water permanence could inform predictions about where aquatic communities are more resistant to drying.

Keywords: aquatic organisms, sediments, river dredging, desiccation resistance, experiment

MAPPING POTENTIAL SENSITIVITY TO HYDROGEOMORPHIC CHANGE IN THE UMRS RIVERSCAPE

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Understanding processes and rates of hydrogeomorphic change within the Upper Mississippi River System (UMRS) related to navigation, climate change, tributary inputs, and watershed land use has motivated substantial monitoring and research and is an ongoing focus for guiding management decisions within the UMRS. This study investigated spatial patterns of hydrogeomorphic processes and change in navigation pool 10 of the UMRS by mapping and characterizing hydrogeomorphic units (HGUs, the building blocks of the valley bottom landscape) and catenas (HGUs linked by their association with sediment sources and flow origins). Because HGUs and catenas are formed and reworked by a specific set of processes, their identification and classification provide a basis for interpreting the origin of landforms, potential processes affecting them (erosional or depositional), and their sensitivity to and expected type of change.

We used automated techniques in a geographic information system (GIS) to map and classify HGUs and catenas, integrating information from systemic datasets including high-resolution, river-wide topobathymetric data; floodplain inundation maps; basin-wide quantitative models on tributary sediment loads; and maps of depositional planform change developed from land cover change analysis. Landforms were identified from the topobathymetric data with the geomorphon method, tailored for the large riverscape, valley bottom environment of the UMRS. We characterized the landforms' detailed morphometry, position within the channel/floodplain, inundation frequency and magnitude, proximity to anthropogenic structures, location relative to sediment sources, and depositional change history and applied multivariate clustering analysis to identify HGUs based on their form and hydrogeomorphic attributes. Mapped HGUs spanned the entire valley bottom, including channels and floodplains. Catenas were mapped based on least-cost path linkages between potential flow/sediment sources (the main channel, side channels, and tributary mouths) and depositional planform change units. We identified catenas associated with multiple types of hydrogeomorphic change including crevasse splays, tributary deltas, and side channel scroll/point bar deposition. These automated GIS analyses using data available system-wide were successful at identifying a range of HGUs, emphasizing those with potential for hydrogeomorphic change. The methods will be tested in additional settings along the UMRS for their applicability to ecological assessments and monitoring as well as habitat restoration plans.

Keywords: Geomorphology; Hydrogeomorphic units; Geomorphic change; GIS; Geospatial analysis

POSTER PRESENTATIONS ABSTRACTS
ALPHABETICAL LISTING BY PRESENTING AUTHOR
(*Student Presenter)

MACROINVERTEBRATE ABUNDANCE AND COMPOSITION ACROSS TWENTY-SIX SIDE CHANNELS OF THE UPPER MISSISSIPPI RIVER

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Side channels of the Upper Mississippi River System (UMRS) provide more sheltered and heterogenous habitat for organisms, such as macroinvertebrates, compared to the highly modified main channel. Although side channels support important ecological processes, few studies have explored differences among side channels and their biological communities. Our objective was to describe aquatic macroinvertebrate community composition within side channels (n = 26) of six pools (Pools 4, 8, 13, 26, Open River and La Grange) within the UMRS. We collected macroinvertebrates from 46 sites using rock baskets and Hester-Dendy samplers following a 30-day colonization period. We used a standardized 500-organism counting procedure to estimate total macroinvertebrate abundance and generally identified organisms to the genus level. We identified a total of 25,888 macroinvertebrates, representing an estimated total abundance of 103,792 organisms across samples. Preliminary results suggest variability in total abundance was high within and across side channels. Side channels in the Open River had the greatest variability in abundance (range = 77 â€“ 15,221 individuals) and mean total abundance varied significantly across all pools (mean = 2256.4 Â± 2861.2). Proportion of Ephemeroptera, Plecoptera, and Trichoptera (EPT%), also varied significantly across pools with the most common taxa being Stenonema (Heptageniidae), Tricorythodes (Leptohyphidae), and Hydropsyche (Hydropsychidae). Pool 13 had the greatest EPT% (49.9%), while Pool 4 had the lowest (11.8%). Further analyses could classify side channels of the UMRS using biotic community composition. Incorporating macroinvertebrate functional traits and side channel characteristics (e.g., connectivity to main channel) will allow us to test hypotheses about what influences biotic community composition and diversity at different spatial scales.

Keywords: Macroinvertebrates, Side channels, Mississippi River

CHARCOAL ANALYSIS OF A SEDIMENT CORE FROM MUD LAKE, WISCONSIN, A LAKE LOCATED IN THE UPPER MISSISSIPPI RIVER WATERSHED

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The Middle-Mississippian people settled in southern Wisconsin around A.D. 1050, near what is now Aztalan State Park. The site was occupied for two hundred years until it was abandoned around A.D. 1250, however little is known about why the Mississippian people chose to leave

the site. This project focuses on the history of this settlement area and how the abandonment of Aztalan enhances our current understanding of climate in Upper Mississippi River watershed. A sediment core was collected from Mud Lake in Jefferson County, Wisconsin (43.05°N, 88.92°W) in January 2014 for the purpose of developing a climate record for the Aztalan site (43.08°N, 88.86°W). A charcoal record is currently being developed from the sediment core to examine the links between climate, vegetation, fire, and anthropogenic activities in the region over the past 2,000 years. Different types of material burned during a fire produce different forms of charcoal and classification schemes exist to differentiate between forms. This information can provide insight as to whether they were climate-driven or human-derived fires. Charcoal is analyzed using standard methods, and dating of the sediment core combines radiocarbon and lead-210 dating techniques. Charcoal forms and the pre- and post-settlement of the Aztalan site will aid in differentiating between human and natural fires, and other geochemical analyses completed on the core will be presented to corroborate our interpretation. This will help us develop a better understanding of the role climate played in the abandonment of the Aztalan site.

Keywords: Paleoenvironments, Human environment interactions, Lake sediments

OCCURRENCE PATTERNS OF NON-GAME FISHES IN THE COON VALLEY WATERSHED

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The Coon Valley watershed supports numerous coldwater streams with well-known trout populations in the Driftless Area of southwestern Wisconsin. Numerous research efforts have documented the occurrence and habitat requirements of sportfish in the region, but less is known about the non-game fishes. To provide a new understanding of the ecology of these lesser-known fishes and inform potential management efforts, we conducted backpack electrofishing at four streams to: (1) identify the occurrence patterns of Slimy Sculpin (Cottus cognatus), Western Blacknose Dace (Rhinichthys obtusus), and White Sucker (Catastomus commersonii); (2) compared the catch-rates and size structures of each species amongst four sampled streams; and (3) quantified the relationship between relative abundances and common stream characteristics. Electrofishing occurred at six 100-m sampling sites in four separate streams (N = 24): berge, hohlfeld, rullands, and spring coulees. All captured fish were identified, counted, and measured to total length (mm) before release. Water chemistry, instream characteristics, and riparian conditions were measured at 11 transects at each site. A Kruskal-Wallis test was used to compare relative abundances of each species among streams. Although mean catch-rates of Slimy Sculpin (range: 0 - 168 fish per hour) and White Sucker (range: 0 - 260 fish per hour) varied among the streams, there was no statistical difference among streams for either species (Slimy Sculpin: $F = 2.9$, $df = 3$, $p = 0.06$; White Sucker: $F = 4.9$, $df = 3$, $p = 0.18$). Western Blacknose Dace were only caught in Hohlfeld Coulee (mean = 5.10 ± 3.57 fish per hour). Further analyses will describe the relationships between fish catch-rates and environmental covariates. This research provides additional ecological insight into these lesser-known species.

Keywords: Occurrence of non-game fishes populations

REAL-TIME REMOTE MONITORING OF WATER LEVELS AND MICROCLIMATE VARIABLES - THE IMPACT OF RAINFALL IN AN URBAN WETLAND

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Gaging stations are used to provide real-time data on the level and flow in major waterways. However, these sophisticated systems are not applied to monitor wetlands and backwaters. Rather, aerial imagery and remote sensing techniques are used as ex post facto ways to establish and track water levels in these systems. To increase our understanding of inland-wetland hydrology in the Upper Mississippi River Basin, we monitored water levels and microclimate variables in an urban wetland located in East Moline, Illinois. Solar powered water level stations (OnSet Computer Corp.) were used to monitor an aquatic system that consists of an inlet stream, a manmade lake, and a wetland during rain events to decipher the movement of water. The three sensor stations were equipped to measure air pressure, water pressure, barometric pressure, and water temperature. The team also outfitted the lake station to measure atmospheric variables, including air temperature, relative humidity, dew point, photosynthetic active radiation, and rainfall. These systems accumulated continuous data every 20 minutes without having to be physically on-site. Monitoring began at the inlet and lake in March 2020 and at the wetland/outlet in Fall 2020. We utilized the Rstudio statistical software for the analysis of the water levels during rainfall events. We found a common trend among major rainfall events in the wetland system at all three sensor sites. Each rainfall event generated four main slopes of water levels over time. These slopes showed a correlated relationship with the amount of rainfall, storm duration, and accumulated drainage. These findings give insight to the mechanics of a naturally functioning wetland system. Monitoring at this site continues in an effort to broaden the accumulation and use of these data to learn more about off-channel flash flooding, correlations with climate change, prediction modeling, as well as an opportunity to compare these mechanics to larger-scale wetlands.

Keywords: Water Levels, Remote Monitoring, Wetland, Rainfall, Hydrology

BUMBLEBEE DIVERSITY AND ECOLOGY IN UPPER MIDWEST RESTORED PRAIRIES ALONG THE MISSISSIPPI RIVER

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In 2017, the rusty-patched bumblebee (Bombus affinis) was listed as Federally Endangered under the Endangered Species Act. The American bumblebee (B. pennsylvanicus) has been petitioned for inclusion and is currently under review. Interest in bumblebee ecology has increased in recent years with numerous surveys occurring throughout the historic range. In 2021, B. affinis was detected (n = 12) on several restored prairies along the Mississippi River at the University of Dubuque's Wolter Woods and Prairies (WWP). The purpose of this project

was to continue an effort to annually survey for bumblebees at WWP for the purposes of monitoring diversity, evaluating prairie wildflower associations, and detecting threatened or endangered species. Surveys were conducted across four restored prairies at WWP during June, July, and August. Ten 100-m transects were sampled, in random order, for bumblebees. Using the capture and release method, bumblebees were captured using butterfly nets, processed, and released in the same location. In addition to a photograph and species identification, the species of associated wildflower, exact location, date, and time were recorded each captured bumblebee. We successfully detected eight species during 2022 with the four most common being the common eastern (B. impatiens; 42%), brown-belted (B. griseocollis; 22%), half-black (B. vagans; 14%), and black-and-gold (B. auricomus; 10%). These four species were detected in all four prairies. The American bumblebee was detected for the first during 2022 and represented 4% of total detections. Although bumblebees were associated with 28 wildflower species during 2022, only two species were yielded associations: wild bergamot (Monarda fistulosa; 30% of all bumblebee associations) and wild senna (Senna hebecarpa; 27%). Common eastern bumblebees were detected mostly on wild senna (50%), wild bergamot (31%), and partridge pea (Chamaecrista fasciculata; 14%). Brown-belted were detected mostly on wild senna (37%) and wild bergamot (35%). Half-black were detected mostly on wild bergamot (37%) and foxglove beardtongue (Penstemon digitalis; 21%). Black-and-gold were detected on wild senna, wild bergamot, and pale purple coneflower (Echinacea pallida) at 16% each. Our results emphasize the importance of annual monitoring for bumblebees. Although we did not detect rusty-patched bumblebees in 2002, we did detect American bumblebees which represent a new species for the property. Also, bumblebee abundance and diversity were less in 2022 than in 2021. This further emphasizes the importance of continued monitoring to document year-to-year variation patterns.

Keywords: bumblebees, diversity, midwest, prairies, wildflowers

ASSESSMENT AND COMMUNITY COMPARISON OF ROLLINGSTONE PONDS

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Two small ponds in Rollingstone, MN, used to support local fishing and have the potential to be an educational resource for an adjacent school, but years of urban runoff have filled in the ponds and resulted in their deterioration. To assess their current status, depth measurements were conducted to determine pond morphometry and develop bathymetric maps for each pond, and zooplankton, aquatic invertebrates, fish, and tadpoles were collected via water samples and overnight minnow traps to assess biotic communities within each pond. Both ponds were very shallow (maximum depth = 58 cm), but green frog tadpoles were collected in each pond, and brook stickleback were collected in the larger pond. The larger pond held 11 taxa of aquatic invertebrates (e.g., bladder snails, leeches, and scuds) and 5 taxa of zooplankton (e.g., Ceriodaphnia species and Cyclops bicuspidatus), whereas there were 7 different invertebrate taxa (e.g., bladder snails and leeches) and 6 zooplankton taxa (e.g., Cyclops bicuspidatus and Brachionus) in the smaller pond. Although both ponds held many of the same taxa, community diversities were very different between ponds, and community similarity comparisons indicated the presence of significant differences. Overall, the ponds can provide a good outdoor classroom experience for the local school.

Keywords: Pond, Invertebrates, Zooplankton, Communities, Diversity

HOT-SPOT WATER QUALITY ANALYSIS IN SILVER CREEK

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Urban stream conditions are often degraded by human activities, urbanization, and land use. Given the complexity of the variables that affect water quality and overall stream health, it can be difficult to isolate specific sources of pollution. Previous studies have shown that some Davenport, Iowa streams are considered impaired due to excessive Escherichia Coli and fecal coliform content (EPA 2022). Silver Creek, a tributary of Duck Creek, which in turn empties into the Mississippi River, is no exception. The purpose of this research was to identify hotspots (locations of low water quality) that might serve as easy to assess indicators of pollution sources. We approached this objective via fine spatial scale sampling on Silver Creek. Sampling of Silver Creek was done between October 11th and October 31st, 2022. Water samples were collected along pre-selected points at each site, and temperature, pH, specific conductance, total dissolved solids, and dissolved oxygen were measured at the same intervals. Water samples were tested for E. coli and fecal coliform levels. Biochemical oxygen demand (BOD) of each sample was also measured. One identified hotspot was a small tributary in a suburban neighborhood. Another potential source of pollution was a stretch that runs downstream of a trailer park, with some agricultural land use to the north and west. At the suburban tributary, increases in BOD, nitrate, and E. coli are noted. All three of these variables increased most significantly just downstream of where the tributary meets the stream. This data is consistent with a potential sewage leak. At the other site, increased levels of E. coli, BOD, and phosphate indicate further evidence of pollution entering the stream, though we did not find an obvious pipe to associate this with. Recommendations to improve the impaired stream include overall water quality management, stormwater management, and sewer management. With further analysis and continued research in Silver Creek, education and outreach should be conducted with residents to help increase the understanding and awareness to help improve the overall quality of Silver Creek.

Keywords: Pollution, Iowa, Water Quality

TEMPORAL AND SPATIAL PATTERNS OF AQUATIC INSECT EMERGENCE IN POOL 8 OF THE UPPER MISSISSIPPI RIVER

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Aquatic insects are a diverse group of organisms that are essential components to aquatic and terrestrial food webs. Aquatic insects transition from their aquatic larval forms to their terrestrial adult forms in mass, a process that is referred to as emergence. Recent evidence suggests that emergence of some aquatic insect populations, such as mayflies, is in decline.

Emergence events can be highly variable over a given temporal (time) and spatial (area) scale. Gaining knowledge about temporal variability of emergence events may prove valuable to furthering understanding food web interactions and improving logistical practices of surrounding human communities where mass emergence events occur. Understanding spatial variability may help identify what habitat areas promote emergence thus informing protection and restoration efforts. In this study, we collected aquatic insects over four time periods at 27 locations in Pool 8 of the Upper Mississippi River during summer 2022. Insects were collected using sticky traps comprised of four petri dishes coated with insect glue. Insects from the orders Ephemeroptera, Plecoptera, Trichoptera, and Odonata were counted and identified to the family level. Preliminary results suggest that the highest emergence of Ephemeroptera was seen in early July, and consisted primarily of Ephemeridae (Hexagenia). Plecoptera occurred in low abundances in the study area. Trichoptera, mainly Hydropsychidae and Leptpceridae were the most abundant and diverse order collected. Odonata consisted primarily of Coenagrionidae and were present throughout the study period and were widespread across sites. Overall, we did not observe strong temporal or spatial patterns in insect emergence, however, further sample processing that includes samples from more sites could help uncover patterns.

Keywords: Aquatic, Insect, Emergence, Temporal, Spatial.

THE USAGE OF MACROINVERTEBRATES IN DETERMINING COMMUNITY INTEGRITY IN SILVER CREEK

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Silver Creek is located in Davenport Iowa and is a small tributary of Duck Creek that flows into the Mississippi river. This stream is surrounded by both urbanized land and cropland and is used by the community for swimming, fishing, and is a great location for parks and recreational areas. As part of Augustana's ongoing work with the City of Davenport, we assessed the health of Silver Creek. Macroinvertebrates are widely used to study stream health, as they vary in tolerance of pollution, and so can be used as an index for community health. For this study, data was collected from six different sites along Silver Creek. The sites included the confluence of Silver and Duck. Five of the sites were on the main stem of silver creek distributed from the confluence with Duck Creek up through the headwaters. One site was a major agricultural tributary of Silver Creek. The sites were sampled by distributing 15 dip net samples among available habitats in proportion to those habitat's abundance. All collected organisms were identified to the family level. A total of 121 invertebrates from 6 total habitats in the sites along Silver Creek were collected. Important factors that determine the health of these sites are EPT's (Ephemeroptera, Plecoptera, and Trichoptera), Family Biotic Index (FBI), and species richness. The healthiest sites had higher levels of EPT and Richness and lower levels of FBI (high FBI indicates high pollution tolerance). The site located on a major agricultural tributary showed lower invertebrate richness, no signs of EPT's, and a higher level of FBI indicating a decrease in health compared to the other sites. Our results are consistent with Silver Creek's impaired status, however the least impaired sites are at the beginning and end of the stream, which also have rocky substrate, while the most polluted areas are near the middle of the stream and have more mud or sand substrate. Findings

suggest that further research on the stream will create positive long term effects, as there will be a better understanding of how social and ecological variables affect one another. Having a broader understanding and educating individuals on how streams can affect them will help benefit stream health and society as a whole.

Keywords: Informative, Background information, research, resource

ATTITUDES AND PERCEPTIONS OF WATERSHED MANAGEMENT

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Natural resource management is reliant on many social factors prevalent within a community. Involving these social factors allows for natural resource managers to create more comprehensive management plans that are locally tailored to that specific community. This study works to better understand the perceptions and attitudes of residents towards local watershed management practices so that managers may use this information to create effective community engagement strategies. In this study, semi-structured interviews were conducted with farmers within the Hickory Creek Watershed. Interviews were recorded and transcribed, coded using grounded methods, and then categorized into themes. In addition, door-to-door surveys with residents who lived in suburban neighborhoods of the watershed were conducted. Findings from this study show that interviewed residents within the Hickory Creek watershed are concerned with six main themes: pointing fingers, risk averseness, lack of communication across communities, sense of place, regulation vs voluntary efforts, and erosion prevention. Surveyed residents were concerned with themes of aesthetics, sense of place, and lack of knowledge. Implications of this research include the display of a significant urban/rural divide within this community, which shows managers they must take a varied approach to community engagement. Inadequate communication across communities was consistent across both groups, so managers must develop strategies to clearly and frequently communicate about management practices. It is important to listen to diverse groups of community members in order to frame watershed management to the unique attitudes and perceptions within the Hickory Creek locale.

Keywords: Social factors, socio-environmental management, community efforts, community perceptions

ECOLOGICAL ASSESSMENT OF PROSPECT AND HERITAGE PONDS IN MOLINE, IL.

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Urban ponds play an important role in providing ecosystem services to local communities as habitat for wildlife, buffers against downstream pollution, and recreational activities for humans. However, they are often at risk of eutrophication, sedimentation, and other incoming pollutants, such as nutrients and fecal coliforms. Eutrophication is caused by excess nutrients, like nitrogen and phosphorus, which then make ponds carriers of harmful algal blooms (HABs), which alter pond ecosystems through oxygen depletion in lower strata. Excess

sedimentation can fill in water bodies, and carry pollutants such as heavy metals. Fecal Coliforms make ponds unsafe for human recreation through the possibility of pathogen exposure. For this assessment, Prospect Pond and Heritage Pond, both owned by the city of Moline, Illinois, were sampled in early July 2022 between 9am and 2pm to determine levels of N, P, fecal coliforms, and E. coli. Prospect Pond has a surface area of about 0.60Ha, and Heritage Pond is 4.45Ha. A Secchi Disk and a light meter were used to determine the light extinction coefficient in both ponds. Additional water quality measurements including temperature, dissolved oxygen, pH, specific conductivity, total dissolved solids were taken in a grid pattern, where roughly 1 grid square equals 12m by 12m long, at each pond. Prospect Pond had about 70 grid squares, while Heritage Pond had about 420 grid squares. ArcGIS Pro was used to create water quality data maps through Kernal interpolation to uncover the locations of incoming pollutants. Samples of algae populations were also collected and identified from both ponds in order to determine the species composition and potential harm to human health. Both ponds were found to be extremely eutrophic, based on light extinction data and water quality measurements like dissolved oxygen. They also contained levels of E. Coli beyond recreational standards, which suggest a high likelihood of nutrient runoff and sewage entering the system. The maps produced from the water quality data suggested some spatial trends regarding algal populations, but the locations of incoming pollutants such as nitrogen, phosphorus, and E. Coli proved difficult to determine (outside of sediments). Both ponds were found to have high levels of blue-green algae, which have the potential to produce toxins harmful to human health. Given our results, a reduction strategy for nutrients and sedimentation was recommended, although further study regarding the sources of pollutants is needed.

Keywords: Ponds, nutrient pollution, algae, eutrophication

HISTORICAL FLOODPLAIN SEDIMENT MAPPING ALONG PLUM CREEK IN SOUTHWEST WISCONSIN

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Rivers in southwestern Wisconsin function differently today than before European-American settlers began to alter the landscape nearly 170 years ago. As the loess-covered high-relief landscape was converted from prairie and deciduous forest to agriculture land use, increased runoff eroded the fertile topsoil. Plum Creek, located in the lower Kickapoo River watershed, exemplifies the downstream effects of this process. Its floodplain aggraded as sediment deposited during overbank floods buried the organic-rich floodplain soil. This largely disconnected Plum Creek from its floodplain and increased the downstream movement of floodwaters. In 2022, the Mississippi Valley Conservancy purchased land along lower Plum Creek and is interested in restoring floodplain connectivity to enhance floodwater storage capacity and habitat diversity. The objectives of this research project are to 1) collect high-resolution aerial imagery to document baseline conditions prior to restoration activities and 2) estimate the depth of post-settlement sedimentation in lower Plum Creek. A Mavic 2 Pro unmanned aerial vehicle (UAV) was flown over the 1 km2 river corridor and 2,640 images were processed in conjunction with 19 ground control points using Pix4D Mapper to create a

2.5 cm resolution orthophoto and a 3D point cloud with 2 cm spatial accuracy. To determine the amount of post-settlement aggradation, actively eroding banks along Plum Creek were cleared and the depth to the buried pre-settlement organic soil was measured where present. Upstream of the Plum Creek Conservation Area, the organic soil was identified under approximately 1 m of alluvium. However, no buried soil was discernible within much of the Conservation Area, suggesting the lower portion of Plum Creek experienced several meters of aggradation since the mid-19th century.

Keywords: Mapping, Remote Sensing, Restoration

ASSESSING THE IMPORTANCE OF MACROINVERTEBRATES AS BIOINDICATORS FOR FRESHWATER AND TERRESRRIAL ENVIRONMENTS IN MISSISSIPPI RIVER WATERSHEDS

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Bioindicators are a great resource when trying to determine the health of an ecosystem. Bioindicators can give advanced warning related to environmental problems such as chemical pollution, excess nutrients, and oxygen depletion. Many different species have been identified to be bioindicators, including select amphibians, some species of fish, and worms. One of the most critical set of bioindicator species for a freshwater environment are macroinvertebrates. Macroinvertebrates are small insects, crustaceans, and larvae that live at the bottom of water bodies and require clean, cool flowing water to survive. These invertebrates are so important as indicators of freshwater health that all fifty states recognize their presence as an official test of water quality in watersheds (Holt & Miller, 2010).
This study examined four sites chosen with respect to their separate and unique habitats, allowing for the examination of a broad range of land use impacts within the freshwater environments. At each site data was collected on macroinvertebrate species present, total numbers of each species present, and then grouped them based on pollutant tolerance. A special focus were placed the genera Ephemeroptera, Plecoptera, and Tricoptera (EPT). These macroinvertebrates were emphasized due to the fact that they are the most pollutant susceptible species and have their own index called the EPT index for quantifying water quality. Water samples were analyzed at multiple intervals at each site and overall averages were determined for temperature (19.4 +/- 2.92 ºC), chloride (277 +/- 46.71 mg/L), nitrate (2.4 +/- 0.93 mg/L), and nitrite (0). At each site a majority of the parameters fell within EPA guidelines and did not negatively impact the species present. However, a site adjacent to an agricultural field that has been left fallow for the last two years, had our highest nitrate value 4 mg/L, yet also surprisingly had the highest EPT index value (Maquoketa 0.77, Mississippi River 0.68, Swiss Valley 0.68, and Bee Branch 0). The spatial and temporal variation in chemical and biological water quality indicators allowed us to compare the sites with one another, and even more importantly has given us a baseline to monitor future land use impacts on the water quality of these Mississippi River tributaries.

Keywords: Macroinvertebrates; Water quality; Bioindicator species

ASSESSMENT OF THE HEALTH OF RIPARIAN ZONES IN THE SILVER CREEK WATERSHED

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Riparian zones are the interfaces between land and a body of water and they are crucial in understanding the integrity of an ecosystem. Riparian zones provide insight on the health of a watershed while acting as a biodiversity hotspot for species and provide many ecosystem services including erosion control, flood management, filtering sediment from runoff, nutrient cycling, and recreation. This leads to our research question of what is the overall health of the riparian zones across the Silver Creek watershed? Silver Creek in Davenport, Iowa is a tributary of Duck Creek which flows directly into the Mississippi River. Seven sites along Silver Creek were assessed for riparian zone health. These sites were located in urban, agricultural, and forested ecosystems.The first site was located at the confluence of Silver and Duck Creek and the remainder of the sites ran north along Silver Creek in ascending order. At these sites, tree diversity, herbaceous understory classifications, presence of invasives, land use, recruitment of riparian zone trees, and lateral connectivity were investigated. At each site point quarter and line point methods were used. The riparian zone was split between the right and left bank of the creek. Each side of the bank had three transects running perpendicular to the creek. Across three points on this transect, mature and sapling tree species and their diameters were measured. Additionally, the presence of invasives were assessed across these transects. Across these transects, herbaceous understory diversity and land use was recorded as well. A report card was used to determine if each site had good, moderate, or poor levels for the measured parameters. Riparian health, as assessed by our report card, was mixed. While invasive shrubs were at low density at most sites, tree diversity was relatively moderate. The recruitment of riparian zone trees was only moderate, in spite of the fact that most sites maintained a wide riparian buffer that was predominantly forested. Finally, at all sites, lateral conductivity was poor. This data indicates that there are ecological transitions occurring at many of these sites. Riparian zone species such as cottonwoods, willows, and maples, for example, are slowly being replaced by generalist species such as mulberries and hackberries. Improvements to these scores in a riparian zone could include invasive species removal, native species planting, cross-vanes to prevent erosion, and pollution clean-up initiatives.

Keywords: Riparian zone, Watershed Health, Silver Creek

BEARISH ON BULLHEAD? AN ANALYSIS OF DECLINE IN AN ANTHROPOGENIC RIVER

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Bullheads (Ameiurus spp.) across the Upper Mississippi River region (UMR) experienced substantial population decline over the last century. Yellow bullhead (A. natalis), brown bullhead (A. nebulosus), and black bullhead (A. melas) are historically important fishes for recreational and commercial harvest in the UMR. Over a 60-year period (1953-2012), the

commercial harvest of bullheads decreased from a high of 135,545 lbs in 1974 to 8,520 lbs in 2012. Currently, catch per unit effort of bullheads in the La Grange pool of the Illinois River is near-zero. Drivers of the decline in catch rate are largely unknown, given the lack of population-level studies on bullheads. Substantial alterations to hydrology, land use, and aquatic communities in the Illinois River watershed have occurred alongside changes in bullhead abundance. A series of lock-and-dams and levees were constructed in the early 20th century, sectioning the river into 8 pools and disconnecting much of the floodplain from the main stem. Changes in flows and floodplain connectivity are altering biotic communities throughout the Illinois River; increasing sedimentation and reducing aquatic vegetation, which is now scarce in most pools. Further, several invasive species have become established in the Illinois River, specifically grass carp (Ctenopharyngodon idella), common carp (Cyprinus carpio), silver carp (Hypophthalmichthys molotrix), and bighead carp (H. nobilis). We analyzed the relationship between bullhead relative abundance, invasive carps, aquatic vegetation, and abiotic variables by performing a principal components analysis with follow-up correlations. The results suggest a strong relationship between the decline in abundance of bullheads, rising water temperatures, declines in aquatic vegetation, ongoing sedimentation, and the establishment of invasive carps. Additional research is needed to assess spatial trends across the UMR, as bullhead abundance has recently increased or stabilized in upper pools of the Mississippi River.

Keywords: Bullheads, Anthropogenic Stressors, Asian Carp, Aquatic Vegetation, and Sedimentation

TEMPORAL AND SPATIAL PATTERNS OF AQUATIC INSECT EMERGENCE IN POOL 8 OF THE UPPER MISSISSIPPI RIVER

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Aquatic insects are a diverse group of organisms that are essential components to aquatic and terrestrial food webs. Aquatic insects transition from their aquatic larval forms to their terrestrial adult forms in mass, a process that is referred to as emergence. Recent evidence suggests that emergence of some aquatic insect populations, such as mayflies, is in decline. Emergence events can be highly variable over a given temporal (time) and spatial (area) scale. Gaining knowledge about temporal variability of emergence events may prove valuable to furthering understanding food web interactions and improving logistical practices of surrounding human communities where mass emergence events occur. Understanding spatial variability may help identify what habitat areas promote emergence thus informing protection and restoration efforts. In this study, we collected aquatic insects over three time periods at 27 locations in Pool 8 of the Upper Mississippi River during summer 2022. Insects were collected using sticky traps comprised of four petri dishes coated with insect glue. Insects from the orders Ephemeroptera, Plecoptera, Trichoptera, and Odonata were counted and identified to the family level. Preliminary results suggest that the highest emergence of Ephemeroptera was seen in early July and consisted primarily of Ephemeridae (*Hexagenia*). Plecoptera occurred in low abundances in the study area. Trichoptera, mainly Hydropsychidae and Leptpceridae, were the most abundant and diverse order collected. Odonata consisted primarily of Coenagrionidae and were present throughout the study period and were widespread across sites. Overall, we

did not observe strong temporal or spatial patterns in insect emergence, however, further sample processing that includes samples from more sites could help uncover patterns.

Keywords: Aquatic, Insects, Temporal, Spacial, Patterns

UNFORESEEN FORTUNE? AN INCREASE IN DIVING DUCKS IN THE ILLINOIS RIVER POST BIGHEADED CARP INVASION

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Invasive species are largely detrimental to native species but can sometimes have unforeseen and important benefits. Bigheaded carps (bighead carp Hypophthalmichthys nobilis and silver carp H. molitrix) are invasive in North American rivers, where they alter systems by mediating energy exchange and influencing aquatic ecosystem interactions. They also have the potential to affect animals like waterfowl, which bridge across aquatic-terrestrial ecosystems. Bigheaded carps can subsidize benthic productivity via the transfer of pelagic resources to the benthos through egestion. This carp-induced benthification can increase nutrient availability and cause shifts in macroinvertebrate community composition, increasing the biomass of Chironomidae spp., a preferred food source for some waterfowl. Three species of diving duck (lesser scaup Aythya affinis, canvasback A. valisineria, and ruddy duck Oxyura jamaicensis) were largely absent from the Peoria pool of the Illinois River during the early 2000s. However, their abundance in the pool has since increased concurrently with the rapidly increasing population of bigheaded carps. Moreover, the increase in diving duck use days is strongly correlated with silver carp biomass. The increase of diving ducks in the Peoria pool may be partially in response to changes associated with the bigheaded carpsâ€™ invasion such as primary-level increases in benthic detritus quality and quantity, or secondary-level differences in benthic macroinvertebrate communities associated with increased benthic nutrients. Further research is needed to translate carp-induced benthification in controlled settings to the dynamic nature of the Illinois River. Reducing this knowledge gap would give researchers, managers, and policymakers a more-complete understanding of aquatic-terrestrial ecosystem interactions in large rivers.

Keywords: Invasive, Carp, Waterfowl, Ecosystem Interactions

INFLUENCE OF SEDIMENT CHARACTERISTICS AND OXYGEN DEMAND ON WINTER HYPOXIA IN BACKWATER LAKES OF THE UPPER MISSISSIPPI RIVER

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Sediment oxygen demand (SOD), gross primary production, and ecosystem respiration are ecological processes affecting availability of dissolved oxygen (DO), a key feature of overwintering habitat. Sediment oxygen demand contributes heavily to the depletion of oxygen from the water column during ice-covered periods, potentially leading to hypoxic conditions in backwater systems. Thus, decreasing the amount of suitable overwintering habitat for riverine fish species in the Upper Mississippi River System (UMRS). Developing an understanding of the effect of SOD on habitat during the winter season is critical for management of the UMRS. Winter SOD rates are not well studied in the UMRS and can be costly to sample directly. This study focused on determining winter SOD rates across different winter habitat types within 12 backwater lakes in 3 pools of the UMRS. Additionally, sediment nutrient and physical characteristics were sampled and analyzed to identify sediment characteristics as potential drivers of winter SOD rates. Intact sediment cores were collected from backwater lakes of Pool 4, Pool 8, and Pool 13 of the UMRS in January and February 2022 and incubated in the laboratory to determine SOD rates. Measured SOD rates ranged from 0.04 – 0.44 g O2/m2/day at in situ temperatures, or 0.14 – 1.46 g O2/m2/day when corrected to 20°C. Results of this study did not show statistically significant relationships between SOD and sediment characteristics, however, DO concentrations were generally lower near the sediment-water-interface than near the surface suggesting that SOD was influencing winter DO concentrations. Additionally, temporal variation of SOD was measured showing that SOD decreased by a factor of 1.5-1.6 between the first and second sampling periods in each of the three pools. The decrease in SOD corresponded with an increase in freezing degree days. The results of this study lend insights into SOD rates and sediment characteristics of backwater lakes of the UMRS that will aid managers in choosing suitable Habitat Restoration and Enhancement Project locations to increase suitable overwintering habitat.

Keywords: Sediment Oxygen Demand; Ice-cover; Sediment

SENSE OF PLACE IN SILVER CREEK WATERSHED

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Sense of place is the way in which people perceive their environment. Understanding residents' sense of place can help watershed managers better understand what residents value about their place. Due to this, managers are able to better understand and communicate watershed management strategies that align with residential values. This study works to better understand the sense of place of residents within the Silver Creek watershed in Davenport, Iowa. Managers may use this information to better understand residents' values and develop management strategies that directly align with these values. In this study, a survey was conducted in which participants answered a series of Likert-scale questions designed to understand sense of place. In addition, respondents were able to express interest in participating in a follow up interview. Semi-structured phone interviews were conducted with

those who were willing. Interviews were recorded and transcribed, and coded using content analysis. This study identifies seven themes that express how surveyed and interviewed residents from the Silver Creek watershed understand and value their place: the valuation of aesthetics, the valuation of recreation, residential decision-making, concerns about physical degradation, uncertainty about management decisions, perceived disagreement with management practices, and divided visions for the future. Implications of this research include the knowledge that community members have a strong connection to the creek, so communication of management practices is of high importance. The presence of nature and recreational activities were highly prioritized by those interviewed, so managers must develop plans that keep these priorities in mind. The desire for more information about watershed management practices was extremely prevalent, which indicates that outreach efforts could be strengthened and/or diversified. Finally, residents had a divided vision for what they desired for the future of the creek, which means managers must communicate the rationale for decisions.

Keywords: Sense of Place, Watershed Management, Values, Connections, Management Strategies

RAPID COLONIZATION BY FRESHWATER MUSSELS IN A RESTORED RIVER REACH

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Stream restoration in various forms is an important way to improve ecosystem function and diversity. A potential benefit of restoration is the capacity for freshwater mussels to colonize formerly degraded or unavailable habitats. The composition of colonizing assemblages depends, in part, on the composition, proximity, and connectivity of source populations. Colonization rates in these habitats are poorly known. We studied mussel colonization rates and community structure in a restored reach of the Pomme de Terre River, a tributary of the Minnesota River in west central Minnesota. The Pomme de Terre was diverted to a constructed adjacent channel in 1939, abandoning 2.2 km of the lowermost channel to stagnate and fill with sediment. Mainstem flow was reconnected to the abandoned channel in October 2018, 79 years later, restoring aquatic connectively to the Minnesota River. We surveyed the restored channel in August 2022 during a 19-hour timed search. General observations suggest that up to 6 vertical feet of accumulated sediment was flushed from the channel with portions of the historic riverbed exposed revealing consolidated sand substrate with a small number of relic mussel shells present. We collected mussels at multiple sites totaling 163 individuals of 9 species, representing 60% of potential species from the source assemblages downstream in the Minnesota River and upstream in the Pomme de Terre River. Age estimates from external annuli counts averaged 1.9 years and included all age classes 0 to 5 years. Species with opportunistic and periodic life history strategies made up 98% of colonists, whereas equilibrium and periodic species were most abundant (70%) in the potential source assemblages. Our results showed that colonization by mussels occurred soon after flow was restored, thus providing measurable benefits in a short time.

Keywords: Mussels, restoration, river, colonization, Pomme de Terre River

STREAM ASSESSMENT OF MICROPLASTICS IN QUAD CITY WATERSHEDS

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Microplastics, small plastic particles measuring less than 5 millimeters in diameter, have become a growing environmental concern in recent years. These particles can originate from various sources, and when these particles are released into the environment, they can persist for years, potentially damaging ecosystems as they accumulate. Urban stream networks in the Quad Cities area (Illinois and Iowa) drain directly or indirectly to the Mississippi River. Microplastic sampling of these streams is essential for further understanding the potential dangers in a water system in which residents of the Quad Cities interact. For the purpose of this project, 19 sites were sampled, each categorized as agricultural, urban, natural, or mixed. Samples were collected directly from 19 select sites with 946 mL mason jars. Samples were then filtered and finally dyed with Nile red dye for identification. The samples were identified using a microscope modified with a yellow film filter and a 470 nm flashlight. After the analysis, we observed that microplastics were found in all of our water samples. We quantified microplastics based on fragments and fibers found, each being considered a different category. We identified a correlation between microplastic counts and site types. Streams within an urban setting were found to have higher concentrations of microplastics compared to sites within a natural and agricultural setting. Overall completion of this pilot project took 4 weeks, though a larger sample size and more sites representative of the categories could be sampled in the future. It is important that sources of microplastics be found and concentrations better understood, especially in communities that constantly interact with their watersheds. Identifying sources and levels of microplastics is key to future understanding of the hazards that they pose within our ecosystems.

Keywords: Microplastics, Quad City

IMPACTS OF HERBIVORY AND COMPETITION ON SILVER MAPLE REGENERATION

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The introduction of invasive species has become an increasing problem in many natural systems. Phalaris arundinacea, reed canary grass (RCG), is an invasive grass that has been introduced to the Upper Mississippi River floodplain forest (UMR-FF). Current studies suggest that RCG has negatively impacted natural regeneration and overall health of native tree species in this region. In addition, damage from deer browse may have negative impacts on tree regeneration. In this study, the effects of RCG competition and deer herbivory on silver maple seedlings in the UMR-FF, specifically at Goose Island, WI, were investigated. Seedling health,

seedling height, and number of leaves for 100 Acer saccharinum (silver maple) seedlings were monitored in six canopy gaps. Within each canopy gap, four treatment plots were established: removal of RCG, deer fencing, RCG removal + deer fencing, and control. Soil pH, soil moisture, and RCG density were also recorded for each of the four plots within each canopy gaps. The effects of herbivory and competition on seedling health, seedling growth, and number of leaves were analyzed. In spring 2023, overwintering survival of the seedlings will be recorded. Based on observations from 2022 on the impact of insect herbivory, insect netting will be installed in the herbivory exclusion treatments for 2023. There has been little research on the effects of RCG and herbivory on silver maple at Goose Island. The analysis of results from 2022 and the collection of additional data in 2023 will inform management decisions for improving the regeneration of silver maple in the UMR-FF.

Keywords: competition, herbivory, regeneration, silvermaple, reedcanarygrass

EFFECTS OF VARYING AQUATIC VEGETATION ON YELLOW BULLHEAD (AMEIURUS NATALIS) POPULATIONS IN THE ILLINOIS AND MISSISSIPPI RIVERS

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Yellow bullhead (Ameiurus natalis) populations have declined in recent decades in the La Grange pool of the Illinois River, but are stable or increasing in pools 4, 8, and 13 of the Mississippi River. Currently, the reasons for these shifts in population are unknown. Both rivers have experienced changes in their structure and ecosystems, such as channelization, reduction in wetlands and backwaters, and sedimentation. These factors negatively impact aquatic vegetation by reducing light availability and reducing suitable habitat for plants to grow. Bullhead species, including yellow bullhead, are usually found in areas of abundant aquatic vegetation. This may explain the decrease in population due to absence of vegetation in the La Grange pool. Quantifying the extent and differences in aquatic vegetation of these pools in both rivers may give insight to the reduction of yellow bullheads in the La Grange pool. For this study, we compared percent frequency and community similarity from pools of abundant aquatic vegetation (pools 4, 8, and 13) to the La Grange pool to determine whether aquatic vegetation is a factor in this reduction in yellow bullhead population. The objectives for this study were comparing percent frequency of emergent and submergent vegetation to determine if there is a relationship between a particular aquatic vegetation type and yellow bullhead relative abundance.

Keywords: yellow bullhead, aquatic vegetation, illinois river, backwaters, and habitat

COLLABORATIVE APPROACH TO LOCATE SPECTACLECASE MUSSEL IN THE UPPER MISSISSIPPI RIVER USING EDNA

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Spectaclecase (Cumberlandia monodonta) mussels are an endangered species with a very limited range in large river drainages of the Mississippi River, with uncertainty regarding its current extant distribution. Traditional dive surveys for mussel populations can be difficult, dangerous, time-consuming, and area limited. This is especially true in the case of Spectaclecase whose preferred habitat is in sheltered areas such as crevices and interstitial spaces of boulders. We developed and validated a new species-specific qPCR assay to more efficiently locate undiscovered populations using environmental DNA (eDNA) analysis. This approach can also be used to add rigor for environmental impact studies or monitor known populations over time to non-invasively evaluate for growth or decline. The Army Corps of Engineers is currently using this method to identify where populations of Spectaclecase occur to better assess the impacts of the continued operation and maintenance of the Mississippi River 9-Foot Navigation Project. The project has spanned 3 years (2020-2022) and sampling sites targeted suitable habitat areas for the Spectaclecase mussel, historic populations, and empty shell locations. We will present the results from the eDNA analysis of water samples collected from preselected locations of the Upper Mississippi River ranging from Pool 2 to 22 and findings from corresponding dive team searches.

Keywords: Navigation Endangered Detection eDNA Genetics

HOT SPOT ANALYSIS OF SANITARY SEWAGE CONTAMINATION OF AN URBAN WATERSHED VIA EXFILTRATION

***Adam P. Schumacher[1]** and Dr. Michael Reisner[1].
[1]Upper Mississippi Center, Augustana College

Crystal Creek in Davenport Iowa drains suburban and park areas before draining into Duck Creek, a tributary of the Mississippi River and is designated for contact recreation. With the city of Davenport, Augustana College's Upper Mississippi Center assessed this stream in the summer of 2021 as a pilot project to determine if relatively inexpensive monitoring tools could be used to pinpoint possible sewage contamination from lines running along the creek. Fecal coliform, optical brighteners, conductivity, pH, dissolved oxygen, biological oxygen demand (BOD), phosphorous, nitrate, and ammonia were assessed in Crystal Creek. On June 21, 2021, seven sites were identified for preliminary screening. Second, based on these results, 27 sites were identified for detailed sampling and analysis on 7/22/21. We found correlations between high fecal coliform count, higher BOD, dips in pH, and peaks in ammonia. A follow-up study began in the same reach during the summer of 2022. On-site testing for dissolved oxygen, pH, and Conductivity was performed. Water samples were collected at 10 of these sites and tested for BOD, ammonia, E. coli, fecal coliforms, and Optical brighteners. Any combination of decreased pH or dissolved oxygen, or increased ammonia, phosphate, BOD, conductivity, fecal coliforms or E. coli, were considered potential contamination sites. High background fluorescence levels prevented optical brighteners from being a usable indicator. A direct leak assessment was conducted by introducing rhodamine dye directly into the sewer, however we did not detect any rhodamine in the stream. This method may be more successful in locations with higher sewer exfiltration. Finally, Caffeine and Cotinie (a nicotine metabolite) were tested for in water samples collected at the end of August and came back with positive hits above sites where rhodamine dye was introduced, suggesting the actual leak may be above the site we

tested. The City of Davenport has indicated their interest in using camera and pipe-lining methods to determine which segments of sewer required repair. Direct evidence for point-source sewage leaks was not found in this study. However, the combination of water quality and specific pharmaceutical/ personal care products (PPCPs) provide strong evidence that sewage exfiltration is occurring. Furthermore, understanding the origin of these pollutants will allow local management to make necessary repairs to applicable sewage systems in order to better protect public health and recreational uses of such waters.

Keywords: Hotspot, Sewage, Exfiltration, Davenport, Streams

THE RECENT INVASION OF FLOWERING RUSH (BUTOMUS UMBELLATUS L.) ON THE UPPER MISSISSIPPI RIVER TRIGGERS MANAGEMENT ACTION & MONITORING

Stephanie Szura[1], Jennifer Froehly[2], Alicia Carhart[1], Eric Lund[3], and Danelle Larson[4].
[1]Wisconsin Department of Natural Resources, [2]U.S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge, [3]Minnesota Department of Natural Resources, [4]U.S. Geological Survey, Upper Midwest Environmental Sciences Center.

Flowering rush (Butomus umbellatus L.) is an invasive plant that made a sudden, widespread appearance along several hundred miles of the Upper Mississippi River and its wildlife refuges in 2020. The U.S. Fish and Wildlife Service Ecological Risk Screening Summary report places flowering rush in the invasive plant species of â€˜high concern categoryâ€™ because of its ability to displace native plants, spread rapidly through a variety of vectors (e.g. humans, wildlife, and water currents), and colonize many hydrologic regimes. Flowering rush expanded exponentially since invasion in 2020 and is found at >10% prevalence in several river pools, based on data from the Upper Mississippi River Restoration Programâ€™s Long Term Resource Monitoring (LTRM) element. Next, we share how the Upper Mississippi River National Wildlife and Fish Refuge implemented a flowering rush treatment plan and monitoring protocol with an adaptive management program during summer 2022. We are monitoring all treatment areas using a Before-After, Control-Impact (BACI) design to assess treatment efficacy and impacts on non-target species. In the â€œBeforeâ€ treatment phase (June 2022), we found that flowering rush negatively affected emergent plant diversity and invaded patches occupied by other emergent plants, such as wild rice and arrowheads. Flowering rush was often found as single plants within another community, but in some areas had expanded to large (2 hectare) monocultures. We describe the herbicide treatments that occurred in July and August 2022 and our observations, but future work will collect the â€œAfterâ€ treatment data in summer 2023. The LTRM and treatment monitoring data will provide a better understanding of how the invasion of flowering rush is progressing, being controlled, and affecting native biodiversity and control treatment methods. Learning via adaptive monitoring and management could result in expanded or modified treatment plans.

Keywords: invasive plant, flowering rush, Butomus umbellatus L., adaptive management, Upper Mississippi River

HOW DO HIGH- AND LOW-RIVER STAGES AFFECT FISH CATCH RATES AND COMMUNITY COMPOSITION?

***McKensie Vaske[1]**, Rory Schmidt[1], Jason DeBoer[1], Wes Bouska[2].
[1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, [2]U.S. Fish and Wildlife Service, La Crosse Fish and Wildlife Conservation Office.

The Mississippi River experienced high- and low-stage environments during autumn 2019 and 2021 respectively. Pools 18 and 19 were surveyed with pulsed-DC electrofishing gear by the Illinois River Biological Station. We examined trends in fish community metrics in main- and off-channel habitats using fish catch and hydrology data from 124 total sites. We used generalized linear models to determine differences in overall catch rate (CPUE), and CPUE of select sportfish, between years and habitats. We also evaluated changes in community composition by examining differences in species richness and the top 10 species (by number) between years. Off-channel sites supported a higher overall CPUE in 2021 (N=54; CPUE=667.3 Â± 56.0 fish/hr) compared to 2019 (N=26; CPUE=264.1 Â± 60.4). Main-channel sites largely produced no difference in CPUE between 2019 (N=14; CPUE=416.0 Â± 140.1), and 2021 (N=30; CPUE=458.9 Â± 68.9). Bluegill and Largemouth Bass showed clear shifts in catch rate between years, though not between habitats, with significantly greater catch rates in 2021. In 2019, a higher percentage of both species were greater than stock length, whereas in 2021, a higher percentage of both species were less than stock length. Species richness was greater in 2019 (N=64) compared to 2021 (N=44). Although there were changes in the order of the top 10 species between years, 8 of the 10 species made the list both years. Our findings indicate stage height can affect sampling efficiency, fish community composition, size structure, and habitat use.

Keywords: high water, low water, fish community

EFFECTS OF INCREASING WATER TEMPERATURE ON GROWTH, SURVIVAL, AND LEAF DECOMPOSITION RATES IN FRESHWATER AMPHIPODS

***Kourtney Walter[1]**, *Tyler Hall[1], Cheyana Bassham[1], Brandon Thill[1], and Ross Vander Vorste[1].
[1]University of Wisconsin La Crosse.

Climate change is resulting in many global effects, including increases in water temperatures in freshwater ecosystems. Increasing water temperature has been found to be a major stressor for aquatic invertebrates that could cause decreased rates of survival and rates of ecosystem functions, such as organic matter decomposition. However, the effects of increasing water temperature may be taxon specific and experiments are needed to test how invertebrates will respond. In 2021 and 2022, we performed aquatic mesocosm experiments using Gammarus sp. (Amphipoda), a dominant organic matter shredder taxa found throughout southwest Wisconsin, to see how their growth, survival, and leaf decomposition rates were affected by

water temperature (15°C, 20°C, 25°C). A total of 10 5-L mesocosms were set up at each temperature treatment (5 replicates per treatment). We added 15-20 amphipods and one leaf litter bag to each mesocosm and estimated growth, survival, and leaf decomposition rates at the end of a two-week period. We hypothesized that amphipod growth, survival, and leaf decomposition would decrease as water temperature increased due to metabolic stress. We found a decrease in amphipod growth rates at the 25°C temperature treatment. Amphipod survival decreased by 16% from 99 ± 3% (mean ± s.d.) in the 15°C treatment to 83 ± 23% at 25°C. We found a 72% increase in leaf litter decomposition rates at the 25°C temperature treatment compared to 15°C. Our results suggest that increasing water temperature to 25°C is a stressor for Gammarus that could have negative effects on survival of amphipod populations. Contrary to our hypothesis, leaf litter decomposition rates increased at our highest temperature treatment, indicating amphipod feeding may increase with higher water temperatures associated with climate change. Future research using different shredder taxa could increase our understanding of how climate change may impact biodiversity and organic matter decomposition in freshwater ecosystems.

Keywords: Amphipods, Survival, Growth, Climate Change

UPPER MISSISSIPPI RIVER FLOODPLAIN FOREST RESPONSE TO TWO LARGE-SCALE FLOOD EVENTS

Shelby A. Weiss[1], Lyle J. Guyon[1], Nathan R. DeJager[2], and Robert J. Cosgriff[3].
[1]National Great Rivers Research and Education Center, [2]USGS Upper Midwest Environmental Sciences Center, [3]U.S. Army Corps of Engineers.

Large-scale disturbance events, although infrequent in occurrence, shape forest community distribution, species composition, and stand structure, driving successional dynamics. Exceptional flood events within the last several decades within the Upper Mississippi River System have raised interest in how vegetation communities within floodplain forests tolerate flooding and are impacted by these disturbances. Recently, a large-scale flood event in 2019 has provided the opportunity to examine the impacts to floodplain forests. The 2019 flood was similar in its intensity, duration and timing to the historic flood of 1993 for the region, allowing for a comparison of impacts from two large-scale flood disturbances. Following the 1993 flood, 554 plots were established within the floodplain across eight navigational pools (Pools 4, 8, 13, 17, 22, 26, and Open River and La Grange reaches) on the Mississippi and Illinois Rivers, and data on vegetation composition, size and abundance were collected. In 2021, 45 plots from each reach were revisited and inventory protocols duplicated to provide a comparable dataset. While the 1993 and 2019 floods were broadly similar in their duration and timing, there were notable differences in where the intensity and duration of the floods were greatest along the river. The forest survey data reflect this, with tree mortality varying across navigation pools. Greater overall tree mortality rates were observed in the upper reaches (Pools 4, 8, 13, and 17) following the 2019 flood, while lower reaches (Pools 22 and 26, La Grange and Open River) experienced greater mortality following the 1993 flood. Across all reaches, mortality rates were higher for smaller diameter individuals, however, the strength of this trend varied by reach and was less strong following the 2019 flood. Importance values for tree species remained relatively consistent before and after each flood event, with the greatest

change in species importance occurring between the two survey periods. Further work will focus on examining aspects of the inundation regime and the individual floods that exert the greatest influence on floodplain forest community composition and development. A better understanding of post-flood survivorship and succession can inform current forest management efforts and help to identify areas where forest restoration may have the greatest impact within the floodplain of the Upper Mississippi River System.

Keywords: flooding, Upper Mississippi River System, floodplain forests, flood tolerance, large-scale disturbance

THE IMPACT OF SHREDDERS ON LEAF DECOMPOSITION IN THE SILVER CREEK WATERSHED

***Charlie Zielinski**[1] and Kevin Geedey[1].
[1]Augustana College, Upper Mississippi Center.

The carbon released from the decomposition of leaves plays a critical role in the riparian ecosystem and food web of streams. By testing rates of leaf decomposition in urban streams we can survey the health of a watershed by sampling the carbon release amidst key locations in the area. In this study, we had two objectives: The assessment of the role of shredder macroinvertebrates in leaf decomposition, and the assessment of leaf decomposition rates across sites in Silver Creek. This project is part of the long term assessment of Davenport streams conducted by Augustana College's Upper Mississippi Center. We hypothesized that by excluding macroinvertebrates from sample leaf bags using 13.97 x 20.06 cm 0.15 mm mesh nylon bags, Sugar Maple leaves would decompose slower than the normal leaf bags of an 20.32 x 20.32 cm 7 mm wider mesh, which would allow macroinvertebrates inside. We put 4.0 (± 0.1g) dry sugar maple (Acer saccharum)leaves inside all bags. We centralized our mesh size comparison at one key site, deploying three groups of five wide mesh bags and three groups of five fine mesh bags. Four other sites received one group of five wide mesh bags only. The fine mesh bags were anchored to the streambed inside empty wide mesh bags so that all bags had the same footprint on the streambed. Bags were staked down underwater for twenty one days and retrieved. Leaf packs were rinsed of debris and dried to a constant weight in a 60 °C drying oven. Invertebrates were collected from each leaf pack while rinsing. Contrary to our hypothesis, there was no significant difference in mass loss between fine and wide mesh bags, however wide mesh bags were significantly more variable in their mass loss than fine mesh bags. Leaf mass loss differed significantly across sites. Preliminary findings suggest that factors such as differential macroinvertebrate colonization or the variability of headwater sites may have influenced the varied results of our leaf bags.

Keywords: Leaf decomposition, macroinvertebrates, sugar maple

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC

2023 BUSINESS MEETING AGENDA

Radisson Center, La Crosse, Wisconsin

April 21, 2023

1. Call to Order

2. President's Report by Eric Hine

a. Acknowledgments

b. Approval of the 2022 Business meeting minutes

c. 2023 attendance/participation information

3. Treasurer's Report by Quinton Phelps

4. Old Business

a. Bylaws Revisions Committee- Steve Winter

Proposed bylaw revisions

5. New Business

a. Future meeting dates

April 17-19, 2024 (Radisson Center, La Crosse, WI)

b. Presentation of Student Travel Awards

c. Presentation of Best Student Platform Presentation and Poster Awards

d.. Executive board student representative

e. Introduction of executive board nominees for Vice President and Treasurer

f. Election of Vice President and Treasurer to the Board of Directors

g. Passing of the Presidency

h. Other new business

6. Adjournment

MISSISSIPPI RIVER RESEARCH CONSORTIUM
TREASURER'S REPORT

Submitted by Pam Squires (LCNI) and Eric Hine (MRRC) April 2023

Checking account balance as of 30 June 2016		18,078.16
Checking account balance as of 30 June 2017		19,051.38
Checking account balance as of 30 June 2018		19,539.12
Checking account balance as of 30 June 2019		22,425.17
Checking account balance as of 30 June 2020		22,173.42
Checking account balance as of 30 June 2021		20,549.92
Checking account balance as of 30 June 2022		19,623.33
Transactions 1 July 2022 to 30 March 2023		
Income		
	Registration	8,190.00
	Interest	0.00
Total Income		8,190.00
Expenses	Awards	182.40
	Beer Glasses	570.14
	Maintenance Charges	20.00
Total Expenses		772.54
Checking account balance as of 30 March 2022		18,573.08
PayPal Account balance as of 30 March 2022		8,190.00

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC

2022 BUSINESS MEETING MINUTES

The Radisson Center, La Crosse, Wisconsin

1. Call to Order at 11:03 AM on April 22, 2022

2. President's Report by Andrya Whitten

a. Acknowledgments
   i. President Andrya Whitten thanks the board members for their contributions to a successful meeting: Levi Solomon (Past President), Eric Hine (Vice President), Alicia Carhart (Secretary), April Burgett (Conference Coordinator), Quinton Phelps (Treasurer), and Stephanie Schmidt (Student Representative). Andrya thanks Kim Dunnigan for assisting at the registration desk, Colin Belby for assisting with Qualtrics, and Eric Strauss for updating the MRRC website. The board would like to congratulate the UW-La Crosse River Studies Center on their 50th anniversary and thank them for the food and refreshments provided on Wednesday night. A special thank you to Dr. Rob Colombo for being our keynote speaker and for speaking to students at UWL. Finally, thank you to the MRRC members for attending and presenting research as well as the members who volunteered to judge student presentations and moderate sessions.

b. Approval of the 2021 Business Meeting minutes
   i. Colin Belby moved to approve the 2021 business meeting minutes and Steve Winter seconded the motion.

c. 2022 attendance/participation information
   i. 123 registrants, 19 oral presentations, 41 posters, 21 judges
   ii. Resume workshop: 9 registrants, only 4 attended, 8 professionals assisted
   iii. Raffle: More than $1600 worth of tickets and t-shirts sold to support the MRRC student travel scholarships

3. Treasurer's Report by Andrya Whitten

a. Summary as of March 23rd 2022
   i. Checking account balance: $19,623.33
   ii. Paypal account balance: $7662.60, this doesn't include all registration
   iii. Motion to approve the 2022 treasurer's report by John Chick and seconded by Jim Fischer.

4. Old Business

a. Tax-Exempt Committee – Updates and summary by Andrea Fritts and Colin Belby
   i. The MRRC had its 501(c)(3) tax-exempt status revoked by the IRS in 2010 due to three consecutive years of not filing Form 990. Instead of applying to reinstate its 501(c)(3), should the MRRC obtain tax-exempt status through a fiscal sponsorship with the non-profit La Crosse Neighborhood Initiative (LCNI)?

Pros of Fiscal Sponsorship with LCNI

i. 501(c)(3) tax exempt status for MRRC by May 2022 *(If MRRC applies for reinstatement, it could take up to 2 years for IRS approval and there would be fees and potentially penalties.)*
ii. Contract with LCNI renewed annually. If the MRRC (or LCNI) wants to sever the relationship that would be possible.
iii. LCNI would provide fiscal oversight and support, but they would not seek to influence the MRRC's mission.
iv. Federal and State agency employees will be able to serve on the MRRC Board *(currently not permitted due to code of ethics)*
v. Liability insurance will be provided for MRRC Board *(currently do not have)*
vi. Form 990 will be filed annually by LCNI *(non-filing caused MRRC to lose tax exempt status)*
vii. Raffle license will be provided by LCNI *(MRRC does not have a raffle license that is required by Wisconsin)*
viii. Reduced costs associated with hosting the conference at the Radisson
ix. Tax exempt certificate provided by LCNI for Radisson and donors
x. PO box provided by LCNI
xi. LCNI will have a parttime bookkeeper that serves as point of contact for MRRC treasurer
xii. MRRC's Board could remain as is, or it could transition to an executive planning committee that reports to LCNI

Cons of Fiscal Sponsorship

xiii. $200 annual fee to LCNI *(might increase a small amount in coming years)*
xiv. MRRC will no longer have its own tax-exempt status *(has not had it since 2010)*

ii. Fiscal sponsorship discussion
    i. Clara Gelatt, a representative for LCNI, was present at the business meeting and provided additional information. La Crosse Neighborhood Initiative will be changing its name in May to La Crosse Community Nonprofits Initiative. Clara states that a fiscal sponsorship is a fairly common approach and that they do this for several other entities as well. The current annual fee is $200. The contract would be renewed each year and the board will have time to review the contract and the associated fees prior to resigning. The main point of contact for MRRC will need to be updated at this time. Clara states that going this route now does not prevent MRRC from applying for its own 501(c) in the future.
    ii. Andrea Fritts – this makes a lot of sense for an organization that has a lot of turnover (2 year term positions) and provides consistency for volunteer based organization
    iii. Steve Winter states that he also supports this idea as previous board member
    iv. Jennie Sauer-echos what has been said and states that liability insurance alone wouldn't be possible for that minimal $200 fee
    v. Andrya Whitten- as a member, nothing changes, it's all behind the scenes for the board of directors (finances).

vi. Colin- this would allow the board to focus on planning the meeting and less so on finances
vii. April Burgett- How will this affect the role of the treasure position?
1. Colin-treasurer position can exist if the board prefers, or we can transfer most of these responsibilities to LCNI.
2. Clara- treasurer and president will be the main points of contacts for MRRC. She encourages MRRC to keep the treasurer position to provide oversight and report out to the board and membership. Funds would be managed by LCNI, not transferred to various places as the treasurer position turns over. MRRC would continue to manage Paypal account and transfer to LCNI account. A LCNI representative could attend the MRRC business meeting to report out to the membership each year.

iii. Andrea Fritts moved to approve the fiscal sponsorship and Meredith Thomsen seconded it. The fiscal sponsorship passes by consensus.

b. Bylaws Revisions Committee- Steve Winter
i. See full list of proposed revisions on the MRRC website.
i. Eligibility of board members – the bylaws currently state the criteria for board member affiliations (at least one state/federal agency, at least one representative from academics). MRRC hasn't been able to do this for years, partly due to lack of non-profit status, but also due to different approaches to ethics reviews for federal agencies (USFWS vs USGS).
ii. Student representative position – bylaws state that this must be a winner of poster/oral presentations. Steve suggests having students apply and the membership vote at annual meeting. At the end of the term, the student representative then recruits nominees for next cycle.
iii. Student award criteria is restrictive and eliminates potential students who are at the very beginning of their research and would benefit from a travel scholarship to contribute to the meeting.
iv. Special symposia – Steve suggests eliminating this section as it is restrictive and not necessary.

ii. Committee (Steve and others interested) will gather input from members, present to board for approval, and the membership will vote on the amendments
i. Andrea – is amending via a non in-person vote in the current bylaws?
ii. Steve – voting needs to happen at in-person meeting (2/3 of the members present), very few have had time to read through revisions currently.
iii. Meredith- would voting be possible via a zoom virtual meeting?
iv. Andrya- we will need to make some changes due to fiscal sponsorship (treasurers' role) so we might as well wait until we know what those changes are. Eric (Vice President) also in favor of waiting until next meeting if changes are not pressing. Alicia (Secretary) agrees with waiting until we have more information on fiscal sponsorship.
v. Members will contact Steve if they are interested in joining the bylaws revision committee or send input on changes via email.

iii. Colin- In order to move forward with the fiscal sponsorship and re-gain our tax exempt status in May, we need the following statement added to the bylaws:

1. "In order to join as a Project and comply with the provisions of LCNI, MRRC shall subscribe to and support the Corporation's bylaws and will adhere to the Corporation's bylaws that apply to the MRRC."
2. Motion to add the above statement to the bylaws by April Burgett and Jason DeBoer seconded it. The membership voted and the motion passed without discussion.

c. Expanded Student Scholarship
   i. Suggestion to increase student award to $1500 to support research presentation at national conference. Nate and Meredith have stepped away and are wondering if others would like to take over the proposed scholarship idea.
   ii. Andrya asks for any discussion, there was none. This item will be removed from the old business, but can be brought forward in the future if there is interest.

5. New Business -Andrya Whitten

a. Future meeting dates
   iii. April 19-21, 2023 (Radisson Center, La Crosse, WI)
b. Presentation of Student Scholarship Travel Awards
   i. Andrya thanks the members for bringing donations and buying raffle tickets to support the student travel awards.
   ii. 2022 scholarship winners: Courtney Baker, Ali Chalberg, Emma Grindle, Patrick Padilla, Bryan Sea, and Courtney Weldon
c. Presentation of Best Student Platform Presentation and Poster Awards
   i. Platform
      i. 1st place-Kristina Morben
      ii. 2nd place- Allisen Hallahan
   ii. Poster
      i. 1st place-Anya Jeninga
      ii. 2nd place-Paige Peterson
d. Introduction of executive board nominees for Vice President and Secretary
   i. Kathi jo Jankowski – Vice President
   ii. Jeremy King – Secretary
   iii. Meredith Thomsen moves to approve the nominations for Vice President and Secretary, Andrea Fritts seconds it, and the motion passes. Welcome Kathi jo and Jeremy!
e. Other awards
   i. Neal Mundahl- 26 years as MRRC Treasurer
   ii. Stephen Winter-MRRC President 2019-2020
   iii. Levi Solomon- MRRC President 2020-2021
f. Passing of the Presidency
   i. Passing of Presidency to Eric Hine
   ii. Eric presents Andrya Whitten with award- MRRC President 2021-2022

6. Other new business – Eric Hine

a. Colin opens a discussion about the student workshop- Enrollment was low and very few students actually attended the workshop, should we continue doing this annually?

i. Steve- as part of the proposed revision of bylaws, the student representative has the ability to choose the activity and it would be their job to recruit students and plan accordingly
    i. Kristina- instead of the morning/afternoon of the first day, there may be more interest in an evening student social
ii. Levi- if student participation continues to be poor, the board may need to consider other options. There was still some uncertainty this year due to the pandemic and many still under travel restrictions so maybe next year there will be a better turnout.
iii. Student question: Is it possible for the student workshop to be a free service to students rather than charging a small fee? This may increase participation.
    i. Steve- that would need to be considered relative to overall conference budget
    ii. April- if its free, there is no commitment (sign up and don't show up), which is problematic for the board that spends time planning the activity and also the professionals that volunteer their time.

iv. Andrya- keep in mind this is only our 2nd workshop (1st one was in 2019). The fee is usually just enough to cover the cost of the meeting room. A different time may help with participation, although there would be a time conflict with poster sessions at night, this may be something for the new board to consider.

7. Meeting adjourned at 12:05pm on April 22, 2022

PAST RECIPIENTS OF THE
MISSISSIPPI RIVER
RESEARCH CONSORTIUM
FRIEND OF THE RIVER AWARD

Friend of the River	Organization	Year	Meeting	Presenter
Calvin R. Fremling	Winona State University	1992	24th	Neal Mundahl
Thomas O. Claflin	University of Wisconsin-La Crosse	1993	25th	Ronald G. Rada
Pamela Thiel	U.S. Fish & Wildlife Service	1997	29th	Terry Dukerschein
Richard V. Anderson	Western Illinois University	1998	30th	Michael A. Romano
Ronald G. Rada	University of Wisconsin-La Crosse	1999	31st	Terry Dukerschein
Marian E. Havlick	Malacological Consultants, La Crosse, Wisconsin	2008	40th	Brian Ickes
Carl Korschgen	USGS, Columbia Environmental Research Center, Columbia, Missouri	2009	41st	Roger Haro and Jim Wiener
Ken Lubinski	USGS, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin	2012	44th	Susan Romano
Neal Mundahl	Winona State University	2016	48th	Susan Romano
Michael Vanderfort	U.S. Fish & Wildlife Service	2018	50th	Pamela Thiel
Jennifer Sauer	Upper Midwest Environmental Science Center	2023	54th	Jeff Houser

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	Canceled	Dr. Edward Cawley
13th	1980	Loras College, Dubuque, IA	Dr. Edward Cawley
14th	1981	Ramada Inn, La Crosse, WI	Mr. Michael Vanderford
			Board of Directors
15th	1982	Radisson Hotel, La Crosse, WI	Dr. Richard Anderson Dr. Dave McConville Dr. Jim Wiener

-----	1983	No Meeting	----------
16th	1984	Radisson Hotel, La Crosse, WI	Dr. Ken Lubinski Ms. Rosalie Schnick Dr. Miles Smart
17th	1985	Radisson Hotel, La Crosse, WI	Mr. Ray Hubley Dr. John Nickum Ms. Pam Thiel
18th	1986	Radisson Hotel, La Crosse, WI	Dr. Jim Eckblad Dr. Carl Korschgen Dr. Jim Peck
19th	1987	Univ. of Wisconsin-La Crosse, La Crosse, WI	Mr. Hannibal Bolton Dr. Leslie Holland Dr. Mike Winfrey
20th	1988	Univ. of Wisconsin-La Crosse, La Crosse, WI	Mr. John Pitlo Mr. Verdel Dawson Dr. Nani Bhowmik

21st	1989	Holiday Inn, La Crosse, WI	Dr. Larry Jahn Mr. Jerry Rasmussen Dr. Bill LeGrande
22nd	1990	Island Inn, La Crosse, WI	Mr. Doug Blodgett Dr. John Ramsey Mr. John Sullivan
23rd	1991	Holiday Inn, La Crosse, WI	Mr. Kent Johnson Dr. Mike Romano Dr. Joe Wlosinski
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
33rd	2001	Radisson Hotel, La Crosse, WI	Dr. Yao Yin Mr. Brent Knights Dr. Michael Romano Dr. Neal Mundahl
34th	2002	Radisson Hotel, La Crosse, WI	Mr. Brent Knights Mr. Jeff Arnold Dr. Michael Romano Dr. Neal Mundahl
35th	2003	Radisson Hotel, La Crosse, WI	Mr. Jeff Arnold Dr. Michael Romano Mr. Jim Fischer Dr. Neal Mundahl
36th	2004	Radisson Hotel, La Crosse, WI	Dr. Michael Romano Dr. Mark Pegg Mr. Jim Fischer Dr. Neal Mundahl
37th	2005	Radisson Hotel, La Crosse, WI	Dr. Mark Pegg Dr. Michael Delong Mr. Lynn Bartsch Dr. Neal Mundahl
38th	2006	Radisson Hotel, La Crosse, WI	Dr. Michael Delong Dr. John Chick Mr. Lynn Bartsch Dr. Neal Mundahl

39th	2007	Radisson Hotel, La Crosse, WI	Dr. John Chick Mr. Brian Ickes Dr. Robert Miller Dr. Neal Mundahl
40th	2008	Grand River Center, Dubuque, IA	Mr. Brian Ickes Dr. Roger Haro Dr. Robert Miller Dr. Neal Mundahl
41st	2009	Radisson Hotel, La Crosse, WI	Dr. Roger Haro Dr. Greg Sass Dr. Susan Romano Dr. Neal Mundahl
42nd	2010	Radisson Hotel, La Crosse, WI	Dr. Greg Sass Dr. Jeff Houser Dr. Susan Romano Dr. Neal Mundahl
43rd	2011	Radisson Hotel, La Crosse, WI	Dr. Jeff Houser Dr. Susan Romano Dr. Eric Strauss Dr. Neal Mundahl
44th	2012	Radisson Hotel, La Crosse, WI	Dr. Susan Romano Dr. Nathan De Jager Dr. Eric Strauss Dr. Neal Mundahl

45th	2013	Radisson Hotel, La Crosse, WI	Dr. Nathan De Jager Dr. Eric Strauss Ms. Nerissa Michaels Dr. Neal Mundahl
46th	2014	Radisson Hotel, La Crosse, WI	Dr. Eric Strauss Dr. Andrew Casper Ms. April Burgett Dr. Neal Mundahl
47th	2015	Radisson Hotel, La Crosse, WI	Dr. Andrew Casper Ms. Michelle Bartsch Ms. April Burgett Dr. Neal Mundahl
48th	2016	Radisson Hotel, La Crosse, WI	Ms. Michelle Bartsch Dr. Gretchen Gerrish Ms. April Burgett Dr. Neal Mundahl
49th	2017	Radisson Hotel, La Crosse, WI	Dr. Gretchen Gerrish Ms. Patty Ries Ms. April Burgett Dr. Neal Mundahl Mr. Mark Fritts
50th	2018	Radisson Hotel, La Crosse, WI	Ms. Patty Ries Dr. Colin Belby Ms. April Burgett Dr. Neal Mundahl Mr. Mark Fritts Mr. Doug Appel
51st	2019	Radisson Hotel, La Crosse, WI	Dr. Colin Belby Dr. Stephen Winter

			Ms. April Burgett Ms. Andrya Ms. Andrya Whitten Dr. Neal Mudahl Mr. Doug Appel Ms. Dominique Turney
-----	2020	Meeting Canceled due to the COVID-19 Global Pandemic	Dr. Stephen Winter Mr. Levi Solomon Ms. Andrya Whitten Ms. April Burget Dr. Neal Mudahl Ms. Dominique Turney
52nd	2021	Virtual Meeting	Mr. Levi Solomon Ms. Andrya Whitten Ms. April Burgett Ms. Alicia Carhart Dr. Quinton Phelps Ms. Stephanie Schmidt
53rd	2022	Radisson Hotel, La Crosse, WI	Ms. Andrya Whitten Mr. Eric Hine Ms. April Burgett Ms. Alicia Carhart Dr. Quinton Phelps Ms. Stephanie Schmidt
54th	2023	Radisson Hotel, La Crosse, WI	Mr. Eric Hine Dr. Kathi Jo Jankowski Ms. April Burgett Mr. Jeremy King Dr. Quinton Phelps Ms. Kristina Morben

The proceedings of the annual meeting 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. Past Proceedings are available on the MRRC website: <http://m-r-r-c.org/History.html>

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Meeting Arrangements & Announcements
Eric Hine, Illinois Natural History Survey, Great Rivers Field Station
Kathi Jo Jankowski, Upper Midwest Environmental Sciences Center

Program & Proceedings
Kathi Jo Jankowski, Upper Midwest Environmental Sciences Center
Eric Hine, Illinois Natural History Survey, Great Rivers Field Station
April Burgett, Illinois Natural History Survey, Illinois River Biological Station

Website
Colin Belby, Department of Geography and Earth Science, University of Wisconsin – La Crosse
Eric Strauss, River Studies Center, University of Wisconsin – La Crosse

Workshop
Eric Hine, Illinois Natural History Survey, Great Rivers Field Station
Kristina Morben, UWL-La Crosse

Poster Boards
Illinois River Biological Station and Illinois DNR

Photography
Kim Dunnigan, Illinois Master Naturalist, Lewistown, Illinois

Awards and Raffle Arrangements
Jeremy King, Wisconsin Department of Natural Resources
Kathi Jo Jankowski, Upper Midwest Environmental Sciences Center

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April Burgett, Illinois River Biological Station, Illinois Natural History Survey

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Andrea Fritts, USGS Upper Midwest Environmental Sciences Center

Oral Presentation Session Moderators
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Rebecca Kreiling, U.S. Geological Survey, Upper Midwest Environmental Sciences Center
Seth Fopma, Iowa Department of Natural Resources
Kristen Bouska, U.S. Geological Survey, Upper Midwest Environmental Sciences Center
Molly Van Appledorn, U.S. Geological Survey, Upper Midwest Environmental Sciences Center