PROCEEDINGS OF THE

MISSISSIPPI RIVER RESEARCH CONSORTIUM

VOLUME 48

27-29 April 2016

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PROCEEDINGS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM
VOLUME 48

Proceedings of the 48th Annual Meeting
April 27 - April 29, 2016
The Radisson, La Crosse, Wisconsin

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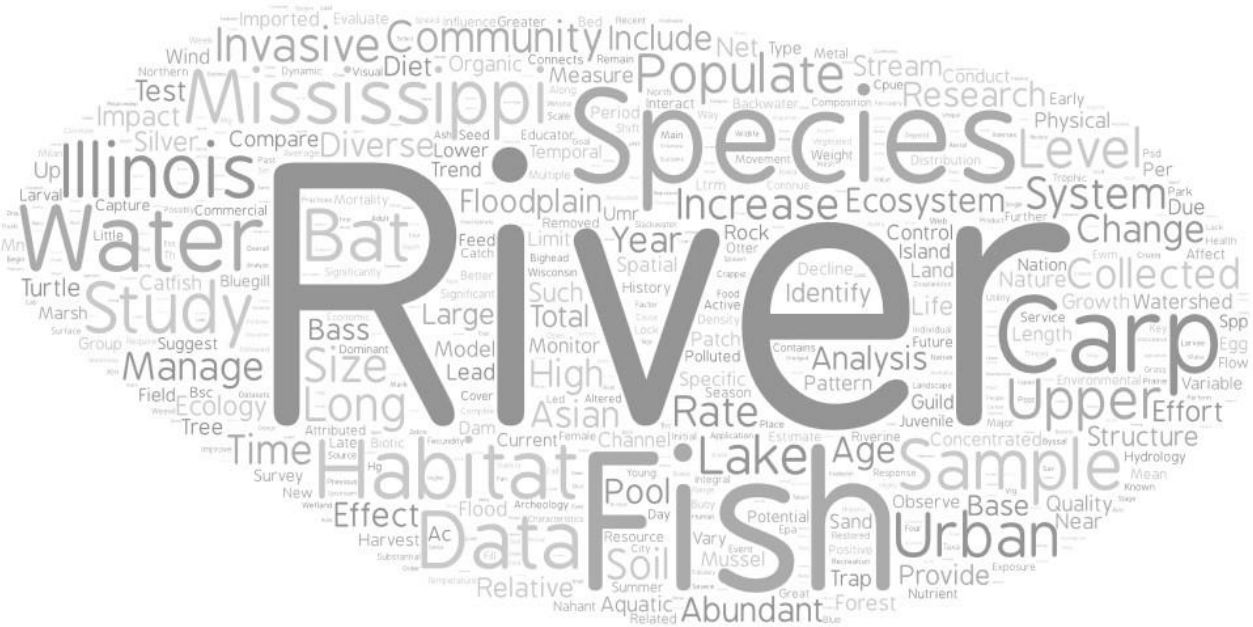
2016



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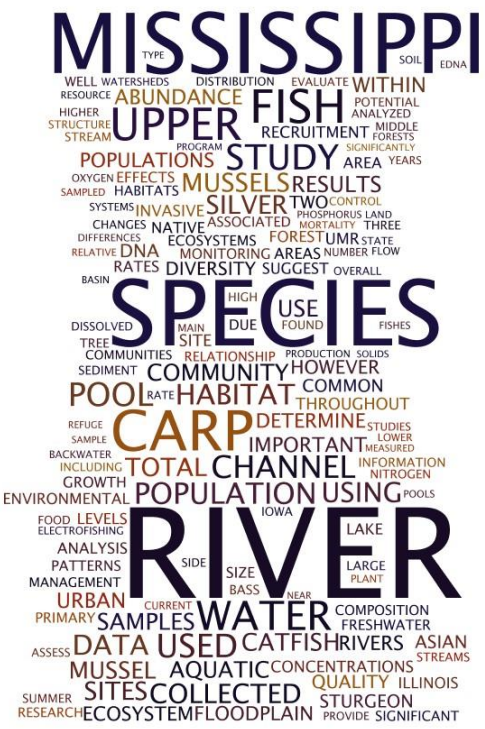
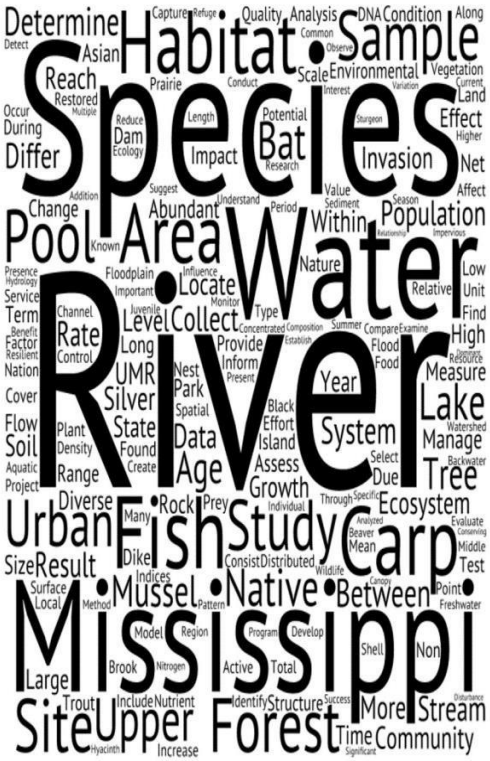


2015



KEYNOTE PRESENTATION AND MIXER

Radisson Hotel - Ballroom B
La Crosse, Wisconsin
Wednesday, 27 April 2016

5:00 PM Registration Table Opens

5:00–6:30 PM Poster Set-Up

6:30–6:40 PM Welcome and Announcements – **Michelle Bartsch**, MRRC President

KEYNOTE PRESENTATION

6:40–7:30 PM TREATING BIOLOGICAL INVASIONS OF LARGE RIVERS LIKE THEY MATTER

Dr. David Strayer, Freshwater Ecologist, Cary Institute of Ecosystem Studies, Millbrook, NY

POSTERS SESSION I AND MIXER

7:30–9:00 PM POSTER SESSION I WITH AUTHORS PRESENT (Hotel Foyer)

7:30–10:00 PM GENERAL CONSORTIUM MIXER (Hotel Foyer)

PLATFORM PROGRAM
Radisson Hotel – Ballroom B
Thursday, 28 April 2016

7:50–8:00 AM: WELCOME: Michelle Bartsch, MRRC President

SESSION I – ASIAN CARP (Moderator: Jon Vallazza) (*Student Presenters)

8:00–8:15 ASSESSING MOVEMENT OF ADULT SILVER CARP AND BIGHEAD CARP IN THE UPPER ILLINOIS WATERWAY SYSTEM USING GPS SATELLITE AND RADIO TELEMETRY

***Andrew T. Mathis[1]**, James T. Lamer[1], Brent Knights[2], and Kevin Irons[3]. [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, LaCrosse, WI 54603. [3] Illinois Department of Natural Resources, Springfield, IL 62702.

8:15–8:30 MOVEMENT AND HABITAT USE OF INVASIVE ASIAN CARP IN POOL 19 OF THE UPPER MISSISSIPPI RIVER

Jon M. Vallazza[1], Brent C. Knights[1], James H. Larson[1], and Neil D. Gillespie[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

8:30–8:45 DOCUMENTATION OF ASIAN CARP REPRODUCTION ABOVE LOCK AND DAM 19 ON THE MISSISSIPPI RIVER

James H. Larson[1], Brent C. Knights[1], S. Grace McCalla[1], Emy Monroe[2], Maren Tuttle-Lau[2], Duane Chapman[3], Amy George[3], Jon M. Vallazza[1], Jon Amberg[1]. [1] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI. [2]U.S. Fish and Wildlife Service, Whitney Genetics Lab, Onalaska, WI. [3] U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO.

8:45–9:00 BIOTIC RESPONSE TO THE ESTABLISHMENT AND EXPANSION OF ASIAN CARP IN THE LOWER ILLINOIS RIVER

Jason DeBoer[1], Mark Fritts[1], Daniel Gibson-Reinemer[1], Collin Hinz[1], Doyn Kellerhalls[1], Richard Pendleton[1], Levi Solomon[1], and Andrew Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

9:00–9:15 ZOOPLANKTON RESPONSE TO ASIAN CARP HARVESTING IN ILLINOIS RIVER BACKWATERS

***Brian Zalay[1,2]**, Andrew F. Casper[2,3]. [1]Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, Il 61820. [2] Illinois Natural History Survey, Illinois River Biological Station, Havana, Il 62644. [3]Illinois Natural History Survey, University of Illinois at Urbana-Champaign, Champaign, Il 61820.

9:15–9:30 USING FOOD WEB MODELING TO DETERMINE EFFECTS OF INCREASED EXPLOITATION ON INVASIVE CARPS IN THE MIDDLE MISSISSIPPI RIVER

***Nicholas W. Kramer[1]**, Quinton E. Phelps[2], Clay L. Pierce[3], and Michael E. Colvin[4]. [1]Southeast Missouri State University, Department of Biology, Cape Girardeau, MO 63701. [2]Missouri Department of Conservation, Big Rivers and Wetlands Field Station, Jackson, MO 63755. [3]U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, Iowa 50011. [4]Mississippi State University, Department of Wildlife, Fisheries and Aquaculture Mississippi State, MS 39762.

9:30–10:00 AM: BREAK (Hotel Foyer)

SESSION II – CHANGING RIVERS: PAST, PRESENT AND FUTURE (Moderator: Gretchen Gerrish)

10:00–10:15 GEOMORPHIC DISCONTINUITIES WITHIN STREAM NETWORKS

Martin Thoms[1] and Murray Scown[1]. [1]University of New England, Australia

10:15-10:30 THE GENETIC DIVERSITY OF THE WESTERN PAINTED TURTLE AT A SUPER-FUND SITE: THE NAHANT MARSH DAVENPORT, IA

***Douglas R. Elliott[1]**, and Michael Romano[1]. [1]Western Illinois University Department of Biological Sciences, Macomb, IL 61455.

10:30–10:45 IMPACT OF LEGACY LEAD CONTAMINATION ON AN URBAN MARSH

Gretchen A. Gerrish[1,2], Colin Belby[2,3], Tisha King-Heiden[1,2], Suzanne Ryan[1,2], Trevor Cyphers[1,2,4,] John Sullivan[5]. [1]UW-La Crosse River Studies Center. [2]UW-La Crosse Biology Department. [3]UW-La Crosse Geography Department, La Crosse, WI 54601. [4]US Fish and Wildlife Survey Chicago, IL. [5]Wisconsin Department of Natural Resources.

10:45–11:00 STRATEGIES FOR MAXIMIZING STAKE PERFORMANCE: USING STORAGE, SOAKING, SCORING, AND AUXIN AS PRE-PLANTING TECHNIQUES FOR SANDBAR WILLOW (*SALIX EXIGUA*) STAKES

***Amber A. Miller-Adamany[1]**, Meredith A. Thomsen[1], and D. Tim Gerber[1]. [1] University of Wisconsin-La Crosse, La Crosse, WI 54601.

11:00–11:15 MULTI-TECHNIQUE INFERENCE OF ECOLOGICAL CHANGE INFERRED FROM HISTORIC MUSEUM COLLECTIONS OF FRESHWATER MUSSEL SHELLS

Andrea K. Fritts[1], Mark W. Fritts[1], Wendell R. Haag[2], Jason A. DeBoer[1], and Andrew F. Casper[1]. [1]Illinois Natural History Survey, Illinois River Biological Station, Havana, IL 62644, [2]Center for Bottomland Hardwoods Research, US Forest Service, Oxford, MS 38655.

11:15-11:30 SUSPENDED PARTICLE DYNAMICS IN POOL 19 OF THE UPPER MISSISSIPPI RIVER

***Amanda S. Milde**[1,2], William B. Richardson[1], Eric A. Strauss[2], James H. Larson[1], Jon M. Vallazza[1], and Brent C. Knights[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603, [2]Biology Department, University of Wisconsin-La Crosse, La Crosse, WI 54601

11:30–11:45 THE GREAT LAKES TO GULF OBSERVATORY - AN INTERACTIVE GEOSPATIAL APPLICATION FOCUSED ON NUTRIENTS IN THE MISSISSIPPI RIVER AND ITS TRIBUTARIES

Edward M. Kratschmer[1], Brock Angelo[2], Marcus Slavenas[2], Jason Votata[2], John Sloan[1], Isaac Chapman[3], Jong Lee[2], William Kruidenier[1], and Richard Warner[1]. [1]National Great Rivers Research and Education Center, East Alton, IL 62035. [2]National Center for Supercomputing Applications, University of Illinois Urbana-Champaign, Urbana, IL 61801.

11:45 AM - 1:15 PM: LUNCH (on your own)

12:30 - 1:15 PM: Informal working group on networking in the UMR: Linking researchers, educators, and outreach - open to all participants (lunch will not be provided – location TBA)

SESSION III – COMMUNITY STRUCTURE (Moderator: Michael Delong)

1:15–1:30 ARGH, THAR BE PATCHES IN THESE RIVERS

Michael D. Delong[1], William B. Richardson[2]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

1:30–1:45 DISTRIBUTION AND RELATIVE ABUNDANCE OF BRYOZOAN SPECIES IN THE UPPER MISSISSIPPI RIVER WATERSHED

***Hannah L. Mello[1]** and Gretchen A. Gerrish[1]. [1]University of Wisconsin-La Crosse, La Crosse, WI 54601.

1:45–2:00 SPATIAL AND TEMPORAL PATTERNS BETWEEN THE INVASIVE SNAIL *BITHYNIA TENTACULATA* AND SUBMERSED AQUATIC VEGETATION IN POOL 8 OF THE UPPER MISSISSIPPI RIVER

***Alicia M. Weeks[1,2]**, Nathan R. De Jager[1], Roger J. Haro[2],and Gregory J. Sandland[2]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602. [2]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

2:00–2:15 HABITAT PREFERENCES OF DEN LOCATIONS FOR THE NORTH AMERICAN RIVER OTTER (*LONTRA CANADENSIS*)

***Pikora, Shanna[1]** and Romano Susan[1]. [1]Western Illinois University-Quad Cities. Moline, IL. 61265.

2:15–2:30 RIVER OTTER DISTRIBUTION AND HABITAT USE WITHIN THE MISSISSIPPI NATIONAL RIVER AND RECREATION AREA

Allison Holdhusen[1]. [1]Mississippi National River and Recreation Area, National Park Service, Saint Paul, MN 55101.

2:30–2:45 GEOMORPHOLOGY, TRANSIENT STORAGE, AND PHOSPHORUS UPTAKE: LONGITUDINAL TRENDS IN A SPRING-FED STREAM

***Katie J. Bohrman**[1], and Eric A. Strauss[1]. [1]University of Wisconsin-La Crosse, La Crosse, WI 54601.

2:45-3:00 BAT MORTALITY BY SINGLE STANDING WIND TURBINES IN NORTHWESTERN ILLINOIS WITHIN THE UPPER MISSISSIPPI RIVER WATERSHED

***Lisa Davila[1]**, Hannah Helms[1], Amber Schorg[2], and Susan Romano[1]. [1]Department of Biological Sciences, Western Illinois University-Quad Cities, Moline, IL 61265. [2]U.S. Fish and Wildlife Service, Ecological Services Field Office, 1511 47th Ave. Moline, IL 61265.

3:00-3:30 PM: BREAK (Hotel Foyer)

SESSION IV – FISH ECOLOGY (Moderator: Mark Sandheinrich)

3:30–3:45 GUILD BASED HABITAT USE AND ENVIRONMENTAL DRIVER OF FISH COMMUNITY CHANGE IN THE UPPER MISSISSIPPI RIVER SYSTEM

***Christopher Schwinghamer[1]** and Quinton Phelps[2]. [1]Southeast Missouri State University. [2]Missouri Department of Conservation.

3:45–4:00 RATES OF ENDOCRINE DISRUPTION IN TWO COMMERCIAL FISHES ALONG A DOWNSTREAM GRADIENT OF THE ILLINOIS RIVER

***Madeleine M. VanMiddlesworth[1,2]**, Andrew F. Casper[1], Jason A. DeBoer[1], Mark W. Fritts[1], and Jeffrey M. Levengood[2]. [1] Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644. [2]Illinois Natural History Survey, Prairie Research Institute, University of Illinois-Urbana-Champaign, Champaign, IL 61801.

4:00–4:15 JUVENILE ASIAN CARP PREDATION ON THE LA GRANGE REACH, ILLINOIS RIVER

***Eli G. Lampo**[1], James T. Lamer[1], Brent Knights[2], Jon Vallazza[2], James H. Larson[2], Andrew Casper[3], Rich Pendleton[3], Levi Solomon[3] [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455; [2]U.S Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602, [3]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

4:15–4:30 POPULATION MONITORING OF ANCIENT SPORT FISHES IN THE MIDDLE MISSISSIPPI RIVER
Edward Culver[1], Benjamin Lubinski[1], and John Chick[1]. [1]Illinois Natural History Survey - Prairie Research Institute.

4:30-6:30 POSTER SESSION II WITH AUTHORS PRESENT (Hotel Foyer)

4:30-6:30 GENERAL CONSORTIUM MIXER (Hotel Foyer)

6:30-9:00 BANQUET – RADISSON BALLROOM A

Radisson Hotel – Ballroom B
Friday, 29 April 2016

7:50–8:00 AM: ANNOUNCEMENTS
Michelle Bartsch, MRRC President

SESSION V – FISH ECOLOGY II (Moderator: Andrew Casper)

8:00–8:15 GRASS CARP POPULATION DYNAMICS IN THE MIDDLE MISSISSIPPI RIVER
***Michael C. Wolf [1]** and Quinton E. Phelps [2]. [1] Southeast Missouri State University. [2] Missouri Department of Conservation.

8:15–8:30 ELUCIDATING THE MECHANISMS OF JUVENILE FISH RECRUITMENT IN THE MIDDLE MISSISSIPPI RIVER.
***Tyler D. Ham[1]**, Quinton E. Phelps[2]. [1]Southeast Missouri State University, Cape Girardeau, MO 63701. [2]Missouri Department of Conservation, Big Rivers and Wetlands Field Station, Jackson, MO 63755.

8:30–8:45 DREDGING IMPROVES THE CENTRARCHID FISHERIES OF LAKE WINONA, REACH 6, UPPER MISSISSIPPI RIVER
Jamie Hoisington[1] and **Neal Mundahl[1]**. [1]Department of Biology, Winona State University, Winona, MN 55987.

8:45–9:00 AN INVASIVE FISH DISPERSING AN INVASIVE AQUATIC PLANT IN A LARGE RIVER: A CAUTIONARY TALE OF WATER HYACINTH AND THE COMMON CARP FROM THE ILLINOIS RIVER
Jay A. VonBank[1,5], **Andrew F. Casper[2,5]**, Heath M. Hagy[1,5], Aaron P. Yetter[1,5], Sean E. Jenkins[5] and Jim T. Lamer[3,5]. [1]Forbes Biological Field Station, [2]Illinois River Biological Station, [3]Kibbe Biological Field Station, [4]Illinois Natural History Survey, University of Illinois Urbana-Champaign IL, [5]Dept. of Biology, Western Illinois University–Macomb IL.

9:00–9:15 FOLLOWING THE EDGE OF THE FLOOD: HABITAT USE OF LARVAL SILVER CARP IN THE UPPER MISSISSIPPI RIVER SYSTEM

John H. Chick[1], Carol Colaninno-Meeks[2], Autumn M. Beyer[1], Kelly B. Brown[1], Stephanie R. Goesmann[1], Tom Higgins[1], Erin N. Laute[1], Abigail T. Uehling[1], Lillian C. Ward[1]. [1]Illinois Natural History Survey, University of Illinois Urbana-Champaign, East Alton, IL 62024. [2]STEM Center, Southern Illinois University Edwardsville, Edwardsville, IL 62026.

9:15-9:30 BLUEGILL DIETS AND THE MILFOIL WEEVIL: IMPACTS ON BIOLOGICAL CONTROL OF EURASIAN WATER-MILFOIL IN WISCONSIN LAKES

Kristopher A. Maxson [1], John E. Havel [1], Susan E. Knight [2]. [1]Department of Biology, Missouri State University, Springfield, MO 65897. [2]Trout Lake Station, University of Wisconsin, Boulder Junction, WI 54512.

9:30–10:00 AM: BREAK (Hotel Foyer)

Session VI – ASSESSMENTS AND LONG-TERM MONITORING (Moderator: Molly Van Appledorn)

10:00–10:15 LINKING FLOOD INUNDATION MODELING, ECOSYSTEM STUDIES, AND ECOSYSTEM SERVICES ASSESSMENTS FOR IMPROVED RESEARCH AND MANAGEMENT OF FLOODPLAIN LANDSCAPES

Molly Van Appledorn[1], Nathan De Jager[1], Kris Johnson[2], Marie Peppler[3]. [1] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603. [2]The Nature Conservancy, Minneapolis, MN 55415. [3]U.S. Geological Survey, Office of Surface Water, Reston, VA 20192.

10:15–10:30 ASSESSING THE SUITABILITY OF LEVEE PROTECTED FLOODPLAIN AREAS FOR STRATEGIC RECONNECTION

Jonathan W.F. Remo[1], Ross J. Guida[2], and Silvia Secchi[1]. [1]Department of Geography and Environmental Resources, Southern Illinois University, Carbondale, IL 62901. [2]Environmental Resources and Policy Program, Southern Illinois University, Carbondale, IL 62901.

10:30–10:45 THE GREAT RIVERS ECOLOGICAL OBSERVATORY NETWORK (GREON) FOR MONITORING WATER QUALITY IN THE UPPER MISSISSIPPI RIVER BASIN

John J. Sloan[1], Ted Kratschmer[1], **Miles J. Corcoran[1],** John H. Chick[1,2]. [1]The National Great Rivers Research and Education Center, Lewis and Clark Community College, East Alton, IL 62024. [2]Illinois Natural History Survey/University of Illinois, East Alton, IL 62024.

10:45–11:00 TEMPORAL TRENDS IN HUMAN-RIVER DYNAMICS IN THE LOWER ILLINOIS RIVER VALLEY THROUGH INTERDISCIPLINARY RESEARCH: A SUMMARY OF THE NSF REU BRIDGING ARCHEOLOGY AND ECOLOGY

Carol Colaninno-Meeks[1], John H. Chick[2], Terrance J. Martin[3], Autumn M. Beyer[4], Kelly B. Brown[5], Curtis T. Dopson[6], Ariana Enzerink[7], Stephanie R. Goesmann[8], Tom Higgins[9], Nigel Q. Knutzen[10], Erin N. Laute[11], Paula M. Long[12], Paige L. Ottenfeld[13], Abigail T. Uehling[14], and Lillian C. Ward[15]. [1]STEM Center, Southern Illinois University Edwardsville, Edwardsville, IL 62026 , [2]Illinois Natural History Survey, University of Illinois Urbana-Champaign East Alton, IL 62024. [3]Illinois State Museum, Springfield, IL 62706. [4]Michigan State University, Department of Anthropology, East Lansing, MI 48824. [5]Veterans Curation Program, New South Associates, Augusta, GA 30907. [6]University of West Georgia, Department of Anthropology, Carrollton, GA 30118. [7]Oberlin College, Department of Anthropology and Department of Biology, Oberlin, OH 44074. [8]Blackburn College, Department of Biology, Carlinville, IL 62626. [9]Siena College, Department of Environmental Science, Albany, NY 12211. [10]Department of Anthropology, Southern Illinois University Edwardsville, Edwardsville, IL 62026. [11]Southeast Missouri State University, Department of Wildlife Conservation Biology, Cape Girardeau, MO 63701. [12]University of Central Arkansas, Department of Anthropology, Conway, AR 72035. [13]Tennessee Technological University, College of Arts and Sciences, Cookeville, TN 38505. [14]Hamilton College, Department of Biology, Clinton, NY 13323. [15]Aquinas College, Department of Biology, Grand Rapids, MI 49506.

11:15 AM-12:00 PM BUSINESS MEETING

12:00 PM-2:00 PM LUNCH AND RAFFLE

POSTER PRESENTATIONS - SESSION I RADISSON HOTEL WEDNESDAY APRIL 27, 2016

Poster Set Up 5:00 PM to 6:30 PM
Authors Present 7:30 PM to 9:00 PM
(Listing by topic, *Student presenters)

FISH ECOLOGY

1) INTERSEX CONDITION IN MALE LARGEMOUTH BASS, BLUEGILL, AND BLACK CRAPPIE FROM THE ILLINOIS RIVER WATERWAY

Mark W. Fritts [1], Andrea K. Fritts [1], Jason A. DeBoer [1], Richard M. Pendleton [1], Levi E. Solomon [1], T.D. VanMiddlesworth [1], and Andrew F. Casper [1]. [1] Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois-Urbana Champaign.

2) COMPARISON OF SPECIES DIVERSITY IN THE ILLINOIS RIVER THROUGHOUT A 2,000 YEAR TEMPORAL SPAN

***Curtis Dopson [1]**, Carol E. Colaninno [2], John H. Chick [3]. [1] University of West Georgia, Department of Anthropology, Carrollton, GA 30118. [2]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [3]Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

3) CHANGES IN LARGEMOUTH BASS POPULATIONS WITHIN THE LA GRANGE REACH OF THE ILLINOIS RIVER FROM 1993-2015

Jacob I. Huey[1], Rich M. Pendleton[1], Levi Solomon[1], and Andrew Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

4) COMMON CARP AGE AND GROWTH TRENDS FROM THE ILLINOIS RIVER

Ryan Ward[1], Madeleine VanMiddlesworth[1], Jason DeBoer[1], Rich Pendleton[1]. [1]INHS - Illinois River Biological Station.

5) ESTIMATING POPULATION SIZE OF SELECT INDICATOR FISH SPECIES AT THE NATURE CONSERVANCY'S EMIQUON NATURE PRESERVE PRIOR TO ILLINOIS RIVER RECONNECTION

Todd D. VanMiddlesworth[1], Jason A. DeBoer[1], Andrea K. Fritts[1], Mark W. Fritts[1], Doyn M. Kellerhals[1], Richard M. Pendleton[1], Levi E. Solomon[1], and Andrew F. Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

6**) A COMPARISON OF FISH COMMUNITIES IN CONTIGUOUS BACKWATER AND VEGETATED IMPOUNDED AREAS OF POOL 19, UPPER MISSISSIPPI RIVER**

***Eli G. Lampo[1]**, James T. Lamer[1], Brent Knights[2], Jon Vallazza[2], James H. Larson[2]. [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455. [2]U.S Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

7) ONTOGENETIC DIET SHIFTS OF BLUE CATFISH (*ICTALURUS FURCATUS*) AND FLATHEAD CATFISH (*PYLODICTIS OLIVARIS*)

***Ashley L Stanley [1]**, James T Lamer[1], and Mark W. Fritt[2]. [1] Kibbe Field Station, Western Illinois University. [2] Illinois River Biological Station, Illinois Natural History Survey.

8) VARIATION IN THE RELATIVE ABUNDANCE OF COMMON FISHES ACROSS ARCHEOLOGICAL AND MODERN TIME PERIODS.

***Paige L. Ottenfeld [2]**, Stevie Goesmann [1], Carol E. Colaninno [3], John H. Chick [4, 2]. [1] Blackburn College, Department of Biology, Carlinville, IL 62626. [2]Tennessee Technological University, College of Arts and Sciences, Cookeville, TN 38505. [3]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [4] Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

9) TRENDS IN THE POPULATIONS OF WHITE AND YELLOW BASS OVER 21 YEARS WITHIN THE ILLINOIS RIVER.

Jacob McQuaid[1], Rich Pendleton[1], Levi Solomon[1], and Andrew Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois.

CONTAMINANTS

10) HISTORICAL CONTAMINANTS IN THE MIXED AGRICULTURE AND URBAN USE CATFISH CREEK WATERSHED, IOWA, USA

***Wade M. Gibson[1]** and Adam R. Hoffman[1]. [1]Department of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

11) THE LEGACY OF LEAD SHOT IN MYRICK MARSH: ESTIMATING LEAD FLUX FROM EMERGENT CADDISFLY ADULTS AND ITS LONG TERM CONSEQUENCES

Roger Haro[1,2], Suzanne Ryan[2], Gretchen Gerrish[1,2], Colin Belby[1,3], and Jacob Ogorek[4]. [1]The River Studies Center, University of Wisconsin – La Crosse, La Crosse, WI 54601. [2]Department of Biology, University of Wisconsin – La Crosse, La Crosse, WI 54601. [3]Department of Geography and Earth Sciences, University of Wisconsin – La Crosse, La Crosse, WI 54601. [4]Wisconsin Water Science Center, USGS, Middleton, WI 53562.

12) MERCURY CONCENTRATIONS IN LARVAL DRAGONFLIES FROM STREAMS DRAINING DIFFERENT LAND COVER CONDITIONS IN THE BLACK RIVER WATERSHED, WI.

***Megan C. Hess[1]**, Roger J. Haro[1,2], and Mark B. Sandheinrich[1,2]. [1]University of Wisconsin - La Crosse, Biology Department, La Crosse, WI 54601. [2]River Studies Center, University of Wisconsin - La Crosse, La Crosse, WI 54601.

INVERTEBRATE ECOLOGY

13) ARE THERE INTERACTIONS BETWEEN BENTHIC INVERTEBRATES AND ZOOPLANKTON COMMUNITIES IN SLACKWATER HABITATS OF A FLOODPLAIN RIVER ECOSYSTEM?

***Trevor Bowers[1]**, and Michael D. Delong[1]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

14) INSECT DIVERSITY IN DIFFERENTLY MANAGED FORESTS IN DUBUQUE COUNTY, IOWA

***Jake M. Theis [1]**, David E. Koch[1]. [1]Dept. of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

AQUATIC AND TERRESTRIAL ASSESSMENT

15) A SURVEY FOR THE PRESENCE OF ANTIBIOTICS IN THE WATERS AND SOILS OF STREAMS SURROUNDING GUTTENBERG, DUBUQUE, AND BELLEVUE, IOWA

***Kayla Neff[1]**, Michael Kennedy[1], and Mark Sinton[1]. [1] Dept. of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

16) AN ASSESSMENT OF STORMWATER QUALITY IN AN URBANIZED WATERSHED

***Brittany A. Poynor[1]**, Tara M. Cullison[1], Kelsey Self[1], Michael Reisner[1], Kevin Geedey[1], Reuben Heine[1], and Tierney Brosius[1]. [1]Augustana College, Rock Island, IL 61201.

17) PHYSICAL HABITAT COMPLEXITY AS A DRIVER OF COMMUNITY STRUCTURE IN A FLOODPLAIN RIVER

***Briana M. Skufca[1]** and Michael D. Delong[1]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

18) UPPER MISSISSIPPI RIVER SYSTEM TOPOBATHY

Jenny L. Hanson[1], **Jayme M. Stone[1]**. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

19) A RIVER OF SAND: DREDGING, RECREATION AND COMMERCIAL NAVIGATION ON THE UMRS

Sara Strassman[1]. [1]Wisconsin Department of Natural Resources, La Crosse, WI 54601.

POSTER PRESENTATIONS – SESSION II RADISSON HOTEL THURSDAY APRIL 28, 2016

Poster Set Up 1:00 PM to 4:00 PM
Authors Present 4:30 PM to 6:30 PM
(Listing by Topic, *Student presenters)

INVERTEBRATE ECOLOGY

20) AN INVESTIGATION OF BUTTERFLY SPECIES DIVERSITY ALONG AN URBAN GRADIENT IN ROCK ISLAND/MOLINE, IL

***Kassandra D. Tyra[1],** Reisner, M[1]. [1]Augustana College, Rock Island, IL 61201.

21) EVALUATION OF CO_2 AS A DREISSENID MUSSEL CONTROL TOOL

Diane Waller[1], Michelle Bartsch[1], Matthew Barbour[1], Jeremy Wise[1], Todd Severson[1], and Riley Buley[1]. [1]USGS – Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

22) EFFECTS OF CO_2 ON NON-TARGET JUVENILE UNIONID MUSSELS (*LAMPSILIS SILIQUIODEA*)

Michelle Bartsch[1], Diane Waller[1], Matthew Barbour[1], Todd Severson[1], Jeremy Wise[1] and Riley Buley[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

FISH ECOLOGY

23) ASSESSING POTENTIAL FOOD WEB IMPACTS OF *HYPOPHTHALMICHTHYS* SPP. USING CARBON AND NITROGEN STABLE ISOTOPE ANALYSIS OF NATIVE PLANKTIVORES AMONG MAIN CHANNEL AND BACKWATER HABITATS OF THE ILLINOIS (LAGRANGE), MISSISSIPPI (POOLS 19 AND 2), AND ST. CROIX RIVERS.

Toben D. Lafrancois[1], Brent C. Knights[2], Byron N. Karns[3]. [1]Northland College, Ashland, WI 54806. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602. [3]St. Croix National Scenic Riverway, St. Croix Falls, WI 54024.

24) THE EVALUATION OF A COST-EFFECTIVE, DIGITAL APPROACH TO ESTIMATE FECUNDITY IN FRESHWATER FISHES

Rich Pendleton[1], Andrew Casper[1], Jason DeBoer[1], Andrea Fritts[1], Mark Fritts[1], Nikolai Klibansky[2], Levi Solomon[1], and T.D. VanMiddlesworth[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois-Urbana Champaign. [2]Southeast Fisheries Science Center, National Marine Fisheries Service, NOAA, Beaufort Lab.

25) EXAMINING *ICTALURUS* SPP. AND *AMEIURUS* SPP. SIZE DISTRIBUTION IN THE LOWER ILLINOIS RIVER OVER 2,000 YEARS

***Paula Long**[1], Abigail T. Uehling [2], Carol E. Colaninno [3], John H. Chick [4]. [1]University of Central Arkansas, Department of Anthropology, Conway, AR 72034. [2]Hamilton College, Department of Biology, Clinton, NY 13323. [3]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [4] Illinois Natural History Survey, University of Illinois Urbana-Champaign, East Alton, IL 62024.

26) MOVEMENT OF PADDLEFISH IN THE UPPER MISSISSIPPI RIVER

John L. Ethen[1], William A. Granholm[1], and **Joshua J. Lallaman[1]**. [1] Saint Mary's University of MN, Department of Biology, Winona, MN 55987.

27) RELATIONSHIP BETWEEN PHYSICAL HABITAT COMPLEXITY AND FISH COMMUNITY COMPOSITION BASED ON FEEDING GUILDS

***Alex V. Karan[1]** and Michael D. Delong[1]. [1] Large Rivers Study Center Biology Department Winona State University, Winona, MN 55987.

28) SHIFTS IN RELATIVE ABUNDANCE OF BACKWATER FISHES IN THE LOWER ILLINOIS RIVER VALLEY THROUGH MILLENNIA

***Nigel Knutzen[1]**, Lilian Ward[2], Carol E. Colaninno[3], John H. Chick[4]. [1]Southern Illinois University Edwardsville, Department of Anthropology, Edwardsville, IL 62025. [2]Aquinas College, Department of Biology, Grand Rapids, MI 49506. [3]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [4]Illinois Natural History Survey, University of Illinois Urbana-Champaign, East Alton, IL 62024.

29) QUANTIFICATION OF DAILY OTOLITH INCREMENTS IN YOUNG OF YEAR ASIAN CARP

***Emily A. Szott [1]**, James T. Lamer[1], James H. Larson[2], Brent Knights[2], John Vallazza[2], Levi Solomon[3], Rich Pendleton[3], and Andrew Casper[3]. [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455. [2]Upper Midwest Environmental Sciences Center, United States Geological Survey, La Crosse, WI 54603. [3]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

30) FISH SIZE WITHIN THE LOWER ILLINOIS AND UPPER MISSISSIPPI RIVER SYSTEMS

***Tom Higgins**[1], Ariana O. Enzerink[1], Carol E. Colaninno[2], John H. Chick[3]. [1]Oberlin College, Department of Anthropology and Department of Biology, Oberlin, OH 44074, [2]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704, [3]Illinois Natural History Survey, University of Illinois Urbana-Champaign, East Alton, IL 62024.

WILDLIFE ECOLOGY

31) COMMON SNAPPING TURTLE SPORTFISH MONITORING AND ASSESMENT IN ILLINOIS

***Katie E. Mainor[1]**, James T. Lamer PhD[1], Emily Szott[1], Mike McClelland[2]. [1]University Circle, Western Illinois University, Macomb IL, 61455. [2]Illinois Natural History Survey Havana, IL 62644.

32) LOOKING FOR BATS IN ALL THE RIGHT PLACES: SPATIAL PATTERNS AT EFFIGY MOUNDS NATIONAL MONUMENT

***Kayla McLaughlin[1]**, Francis Tillman[1], and Gerald L. Zuercher[1]. [1]Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001.

33) THE EFFECTS OF URBANIZATION ON AMPHIBIAN DIVERSITY

***Daniel J. Herrera[1]**, Megan Lipke[1]. [1]Augustana College Upper Mississippi Center.

34) COMPARISON OF RIVER TURTLE COMMUNITIES BETWEEN THE MISSISSIPPI RIVER AND A TRIBUTARY STREAM

***Anthony M Vorwald[1]**, David E Koch[1]. [1]Dept. of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

35) THE SPATIAL DISTRIBUTION AND DENSITY OF THE EMERALD ASH BORER INFESTATION IN ROCK ISLAND AND MOLINE ILL

***Kendall Smith[1]**, Victoria Lason[1], Morgan Conley[1], Tierney Brosius[1], Michael Reisner[1]. [1]Department of Environmental Studies, Augustana College. Upper Mississippi Center, Augustana College Rock Island, IL 61201.

NUTRIENTS AND SEDIMENTS

36) INFLUENCE OF URBAN DISTURBANCES, SOIL PROPERTIES, AND OTHER ABIOTIC AND BIOTIC FACTORS ON *L. MAACKII* INVASION OF REMNANT URBAN RIPARIAN HARDWOOD FOREST

***Taylor B. Johnson [1]**. [1]Upper Mississippi Center of Sustainable Communities, Augustana College, Rock Island, IL 61201.

37) EFFECTS OF BIOLOGICAL SOIL CRUSTS ON CHEMICAL AND PHYSICAL SOIL PROPERTIES IN A WISCONSIN SAND PRAIRIE

***Brittany Harried[1]**, Todd Osmundson[1], Tom Volk[1], Meredith Thomsen[1]. [1]Department of Biology, University of Wisconsin - La Crosse, La Crosse, WI 54601.

38) USING RECIRCULATING CHAMBERS TO MEASURE SUBSTRATE SPECIFIC PHOSPHORUS UPTAKE RATES IN A DRIFTLESS AREA STREAM

***Alisha M. Saley[1]** and Eric A. Strauss[1,2]. [1]University of Wisconsin-La Crosse, La Crosse, WI. [2]River Studies Center, La Crosse, WI.

39) WATER QUALITY AND MEIOFAUNA IN THE ROCK ISLAND WATERSHED

Sean Blais[1], ***Tayvian Johnson[1], *Suhaiba Mohiuddin[1]**, and Kevin Geedey[1]. [1]Augustana College, Rock Island, IL, 61201.

40) THE EFFECTS OF URBANIZATION ON LEAF BREAKDOWN RATES IN A ROCK ISLAND WATERSHED

***Laura Becker[1], *Kourtney Hix[1],** ***Jillian Jesperson[1]**, and Kevin Geedey[1]. [1]Augustana College, Rock Island, IL, 61201.

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

GEOMORPHOLOGY, TRANSIENT STORAGE, AND PHOSPHORUS UPTAKE: LONGITUDINAL TRENDS IN A SPRING-FED STREAM

***Katie J. Bohrman**[1], and Eric A. Strauss[1]. [1]University of Wisconsin-La Crosse, La Crosse, WI 54601.

Anthropogenic activities have increased nutrient loading in freshwater systems. Despite the abundance of research conducted on nutrient cycling, the role of low order streams in phosphorus retention is not well defined. Furthermore, intra-stream comparisons of phosphorus uptake in relation to geomorphology and storage area have yet to be made. This study hopes to fill in these gaps by allowing for a longitudinal, intra-stream comparison of phosphorus sequestration in relation to morphological stream characteristics. In the summer of 2015, a series of conservative and reactive tracer releases were conducted in eight reaches of Spring Coulee Creek, a Driftless Area stream in western Wisconsin. Phosphorus release data were analyzed with the breakthrough curve integration method to obtain phosphorus spiraling metrics (e.g., uptake length and areal uptake rate). The conservative tracer release data were then modeled using One-dimensional Transport with Inflow and Storage (OTIS), and OTIS-P software to provide values of hydrological parameters (e.g., discharge and transient storage) and channel characterization. The hydrological values, phosphorus spiraling metrics, and other physical measurements were compared across the eight reaches. Results from this analysis, and other similar studies, can help develop management practices aimed at limiting nutrient inputs to the Mississippi River.

Keywords: Phosphorus, stream, geomorphology, transient storage, nutrient cycling

AN INVASIVE FISH DISPERSING AN INVASIVE AQUATIC PLANT IN A LARGE RIVER: A CAUTIONARY TALE OF WATER HYACINTH AND THE COMMON CARP FROM THE ILLINOIS RIVER

Jay A. VonBank[1,5], **Andrew F. Casper[2,5]**, Heath M. Hagy[1,5], Aaron P. Yetter[1,5], Sean E. Jenkins[5] and Jim T. Lamer[3,5]. [1]Forbes Biological Field Station, [2]Illinois River Biological Station, [3]Kibbe Biological Field Station, [4]Illinois Natural History Survey, University of Illinois Urbana-Champaign IL, [5]Dept. of Biology, Western Illinois University –Macomb IL.

Water hyacinth (*Eichhornia crassipes*) is an invasive aquatic macrophyte that is prolific throughout the southern United States, is known from the Illinois River since the early 2000's, and was found in the Upper Mississippi River in 2015. We conducted aerial searches for water hyacinth and other beds of floating-leaved aquatic macrophytes along the entire upper Illinois River (i.e., Hennepin, IL to Joliet, IL) using aerial and boat surveys. We collected benthic core samples to determine prevalence of seed in the seed bank. We also collected common carp (*Cyprinus carpio*) which commonly ingest seeds while they forage and may potentially act as dispersal vectors for water hyacinth seed. Generally, aerial estimations of species identity,

species composition, and extent were all fairly accurate, but aerial estimates of bed size were inaccurate. Aerial observers were able to correctly identify water hyacinth aerially using unique visual signatures contrasting Illinois native aquatic flora. Water hyacinth standing biomass varied temporally and spatially, but it is unlikely that water hyacinth at current densities can restrict commercial navigation or degrade benthic, fish or waterfowl habitat due to low overall biomass and late temporal arrival into the system. Water hyacinth seeds were commonly detected in benthic samples at random locations through the reach, at locations where hyacinth beds had been reported in previous years, and underneath existing water hyacinth beds where they were most prevalent indicating that there is a strong potential for water hyacinth persistence and proliferation through the seed bank. Whole water hyacinth seeds were present in the digestive tracts of carp (14.1%; n = 92), suggesting that not all seeds are lost during ingestion and indicating the threat of post-expulsion dispersal to previously unoccupied areas.

Keywords: invasive, dispersal vectors, spatial ecology

FOLLOWING THE EDGE OF THE FLOOD: HABITAT USE OF LARVAL SILVER CARP IN THE UPPER MISSISSIPPI RIVER SYSTEM

John H. Chick[1], Carol Colaninno-Meeks[2], Autumn M. Beyer[1], Kelly B. Brown[1], Stephanie R. Goesmann[1], Tom Higgins[1], Erin N. Laute[1], Abigail T. Uehling[1], Lillian C. Ward[1]. [1]Illinois Natural History Survey, University of Illinois Urbana-Champaign, 1 Confluence Way, East Alton, IL 62024. [2]STEM Center, Southern Illinois University Edwardsville, Edwardsville, IL 62026.

Silver carp spawning occurs in rivers when water temperature is $\geq 18^0$C and there is a rise in the water level. Trends of increased water temperature and increased frequency and magnitude of flooding in the Upper Mississippi River System appear to be beneficial to the reproductive success and recruitment of silver carp. We examined the use of "edge of flood" habitats by larval silver carp during the extensive flooding that occurred in Pool 26 and the Middle Mississippi River during the summer of 2015. Sampling with small aquarium nets in shallow flood waters, we captured over 12,700 individual fishes from eight taxa. Over 12,000 of these individuals (> 95%) were silver carp larvae between 5 and 21 mm standard length. Peak catch rates occurred near the confluence of the Illinois and Mississippi rivers. This study suggests the affinity for larval silver carp to move with the edge of a flood has been under-appreciated. The high catch rates observed at the confluence of the Illinois and Mississippi rivers raises the question of whether this is a unique instance or whether other major river confluences will also be hot zones for larval silver carp.

Keywords: Silver Carp, Upper Mississippi River System, Larvae, Flooding

TEMPORAL TRENDS IN HUMAN-RIVER DYNAMICS IN THE LOWER ILLINOIS RIVER VALLEY THROUGH INTERDISCIPLINARY RESEARCH: A SUMMARY OF THE NSF REU BRIDGING ARCHEOLOGY AND ECOLOGY

Carol Colaninno-Meeks[1], John H. Chick[2], Terrance J. Martin[3], Autumn M. Beyer[4], Kelly B. Brown[5], Curtis T. Dopson[6], Ariana Enzerink[7], Stephanie R. Goesmann[8], Tom Higgins[9], Nigel Q. Knutzen[10], Erin N. Laute[11], Paula M. Long[12], Paige L. Ottenfeld[13], Abigail T. Uehling[14], and Lillian C. Ward[15]. [1]STEM Center, Southern Illinois University Edwardsville, Edwardsville, IL 62026 , [2]Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024. [3]Illinois State Museum, Springfield, IL 62706. [4]Michigan State University, Department of Anthropology, East Lansing, MI 48824. [5]Veterans Curation Program, New South Associates, Augusta, GA 30907. [6]University of West Georgia, Department of Anthropology, Carrollton, GA 30118. [7]Oberlin College, Department of Anthropology and Department of Biology, Oberlin, OH 44074. [8]Blackburn College, Department of Biology, Carlinville, IL 62626. [9]Siena College, Department of Environmental Science, Albany, NY 12211. [10]Department of Anthropology, Southern Illinois University Edwardsville, Edwardsville, IL 62026. [11]Southeast Missouri State University, Department of Wildlife Conservation Biology, Cape Girardeau, MO 63701. [12]University of Central Arkansas, Department of Anthropology, Conway, AR 72035. [13]Tennessee Technological University, College of Arts and Sciences, Cookeville, TN 38505. [14]Hamilton College, Department of Biology, Clinton, NY 13323. [15]Aquinas College, Department of Biology, Grand Rapids, MI 49506.

Archaeology and ecology can benefit greatly from interdisciplinary studies that integrate the methods, theory, and data from each discipline. Ecosystems today, and the organisms within them, have been shaped from millennia of human actions. Conversely, the trajectory of human culture and societies are influenced by the world people live in, including the plants and animals they depend upon. In the summer of 2015, undergraduate students of archeology and ecology engaged in truly interdisciplinary research exploring deep-time human-environmental interactions within the lower Illinois River Valley. Funded through the National Science Foundation Research Experience for Undergraduates program, these 10 students gained practical experiences in both the fields of archeology and ecology. The students learned archeological excavation methods, zooarcheological analysis, fish sampling methodology, data analysis, and scholarly writing. We review the research experiences of this program, results from their interdisciplinary research, and limitations encountered integrating archeological and ecological datasets. We discuss future directions for this research and offer suggestions to make archeological and ecological data more compatible.

Keywords: Interdisciplinary Research, Zooarchaeology, Aquatic Ecology, Undergraduate Research, Temporal Investigations

THE GREAT RIVERS ECOLOGICAL OBSERVATORY NETWORK (GREON) FOR MONITORING WATER QUALITY IN THE UPPER MISSISSIPPI RIVER BASIN

John J. Sloan[1], Ted Kratschmer[1], **Miles J. Corcoran[1],** John H. Chick[1,2]. [1]The National Great Rivers Research and Education Center, Lewis and Clark Community College, East Alton, IL 62024. [2]Illinois Natural History Survey/University of Illinois, East Alton, IL 62024.

The ability to continuously monitor water quality throughout the Mississippi River Basin is important for assessing nutrient and sediment transport and the ecological health of the river system. The National Great Rivers Research & Education Center has established a network of water quality monitoring buoys at strategic locations on the Mississippi River and its tributaries. The network has grown from a single buoy deployed in 2013 on the main stem of the Mississippi River near Saint Louis, Missouri during a historic flood event, to the 2015 deployment of five buoys on the Mississippi River from Lacrosse, Wisconsin to Cape Girardeau, Missouri, as well as two buoys in reservoirs on the Sangamon River and Kaskaskia River in Illinois. The GREON buoys are based on the YSI, Inc. Pontoon Platform for In-Situ Characterization of Environmental Systems (PISCES). The buoys include calibrated sensors that monitor a suite of water quality parameters including temperature, dissolved oxygen, specific conductance, turbidity, chlorophyll, blue-green algae, fluorescing dissolved organic matter, and nitrate. Additionally, one of the GREON buoys was fitted with a micro-fluidic phosphate analyzer capable of measuring orthophosphate in situ on a filtered (<10 µm) sample. For quality assurance purposes, data from the GREON units is compared to grab samples collected adjacent to each unit and analyzed in the laboratory using standard methods. Data from the GREON units is available through the Great Lakes to Gulf (GLTG) virtually observatory.

Keywords: Mississippi River, research applications, water quality, monitoring

POPULATION MONITORING OF ANCIENT SPORT FISHES IN THE MIDDLE MISSISSIPPI RIVER

Edward Culver[1], Benjamin Lubinski[1], and John Chick[1]. [1]Illinois Natural History Survey - Prairie Research Institute.

As part of the Long-Term Survey and Assessment of Large-River Fishes in Illinois, we have examined potential monitoring designs for ancient sport fishes (e.g. Shovelnose Sturgeon, Paddlefish) as well as main-channel fishes (e.g. Blue Catfish). We examined different combinations of two-, three-, and five-inch square mesh gill nets. Presently, we have collected data from 575 Shovelnose Sturgeon, including length and weight measurements as well as pectoral fin ray samples for aging analysis. Preliminary analysis of the catch per net-night data for the last three sampling seasons shows that Shovelnose Sturgeon CPUE in two-inch mesh gill nets was consistently the highest of the three mesh sizes. The mean length of sturgeon collected across all sampling types for the last three sampling seasons was 597 mm. Age analysis of Shovelnose Sturgeon revealed age ranges between three and 22 years. The average age of fish collected was similar across the three sampling seasons. Additional analysis will be

conducted to compare the population dynamics of our study compared to previous studies conducted prior to the closure of commercial fishing for Shovelnose Sturgeon in the Middle Mississippi River. Further study is required to determine more long-term population dynamics.

Keywords: sturgeon, Mississippi River, paddlefish, aging

BAT MORTALITY BY SINGLE STANDING WIND TURBINES IN NORTHWESTERN ILLINOIS WITHIN THE UPPER MISSISSIPPI RIVER WATERSHED

***Lisa Davila[1]**, Hannah Helms[1], Amber Schorg[2], and Susan Romano[1]. [1]Department of Biological Sciences, Western Illinois University-Quad Cities, Moline, IL 61265. [2]U.S. Fish and Wildlife Service, Ecological Services Field Office, 1511 47th Ave. Moline, IL 61265.

While the increase in wind energy has greatly reduced the use of fossil fuels, there have also been major negative impacts on migratory tree bat populations. Species often impacted by wind farms include the hoary bat (*Lasiurus cinereus*), the eastern red bat (*Lasiurus borealis*) and the silver-haired bat (*Lasionycteris noctivagans*). Previous research indicates that wing morphology and bat body size do not allow evasive maneuvers to avoid wind turbine blades. While the exact nature of these occurrences is still not clear, previous research indicates that higher rates of mortality occur during seasonal migrations when they are most likely to encounter wind farms. Our study focused on four single-standing turbines found in Erie, IL, two in Geneseo, IL, and Sherrard, IL. We used searcher efficiency trials, carcass removal trials, and searched for dead bat carcasses within a 48m radius of the turbine base to determine frequency of bat mortality each week from 6/8/2015 to 8/28/2015 (summer roosting season) and 9/1/2015 to 10/31/2015 (fall migration period). Dead bats located within the circular plot were marked with GPS, and species were identified. Anabat acoustic detectors were used to determine species present in the surrounding habitat. Average wind direction and speed (NOAA) and distance to nearest forested habitat (ArcGIS, point to polygon) were modeled using multiple regression. Thirty-three carcasses were found at the sites, increasing in August, during the summer (6/8/2015 to 8/28/2015) and an additional 10 carcasses were found during the fall migration season (9/1/2015 to 10/31/2015). Our results indicated that increasing average wind speed, and the interaction between wind speed and date, has a significant impact on bat mortality near single standing wind turbines. Date was important, indicating an increase in mortality in late summer and fall during the migration period. Our research illustrates that the increased passage of bat species during the fall migration, particularly during high wind, causes an increase bat mortality. Bat carcasses were found on sampling days where maximum wind speeds of 12.52m/s were present the day before, and 8.94m/s on the sampling day. Wind turbines are typically set to function only during high wind speeds. Bats of this region typically fly during wind speeds averaging no more than 8m/s, so passage of bat species during high wind was not expected.

Keywords: migratory tree bats, wind turbines, mortality rates, searcher efficiency, habitat

BIOTIC RESPONSE TO THE ESTABLISHMENT AND EXPANSION OF ASIAN CARP IN THE LOWER ILLINOIS RIVER

Jason DeBoer[1], Mark Fritts[1], Daniel Gibson-Reinemer[1], Collin Hinz, Doyn Kellerhalls[1], Richard Pendleton[1], Levi Solomon[1], and Andrew Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

As a heavily modified river system that connects the Mississippi River watershed to the Great Lakes watershed, the Illinois River is a conduit for the movement of invasive species between watersheds. The most-recent – and perhaps most-feared – invasives are Asian carps, which threaten the Great Lakes themselves, and countless highly productive miles of connected rivers as well. In the 1950s, Illinois Natural History Survey scientists initiated a standardized electrofishing sampling program (Long-Term ElectroFishing - LTEF) on the Illinois River Waterway (IRW). The Upper Mississippi River Restoration Program's Long Term Resource Monitoring (LTRM) element combines environmental monitoring, research, systemic data acquisition, and modeling to provide a solid scientific foundation for its partners in the Upper Mississippi River System. Using the unparalleled spatio-temporal record of the LTEF and LTRM programs in Illinois, we present an analysis of ongoing large-scale datasets, including ebbs and flows in Asian carp CPUE, condition, and chronic effects on the fish, zooplankton, and phytoplankton communities. These programs provides biotic community data prior to the invasion and at every step as it happens. Our objective is to provide a better understanding of how Asian carps have affected biotic communities in the lower Illinois River. We believe these findings provide indications of how Asian carp populations can affect native biota in novel habitats.

Keywords: Asian carp, invasive, river ecology, fisheries ecology

ARGH, THAR BE PATCHES IN THESE RIVERS

Michael D. Delong[1], William B. Richardson[2]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

The physical and biological characteristics of riverine landscapes are organized through the interaction of hydrological, geomorphological, and ecological processes. These processes work together as the fundamental drivers of patches of different spatial and temporal scales across riverine landscapes. Patches of biological entities or processes, are often readily apparent within these landscapes – such as the location of different species of plants across the floodplain, "hot" and "cold" spots of primary productivity, and the composition of communities. Discerning the hydrological and geomorphological character of patches at first glance can be challenging. Discrimination of these attributes can, however, be readily accomplished through quantification of short- and long-term temporal patterns of flow and the quantification and spatial arrangement of geomorphic features. This presentation uses zooplankton community composition across different habitats of the Upper Mississippi River between Winona, MN and Trempealeau, WI, as an example of patchiness within a riverine landscape. Data are from a study conducted 2009

– 2011 where zooplankton samples were taken from a series of off-channel and channel sites. Data presented depict sites during a period of hydrological stability (July 2009). nMDS linked with cluster analysis demonstrated that zooplankton communities remained distinctive at 60% similarity within both sites and habitat types, including channels. Multivariate dispersion, a measure of the extent of variability across multivariable data sets, also revealed that community composition varied both within each habitat and across sites. This variability across both sites and habitat types further emphasizes that community composition is organized within each site in response to physical, hydrological, and ecological attributes that are distinctive to the patch in which they occur. Even channels, where samples were collected in the thalweg, exhibit distinctive patch characteristics expressed as variation in physical and ecological attributes. A critical determinant of the organization of these patches in space and time was stability of discharge and distance of site from the main channel (e.g., level of hydrological connectivity). It is important to note, that these conditions are not necessary in the establishment of patches. These patches persist under conditions of high hydrological variability. Under these conditions though, the spatial and temporal dynamics of flow change lead to a shift in the arrangement of patches and concomitant change in ecological organization. This further emphasizes the dynamic nature of patch organization in rivers is concordance with the known dynamic nature of riverine landscapes.

Keywords: heterogeneity, interdisciplinary science, hydrology, geomorphology, ecology

THE GENETIC DIVERSITY OF THE WESTERN PAINTED TURTLE AT A SUPER-FUND SITE: THE NAHANT MARSH DAVENPORT, IA

***Douglas R. Elliott[1]**, and Michael Romano[1]. [1]Western Illinois University Department of Biological Sciences, Macomb, IL 61455.

The Nahant Marsh is a reclaimed wetland and EPA Superfund site in Davenport, IA. Located adjacent to the Mississippi River, it provides habitat to different turtle species including the threatened Blanding's Turtle, *Emydoidea blandingii*, and the more common Western Painted Turtle, *Chrysemys picta*. Between 1969 and 1995 the Davenport Trap and Gun Club deposited an average of 9 tons of lead shot onto the property annually. Although the EPA performed a site cleanup in 1999, lead possibly persists at subtly harmful levels that are affecting the marsh's communities. As of 2004, the site met EPA research station standards for all contaminants except lead. Recently, mark-recapture studies have been performed to monitor Nahant's turtles. Data show that the number of individuals has increased for every turtle species present. In order to determine the possible effects lead had on turtles, the genetic structure of one species, *C. picta*, was characterized utilizing microsatellite DNA loci. Through our own mark-recapture efforts, we collected tissue samples from Western Painted Turtles at Nahant Marsh (n = 33) and two other regional wetlands without a history of heavy-metal pollution: Milan Bottoms Wildlife Refuge, Milan IL (n = 24) and the Odessa Wildlife Management Area (ODMA), Wapello, IA (n = 27). DNA was extracted and seven microsatellite DNA loci were amplified by polymerase chain reaction according to procedures developed by King and Julian (2004). A LiCor 4300 DNA Analyzer was used to quantify microsatellite DNA alleles. Genotypic data from a

preliminary sample of four loci from Nahant Marsh (n = 15), Milan Bottoms (n = 21) and ODMA (n = 14) were imported into the GenAlex software package to analyze relationships among subpopulations. All populations showed high levels of inbreeding with Nahant showing the highest level: ODMA (F = 0.484, se = 0.140), Milan Bottoms (F = 0.461, se = 0.223), and Nahant Marsh (F = 0.502, se = 0.208). Analysis of Molecular Variance indicated significant inbreeding levels as measured by F-statistics (Fis = 0.617, P = 0.001). Nahant Marsh turtles also showed significant divergence from Milan Bottom animals located just 6.3 miles away (Fst = 0.042, P = 0.001). Nei Distance between Nahant Marsh and Milan Bottoms (DN = 0.484) was far larger than the distance between ODMA and Milan Bottoms (DN = 0.299) despite a physical distance of 58 miles between the latter two. From these preliminary data, the *C. picta* subpopulation at Nahant Marsh has been deeply altered relative to the two comparison populations.

Keywords: Microsatellite DNA, Genetic Diversity, Wetland Ecosystem, Superfund Cleanup

MULTI-TECHNIQUE INFERENCE OF ECOLOGICAL CHANGE INFERRED FROM HISTORIC MUSEUM COLLECTIONS OF FRESHWATER MUSSEL SHELLS

Andrea K. Fritts[1], Mark W. Fritts[1], Wendell R. Haag[2], Jason A. DeBoer[1], and Andrew F. Casper[1]. [1]Illinois Natural History Survey, Illinois River Biological Station, Havana, IL 62644, [2]Center for Bottomland Hardwoods Research, US Forest Service, Oxford, MS 38655.

The Illinois River Waterway was substantially altered during the 20th century, and freshwater mussel species were affected by many of these changes. We used sclerochronology and stable isotope techniques to evaluate changes in age-and-growth patterns and nutrient sources for two mussel species collected from the Illinois River near Havana, IL in surveys conducted from 1894-2013 and specimens from archaeological collections assumed >1000 years old. Our von Bertalanffy analyses indicated that modern animals are growing at a 50-100% greater rate and reaching a maximum size substantially larger than their historic counterparts. Stable isotope analyses showed substantial enrichment in both δ13C and δ15N through the middle of the 20th century, but a shift back towards historic conditions was observed in specimens collected in 2013. These alterations in growth patterns and isotopic signatures are likely attributable to the influx of nutrient pollution that increased in the Illinois River during the 20th century.

Keywords: freshwater mussel growth, sclerochronology, historical ecology, eutrophication, isotopes

IMPACT OF LEGACY LEAD CONTAMINATION ON AN URBAN MARSH

Gretchen A. Gerrish[1,2], Colin Belby[2,3], Tisha King-Heiden[1,2], Suzanne Ryan[1,2], Trevor Cyphers[1,2,4,] John Sullivan[5]. [1]UW-La Crosse River Studies Center. [2]UW-La Crosse Biology Department. [3]UW-La Crosse Geography Department, La Crosse, WI 54601. [4]US Fish and Wildlife Survey Chicago, IL. [5]Wisconsin Department of Natural Resources.

Historically, trap shooting ranges commonly occurred over waterbodies throughout the Mississippi River watershed. Lead shot was used on many trap ranges until 1991 when it was banned due to evidence that waterfowl mortality could occur with ingestion of even a small number of pellets. While trap shooting practices have changed, the historical deposition of lead has caused accumulation of this heavy metal contaminant in sediments of localized regions. The La Crosse River Marsh, an urban wetland environment, received large amounts of lead shot from the 1930's until 1963 when members of the La Cross Gun Club actively shot trap over the southern region of the marsh. While the sediment contains high concentrations of lead, the contamination is relatively localized in the deposition region. Our data show that lead is transferring into the water and food web (aquatic plants, invertebrates and fishes) of the marsh at low concentrations. In addition, a portion of lead is leaving the marsh with the emergent insects each year. While lead is present in organisms at multiple trophic levels, minimal toxicological responses are shown in invertebrates or fishes.

Keywords: lead contamination, marsh, mobilization

ELUCIDATING THE MECHANISMS OF JUVENILE FISH RECRUITMENT IN THE MIDDLE MISSISSIPPI RIVER.

***Tyler D. Ham[1]**, Quinton E. Phelps[2]. [1]Southeast Missouri State University, Cape Girardeau, MO 63701. [2]Missouri Department of Conservation, Big Rivers and Wetlands Field Station, Jackson, MO 63755.

Spatial and temporal fluctuation in abundance is ubiquitous amongst animal populations. This fact is driven by variable recruitment, growth, and mortality driving shifts in populations. Numerous studies have sought to elucidate these processes in both terrestrial and aquatic ecosystems to varying degrees of success. Abiotic and biotic factors operate at multiple spatial scales and interact in complex ways, creating complicated answers to important questions. The purpose of this study was to elucidate the mechanisms underlying recruitment of juvenile fish in the Middle Mississippi River. To do this, we utilized a regression residual analysis on long-term data to assess year-class strength for ten species from 1993-2014. From this analysis, we determined that species-specific recruitment patterns correlate with seasonal variations in both abiotic and biotic factors. More specifically, water temperature, discharge, and precipitation had the greatest effect on recruitment patterns in the Middle Mississippi River. From this study we can then begin to predict year-class strength in various species from year-to-year. This is useful not only to biologists but also to commercial and recreational anglers who use the Middle Mississippi.

Keywords: Recruitment, Population dynamics, Middle Mississippi River, Year-class strength, Residual analysis

RIVER OTTER DISTRIBUTION AND HABITAT USE WITHIN THE MISSISSIPPI NATIONAL RIVER AND RECREATION AREA

Allison Holdhusen[1]. [1]Mississippi National River and Recreation Area, National Park Service, Saint Paul, MN 55101.

River otters (*Lontra canadensis*) are charismatic, apex predators, that were largely extirpated from the Upper Mississippi River by the early twentieth century. Local otter populations have since rebounded due to sustainable harvest regulations, habitat and water quality improvements and reintroduction efforts in Minnesota. Otter sightings have become increasingly common in the Twin Cities Metro Area, inciting public and scientific interest to better understand this indicator species and their linkages to the greater Mississippi River ecosystem. Beginning in 2009, the National Park Service teamed with local partners and volunteers to determine otter distribution and habitat use within the Mississippi National River and Recreation Area. Baseline studies led to the development of a low-cost, low effort occupancy monitoring program for river otter within the park, while fostering a public connection to urban wildlife and river stewardship.

Keywords: river otter, National Park, wildlife

USING FOOD WEB MODELING TO DETERMINE EFFECTS OF INCREASED EXPLOITATION ON INVASIVE CARPS IN THE MIDDLE MISSISSIPPI RIVER

***Nicholas W. Kramer[1]**, Quinton E. Phelps[2], Clay L. Pierce[3], and Michael E. Colvin[4]. [1] Southeast Missouri State University, Department of Biology 1 University Plaza, Cape Girardeau, MO 63701. [2] Missouri Department of Conservation, Big Rivers and Wetlands Field Station 3815 E. Jackson Blvd, Jackson, MO 63755. [3]U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University 11 Science II, Ames, IA 50011. [4]Mississippi State University, Department of Wildlife, Fisheries and Aquaculture Mississippi State, MS 39762.

Beginning with the inception of fisheries management in North America, nonnative fish species have been introduced to new waters with the goal of enhancing existing populations. Many of these changes have led to unanticipated, deleterious consequences. This has led to large scale fish removal efforts to combat the negative impacts of invasive fishes such as the Common Carp, Grass Carp and Silver and Bighead Carps. The objective of this study was to determine the amount of harvest required to control these invasive carps in a large Midwestern U.S. river system and its impact on remaining fish groups. We developed a mass balance trophic model of the Middle Mississippi River near Cape Girardeau, MO using Ecopath with Ecosim software (EwE, v. 6.4). In doing so, we developed biomass, production, consumption and diet composition estimates for 35 fish groups using Long Term Research Monitoring Program data for this location. Using the Ecosim component of the software we then modeled increasing amounts of harvest of invasive carps from 5-100% of their initial biomass to determine whether the removal of these nuisance species would either benefit or hinder other species. Common Carp and Grass Carp were more susceptible to increased harvest with populations becoming

nonexistent with increased exploitation however, twice as much effort is needed before Silver Carp and Bighead Carp showed signs of being overfished. The remaining fish groups exhibited increases in relative biomass with the varying amounts of carp harvest while others, such as the Gar spp. or Moronids, showed decreases in relative biomass due to the high composition of invasive carps in their diet. Ultimately, this information can be used by river managers and commercial fisheries coordinators to evaluate management policies promoting the removal of these species from our waters, resulting in enhanced populations of native fish species.

Keywords: Ecopath with Ecosim, Asian Carp, Common Carp, Grass Carp, Mississippi River

THE GREAT LAKES TO GULF OBSERVATORY - AN INTERACTIVE GEOSPATIAL APPLICATION FOCUSED ON NUTRIENTS IN THE MISSISSIPPI RIVER AND ITS TRIBUTARIES

Edward M. Kratschmer[1], Brock Angelo[2], Marcus Slavenas[2], Jason Votata[2], John Sloan[1], Isaac Chapman[3], Jong Lee[2], William Kruidenier[1], and Richard Warner[1]. [1]National Great Rivers Research and Education Center, East Alton, IL 62035. [2]National Center for Supercomputing Applications, University of Illinois Urbana-Champaign, Urbana, IL 61801.

The Great Lakes to Gulf Observatory (GLTG), www.greatlakestogulf.org, is an interactive geospatial application that integrates water quality data from multiple sources to better facilitate analysis and ultimately, knowledge of nutrient pollution, large river ecology and water quality conditions in the Mississippi River watershed. The GLTG's web-based application allows users to dynamically browse, search for and visualize water quality information on the Mississippi River and its tributaries. The application uses a combination of different respected data sources including long-term historical datasets and continuous real time sensors, providing the users with a better picture of water quality in the watershed. Meant to add value to users of existing datasets and projects, the application's features, visualizations and design allow researchers, communities, and decision makers to better understand nutrient inputs and loads, expedite data-to-knowledge-to policy connections, enhance risk management decisions, empower emergency response and inform long-term strategic planning. With the first phase of the project focused on nutrient pollution, the application and its infrastructure is relevant to state nutrient reduction strategies, watershed planning efforts and focused watershed initiatives. Led by the National Great Rivers Research and Education Center, data integration and visualization occurs within a cyber-infrastructure framework constructed in collaboration with the National Center for Supercomputing Applications (NCSA) and the Illinois-Indiana Sea Grant Program (IISG) at the University of Illinois.

Keywords: nutrients, geospatial, website, outreach, monitoring

JUVENILE ASIAN CARP PREDATION ON THE LA GRANGE REACH, ILLINOIS RIVER

***Eli G. Lampo**[1],James T. Lamer[1], Brent Knights[2], Jon Vallazza[2], James H. Larson[2], Andrew Casper[3], Rich Pendleton[3], Levi Solomon[3] [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455; [2]U.S Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602, [3]Illinois River Biological Station, Illinois Natural History Survey, Havana Field Office, Illinois Department of Natural Resources, Havana, IL 62644.

In 2014, a large Asian carp spawning event in the La Grange reach of the Illinois River produced an abundance of juvenile silver carp in 2015. This provided the opportunity to investigate their use as forage for native piscivorous fishes and the size structure of fish utilizing this resource. We collected fishes from contiguous backwaters and tributaries on the La Grange Reach of the Illinois River using pulsed DC- electrofishing from June through November, 2015. Diets were removed for analysis from all native piscivorous fishes during runs when young Asian carp were detected. Diet components were identified, enumerated, and weighed by taxa. Asian carp ≤250 mm were collected to validate age and build a length vs. pharyngeal teeth regression as well as a length vs. masticating pad regression. The presence of silver carp pharyngeal teeth and masticating pads in the diets were used to confirm identification and allowed us to estimate silver carp length. Silver carp were predominantly found in the diets of largemouth bass (25/222, 11%), white bass (6/56, 10%), and shortnose gar (6/30, 20%). We estimated silver carp lengths found in the predators diets, and determined that there was significant relationship between the size of largemouth bass and the size of silver carp they consumed (p=0.0001). Identifying species and size of native predators able to utilize this resource provides insight into natural biological management of this invasive species.

Keywords: Silver Carp, Invasive Species, Diet Study, Illinois River, Native Predators

DOCUMENTATION OF ASIAN CARP REPRODUCTION ABOVE LOCK AND DAM 19 ON THE MISSISSIPPI RIVER

James H. Larson[1], Brent C. Knights[1], S. Grace McCalla[1], Emy Monroe[2], Maren Tuttle-Lau[2], Duane Chapman[3], Amy George[3], Jon M. Vallazza[1], Jon Amberg[1]. [1] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI [2] U.S. Fish and Wildlife Service, Whitney Genetics Lab, Onalaska, WI [3] U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO.

Bighead Carp, Silver Carp and Grass Carp (collectively Asian carp) were introduced to North America in the 1960s and 70s and have been established in the lower Mississippi River basin for many years. In the upper Mississippi River, these species have not been previously shown to spawn above lock and dam 22 (near Saverton, MO). In 2013 and 2014, we sampled ichthyoplankton at 18 locations in the main stem of the upper Mississippi River from lock and dam 19 to lock and dam 9 and in 4 tributary rivers (the Des Moines, Skunk, Iowa and Wisconsin Rivers). We identified eggs and larvae using morphological techniques and then

used genetic sequences to confirm species identity. The spawning events we observed often included more than one species and in a few cases included eggs that must have been derived from more than one upstream spawning event. The upstream-most captures of genetically confirmed Silver, Bighead and Grass Carp eggs or immediately post-hatch larvae were all in pool 16. At the observed water temperatures, these individuals were likely developing for between 8-35 hours prior to collection. As has been observed elsewhere, no eggs or larvae were collected prior to water temperature reaching 17°C and discharge was usually high when eggs or larvae were observed. We also found that morphological screening methods alone are insufficient to identify Asian carp eggs in locations where Asian carp make up a small portion of the population and suggest the use of genetic sequences to confirm species identity.

Keywords: Asian carp, Bighead Carp, Silver Carp, Grass Carp, spawning

ASSESSING MOVEMENT OF ADULT SILVER CARP AND BIGHEAD CARP IN THE UPPER ILLINOIS WATERWAY SYSTEM USING GPS SATELLITE AND RADIO TELEMETRY

***Andrew T. Mathis[1]**, James T. Lamer[1], Brent Knights[2], and Kevin Irons[3]. [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603. [3]Illinois Department of Natural Resources, Springfield, IL 62702.

Invasive silver carp and bighead carp have established populations throughout the Illinois River. Efforts to prevent invasion into the Great Lakes rely on a comprehensive monitoring program. Despite a wealth of information on Asian carp movement, a finer-scale approach to understand real-time movements and habitat use would strengthen management efforts. We are testing GPS tags to determine patterns of movement, identify potential feeding and spawning areas, and inform commercial removal efforts in the Upper Illinois River. To optimize and determine the feasibility of this technology, data logging tags (manually tracked with radio telemetry) were tethered to bighead and silver carp species in raceway and field experiments. Seven of fifteen field-deployed tags have been recovered and have returned 1,461 individual waypoints. We have demonstrated the use of this technology to monitor Asian carp and will begin testing remotely-accessed, real-time satellite-linked prototypes in 2016. Fine-scale accuracies and fast acquisition speeds make this an ideal tool, and is the first use of GPS technology to track fish in riverine systems.

Keywords: Invasive Species, Asian Carp, Illinois River, Radio Telemetry, GPS

BLUEGILL DIETS AND THE MILFOIL WEEVIL: IMPACTS ON BIOLOGICAL CONTROL OF EURASIAN WATER-MILFOIL IN WISCONSIN LAKES

Kristopher A. Maxson[1], John E. Havel[1], Susan E. Knight[2]. [1]Department of Biology, Missouri State University, Springfield, MO 65897. [2]Trout Lake Station, University of Wisconsin, Boulder Junction, WI 54512.

Eurasian water-milfoil (*Myriophyllum spicatum L.,* henceforth "EWM") is the most heavily managed nuisance submersed aquatic plant in the United States. EWM's rapid spring growth and formation of dense surface mats inhibits native macrophyte communities, serves as poor -quality habitat for fish and macroinvertebrates, impacts recreation, and can clog water supply infrastructure. EWM invasions result in economic losses to revenues associated with recreational activities, decreased property values, and the cost of control. The milfoil weevil (*Euhrychiopsis lecontei,* Dietz*)* has been associated with EWM declines in several states, though natural weevil densities are generally too small to effect control. Augmentative biocontrol has had varied success. Fish predation may be a primary factor influencing weevil populations. Weevils were augmented in 2 of 4 EWM beds in each of 4 northern Wisconsin lakes in summer 2013. To assess fish feeding habits and preference for particular prey items, we collected invertebrates associated with EWM (150 environmental samples) plus 442 diet samples from bluegill sunfish (*Lepomis macrochirus,* Rafinesque) in the EWM beds. Captured bluegill ranged in size from 37 to 200 mm (mean 106 mm). A total of 40 invertebrate taxa were identified from diets and environmental samples. Overall, chironomids and oligochaetes were the dominant invertebrates associated with plants, while chironomids and Daphnia spp. constituted up to 27.2% and 24.0% of the fish diets, respectively. When compared to prey availability in the environment, bluegill appeared to avoid littoral cladoceran species, oligochaetes, and gastropods while preferring pelagic cladoceran species, in particular Daphnia spp. Milfoil weevils were rare in the diets, occurring in 2.9% of diet samples examined. Weevil larvae were preyed upon more frequently than adults (94.2% of weevils consumed) and sometimes occurred in high numbers within single diet samples. Since the larval stage contributes the most to EWM damage, selective predation on this stage may limit its use as a control agent.

Keywords: Eurasian water-milfoil, milfoil weevil, biological control, bluegill, diet

DISTRIBUTION AND RELATIVE ABUNDANCE OF BRYOZOAN SPECIES IN THE UPPER MISSISSIPPI RIVER WATERSHED

***Hannah L. Mello[1]** and Gretchen A. Gerrish[1]. [1]University of Wisconsin-La Crosse, La Crosse, WI 54601.

The Mississippi River is an ecologically, economically, and socially valuable system that undergoes constant change, notably through agriculture, irrigation, and damming. Physical and chemical factors within these habitats affect food availability and habitat sustainability for existing native species. Disturbances in aquatic systems allow for the establishment of non-native species and contribute to the further change to the ecosystem. Changes in precipitation and temperature also impact species assemblages in aquatic ecosystems. Bryozoans have a relatively unexplored distribution in the Upper Mississippi River watershed. Establishing research to map and understand bryozoan species distribution across habitat types and latitudes in the Upper Mississippi River watershed will help lay the groundwork for understanding how flow patterns, changing water usage, and changes in temperature affect distribution and abundance of both native and invasive bryozoan species. In my research, I provide and

comprehensive distribution of bryozoan species within the Upper Mississippi River watershed by determining the relative abundance of species among five habitat types: river main channels, backwater areas, marshes, lakes, and vernal pools. I also determine possible water chemistry requirements for each species.

Keywords: Bryozoans, diversity, distribution

SUSPENDED PARTICLE DYNAMICS IN POOL 19 OF THE UPPER MISSISSIPPI RIVER

***Amanda S. Milde**[1,2], William B. Richardson[1], Eric A. Strauss[2], James H. Larson[1], Jon M. Vallazza[1], and Brent C. Knights[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603, [2]Biology Department, University of Wisconsin – La Crosse, La Crosse, WI 54601

Suspended particles in large rivers are essential in channel morphology, energy flow, nutrient cycling, and represent the primary food source for filter-feeding organisms. Thus, the quantity and quality of suspended particles is important. The Upper Mississippi River (UMR) is a large, floodplain river that exhibits pronounced spatio-temporal variation in environmental conditions and biota providing an ideal environment for investigating suspended particle dynamics in large river ecosystems. Questions addressed were: 1) How do suspended particle characteristics vary temporally and spatially? And 2) What environmental variables have the strongest association with particle characteristics? Water sampling was conducted in June, August, and September 2013 and 2014 in Navigation Pool 19 of the UMR. Particles 53 – 300 µm in diameter were enumerated and measured for size and shape characteristics using a FlowCAM particle imaging system and water variables were analyzed according to standard methods. Suspended particle characteristics varied considerably over time and among aquatic habitats; and were strongly associated with discharge, nitrate/nitrite (NO3-), and soluble reactive phosphorous (SRP) concentrations. Particle characteristics in backwaters followed a trajectory distinct from other habitats likely due to reduced hydrologic connectivity and higher biotic production. Relatively higher proportions of phytoplankton, zooplankton, and detritus were seen in FlowCAM images during low discharge and concurrently with increases in relative chlorophyll, volatile suspended solids, and total phosphorous concentrations, as well as decreases in NO3- and SRP concentrations. Examining suspended particle dynamics in the UMR provides insight into the complex interactions between river flow, geomorphology, and nutrients as drivers of suspended particle quantity and quality in large floodplain rivers.

STRATEGIES FOR MAXIMIZING STAKE PERFORMANCE: USING STORAGE, SOAKING, SCORING, AND AUXIN AS PRE-PLANTING TECHNIQUES FOR SANDBAR WILLOW (*SALIX EXIGUA*) STAKES

***Amber A. Miller-Adamany[1]**, Meredith A. Thomsen[1], and D. Tim Gerber[1]. [1]University of Wisconsin-La Crosse, La Crosse, WI 54601.

Willow (*Salix* spp.) stakes are often used in riparian restoration projects due to their large root systems, wetland adaptations, and ability to produce adventitious roots. Their rapid growth and height advantage over seedlings allows for swift canopy closure, which helps preempt invasive species establishment. Best practices for maximizing stake performance need to be developed. We harvested sandbar willow stakes from a wetland stand and subjected them to combinations of storage (with and without soaking), scoring, and auxin application in a potted plant experiment. We found that storage resulted in significantly better performance in terms of height, longest stem length, and above- and belowground biomass. Results for height and aboveground biomass were enhanced when stakes were soaked during storage. There were no significant effects of scoring or auxin application. Our results show that willow stake performance is significantly improved by storing and soaking treatments. Improving stake performance in the field could lead to faster canopy closure and better control of invasive species, thus increasing restoration success.

Keywords: Restoration, wetland, rooting hormone, cutting

DREDGING IMPROVES THE CENTRARCHID FISHERIES OF LAKE WINONA, REACH 6, UPPER MISSISSIPPI RIVER

Jamie Hoisington[1] and **Neal Mundahl[1]**. [1]Department of Biology, Winona State University, Winona, MN 55987.

Lake Winona is a 318-acre, urbanized lake within Reach 6 of the Upper Mississippi River. It occupies an old side channel of the river, but has been modified extensively by dredging, filling of fringe wetlands, and shoreline stabilization. It was restored (i.e., treatment with rotenone, restocking with game fishes, installation of aerators and an electric fish barrier) as an urban fishery in 1973, but was plagued by overabundant and stunted sunfish populations. During 1999-2001, 2.3 million yards3 of sand were dredged from the lake to provide construction fill for nearby commercial and industrial development. Dredging significantly deepened the lake and eliminated extensive macrophyte beds that were suspected of providing refuge for young sunfishes. The objective of this study was to compare abundances and growth rates of Bluegill, Black Crappie, and Largemouth Bass before and after dredging to determine if these fish species were affected by dredging. Catch rates and growth rates were obtained from various MN DNR-Fisheries population assessments and lake surveys from 1981-2012. Additional sampling was conducted in summer and fall 2014 to assess recent growth rates and fish condition. After dredging, trap net catch rates of Bluegill and Black Crappie declined by 79 and 89%, respectively (rates now at MN state averages), whereas electrofishing catch rates of Largemouth Bass increased 873%. Growth rates of Bluegill and Black Crappie improved significantly, whereas growth rates of Largemouth Bass remain moderate and unchanged. Fish condition (based on relative weights) is good for all three species examined: Black Crappie = 96%, Bluegill = 101%, Largemouth Bass = 110%). Dredging of Lake Winona significantly altered the physical and biological nature of the lake, improving three major sport fisheries in this system. The number of anglers using the lake has increased dramatically, especially during winter.

Keywords: Dredging, growth rates, sunfish, catch rates

HABITAT PREFERENCES OF DEN LOCATIONS FOR THE NORTH AMERICAN RIVER OTTER (*LONTRA CANADENSIS*)

***Pikora, SE[1]** and Romano S[1]. [1]Western Illinois University-Quad Cities. Moline, IL. 61265.

Historically, the North American River Otter (*Lontra canadensis*) were more abundant, but over-trapping and habitat degradation caused critical population reductions in the Midwest. Currently, not much is known about certain habitat preferences of river otters, particularly regarding den location selection. The purpose of this research is to identify habitat preferences related to den location, particularly water stability and landscape features. This research was conducted at Spring Lake, Upper Mississippi River National Wildlife and Fish Refuge in Savanna, Illinois, and private property near Industry, Illinois. Den sites were identified through scouting and tracking, and locations were documented using GPS. Percent slope was measured for each location (Suunto clinometer), and water stability was based on the annual number of flood events. Regression analysis indicated that slope ($p=0.028$) was an important factor for den site selection. Slope preference ranged from 35-60 degrees. Both slope and water stability ($p=0.061$) combined were significant in the model ($p=0.025$). Results may indicate that the topographic diversity provided by levees in the Upper Mississippi River and the availability of controlled water environments may increase river otter populations in the Midwest.

Keywords: River Otter, Habitat Preferences, Den Locations, Slope, Water Stability

ASSESSING THE SUITABILITY OF LEVEE PROTECTED FLOODPLAIN AREAS FOR STRATEGIC RECONNECTION

Jonathan W.F. Remo[1], Ross J. Guida[2], and Silvia Secchi[1]. [1]Department of Geography and Environmental Resources, Southern Illinois University, Carbondale, IL 62901. [2]Environmental Resources and Policy Program, Southern Illinois University, Carbondale, IL 62901.

Levee protected floodplains along a 125-km LaGrange Segment (LGS) of the Illinois River were screened for their abiotic suitability to provide an array of ecosystem services (ESs) including wetland creation, habitat, floodwater denitrification, and flood-tolerant agriculture. The suitability framework used in this study builds upon the Land Capability Potential Index and is informed by the current understanding of the linkages between river hydrology, river hydraulics, floodplain soils, floodplain vegetation, and floodplain nutrient cycling. In this study, we also demonstrate how this framework can be combined with economic assessments of current floodplain services to inform how strategic floodplain reconnection (i.e., restoration of hydrologic linkages between river and floodplain for the purpose of flood mitigation and provisioning of multiple ESs) could be used to work towards sustainable floodplain management. Results show that floodplain ESs increase with upstream distance from the LaGrange Lock and Dam. This is attributed to the operation of the lock and dam (LD) generating a water level that would result in the inundation of a substantial portion of floodplain (>70 km^2) up to ~60 km upstream if the levees were to be removed or set back. Comparison of the profits from current floodplain agriculture with the potential profits of flood-tolerant agriculture suggests that overcoming the economic costs of floodplain reconnection within the LGS will likely require both conversion of reconnected floodplain lands to flood-tolerant

agriculture and payments for ESs. Future evaluations of levee protected floodplains for strategic floodplain reconnection would benefit from detailed research into the hydro-spatiotemporal variation of biogeochemical cycling of nutrients, particularly nitrogen, in floodwaters across the entire floodplain. In addition, water-level management via the LDs along LGS and elsewhere within the MRB should be explored. The results of our study suggest that science based management of water levels has the potential to enhance critical ESs, such as nutrient sequestration and habitat, which can also have substantial benefits for provisioning ecosystem services such as food production.

Keywords: Floodplain Reconnection, Suitability Analysis, Illinois River, Ecosystem Services

GUILD BASED HABITAT USE AND ENVIRONMENTAL DRIVER OF FISH COMMUNITY CHANGE IN THE UPPER MISSISSIPPI RIVER SYSTEM

***Christopher Schwinghamer[1]** and Quinton Phelps[2]. [1]Southeast Missouri State University. [2]Missouri Department of Conservation.

The community of fish found in stretch of a river is highly dependent on the environmental conditions that the stretch experiences. Conditions preferred by groups of fish are dependent on the life histories of those species. The way a species feeds and where it reproduces are two highly important factors that drive a species life history. As such species that feed or reproduce in a similar fashion will generally be found in similar habitat whereas opposing feeding or reproducing strategies will warrant different habitat preferences. These life history-habitat use relationships have been forged over centuries through evolution but anthropogenic influences have rapidly changed river conditions, threatening to disrupt the delicate balances struck by fishes and their habitats. Invasive species, changes to physical habitat, and climate changes have all dramatically altered the available habitats within the Upper Mississippi River System (UMRS) and fish communities have changed with them. Long Term Resource Monitoring Program data was used to evaluate the habitats used by different guilds and the drivers of temporal community change. To evaluate the habitats used by different feeding and reproductive guilds we used non-metric multidimensional scaling to ordinate habitat data for representative fish species belonging to each guild and a one-way ANOVA was used to find significant difference in the scores of the groups. Feeding guilds were found to use significantly different habitats while no significant differences existed in reproductive guilds. Environmental drivers of temporal community change were evaluated with redundancy analysis on annual fish communities of each field station individually. Subsequent permutation tests provided significant result and environmental drivers differed between field stations. Invasive species appear to be the largest driver of community change across most of the UMRS while habitat changes and climate change also have an impact. Our results suggest that fish community structure has changed over time as habitats have changed.

Keywords: Habitat, Community, Climate Change, Guilds, Invasive Species

SHORT- AND LONG-TERM HYDROLOGIC EFFECTS ON FISH COMMUNITY STRUCTURE IN VARYING HABITATS IN A FLOODPLAIN RIVER

***Ethan J. Sorenson[1]**, Michael D. Delong[1]. [1]Large River Study Center, Biology Department, Winona State University, MN 55987.

There is much research left in toward gaining a better understanding of how hydrological patterns influence fish community composition with riverine landscapes. This opens up the opportunity to examine hydrological variability as a driver for fish community structure. The objective of this study was to determine what attributes of short- and long-term hydrology influence fish community structure in various habitats of a floodplain river. Fish were collected in 2010, 2012, and 2014 in the Upper Mississippi River near Winona, MN. Habitats sampled were main channel, secondary channel, and slackwaters. Fish were collected using a boat electrofisher using 5 – 10 min runs along nearshore transects. Two to four transects were sampled for each site in each year of the study. Fish were identified, counted, and later converted to catch per unit effort for a measure of relative density. Community composition differed between all habitats except slackwaters and secondary channels. Discharge data were obtained from the USGS gaging station at Winona, MN. Short- and long-term discharge variables were calculated using the Richter method. Seasonal flow/flood pulses will be evaluated along with measures of flow history and variability of flow. These data will be compared to fish community composition across and within habitats to determine which hydrological variables act as potential drivers of community organization.

Keywords: Hydrology, channel, backwater, floodplain lake, community response

GEOMORPHIC DISCONTINUITIES WITHIN STREAM NETWORKS

Martin Thoms[1] and Murray Scown[1]. [1]University of New England, Australia

This paper investigates the spatial organization and strength of geomorphic discontinuities throughout the stream network of the Kimberley region, north-western Australia. Current models of river networks emphasize the importance of longitudinal connectivity in terms of hydrology, sediment transport and ecological movement. Studies of the physical character of stream networks view them as an assemblage of segments, with each segment exhibiting a particular and identifiable set of physical characteristics. Transitions from one segment type to another represent potential discontinuities in the stream network, thus are areas of high geomorphic work, increased habitat heterogeneity and biodiversity hotpots. Relatively little attention has been paid to the spatial organization of geomorphic discontinuities and the strength of these discontinuities within stream networks. Research that has been undertaken tends to focus on tributary junctions. However, new approaches to quantitatively characterizing stream segments based on principles of self-emergence and hierarchy theory suggest that geomorphic discontinuities occur at locations other than tributary junctions within the stream network. These discontinuities are more ubiquitous and are stronger in terms of geomorphic conditions.

Keywords: Stream networks, geomorphic discontinuities, spatial organization, self-emergence

MOVEMENT AND HABITAT USE OF INVASIVE ASIAN CARP IN POOL 19 OF THE UPPER MISSISSIPPI RIVER

Jon M. Vallazza[1], Brent C. Knights[1], James H. Larson[1], and Neil D. Gillespie[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

Range expansion of invasive bigheaded Asian carp (Silver Carp and Bighead Carp; hereafter, AC) continues throughout the major river systems of the central US, including the Upper Mississippi River (UMR) upstream of Lock and Dam 19. Strategies to control the spread of AC (e.g., harvest, barriers) require understanding the behavior of these species in recently invaded systems. We used telemetry to study the movement and habitat use of AC in Pool 19 of the UMR. Two groups of AC were implanted with transmitters and tracked from June 2014 through September 2015 using both active and passive tracking techniques. We observed AC movements past navigation dams, generally coinciding with high-water events and presumed AC spawning migrations. Movement of up to 270 km during 27 d was observed. Tagged AC used a variety of habitats seasonally, including both lotic and lentic areas. Seasonal use of a Pool 19 tributary (i.e., Skunk River) during late spring was observed. Extensive AC use of a backwater lake (i.e., Carthage Lake) for overwintering demonstrates the potential opportunity for targeting removal efforts.

Keywords: Asian carp, telemetry, movements, habitat

LINKING FLOOD INUNDATION MODELING, ECOSYSTEM STUDIES, AND ECOSYSTEM SERVICES ASSESSMENTS FOR IMPROVED RESEARCH AND MANAGEMENT OF FLOODPLAIN LANDSCAPES

Molly Van Appledorn[1], Nathan De Jager[1], Kris Johnson[2], Marie Peppler[3]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603. [2]The Nature Conservancy, 1101 W River Pkwy #200, Minneapolis, MN 55415. [3]U.S. Geological Survey, Office of Surface Water, 12201 Sunrise Valley Dr MS415, Reston, VA 20192.

Flooding is a dominant physical process structuring bottomland ecosystems, forming the physical template that influences biogeochemical cycling, sediment transport, habitat quantity and quality for aquatic and terrestrial organisms, and patterns of plant succession and diversity. These ecosystem functions, in turn, directly impact the services floodplain ecosystems provide to society such as water quality improvement or recreational opportunities. As new geospatial data and technological advancements in hydrodynamic and GIS modelling have emerged to examine biophysical relationships in floodplain ecosystems, so too has the potential to conduct broad-scale, interdisciplinary research at the intersection of hydrology, ecology, and ecosystem services. This presentation reviews the state of the science in flood inundation modeling, floodplain ecosystem science, and ecosystem services assessments. We present an initial framework that identifies connections between biophysical processes in floodplains and the provisioning of valuable ecosystem services. We suggest this framework can contribute to more

holistic management of floodplain landscapes by integrating relevant fields of study and inform research poised to take full advantage of new data and technological advancements.

Keywords: ecosystem goods and services, flood regime, geospatial analysis, hydrodynamic models, inundation mapping

RATES OF ENDOCRINE DISRUPTION IN TWO COMMERCIAL FISHES ALONG A DOWNSTREAM GRADIENT OF THE ILLINOIS RIVER

***Madeleine M. VanMiddlesworth[1]**, Andrew F. Casper[1], Jason A. DeBoer[1], Mark W. Fritts[1], and Jeffrey M. Levengood[2]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644. [2]Illinois Natural History Survey, Prairie Research Institute, University of Illinois-Urbana-Champaign, Champaign, IL 61801.

Endocrine-disrupting chemicals (EDCs) can be found in high concentrations in aquatic systems, especially via point source discharges such as waste water effluent. Controlled exposures in laboratory settings suggest feminization of male fishes, such as the intersex condition in the gonads and the presence of the liver-synthesized female-specific lipoprotein, vitellogenin (VTG), in blood circulation. Field assessments of the distribution of these characteristics in feral fish populations may provide insight into the extent of endocrine disruption within a system and which species may be more affected. The Illinois River has a notable history of pollution originating from urbanized and industrialized areas, particularly in upstream locations. This study explores patterns of intersex and elevated VTG levels in mature male gonads of common carp and channel catfish collected throughout a downstream gradient of sites in the Illinois River. Absolute fecundity and mean egg size of females was also monitored between species and sites. Standard histological techniques were utilized to assess feminization in male gonadal samples. For common carp, blood plasma was also sampled for detectable levels of VTG via a carp-specific Enzyme-Linked Immunosorbent Assay (ELISA) kit from specimens caught in upper and lower river sites. Evidence of feminization was observed in male testes from both fish species, however low rates of intersex were overall observed. Male VTG was consistently low or below detection in all sites with an average of 6.7 ug/mL in comparison to females with levels in the 100+ ug/mL range. Female VTG was significantly elevated in the upper river site. Liver size in male carp was significantly higher in the upper river and greater than in females. Absolute fecundity did not differ between upper and lower sites for both species, but egg diameter was greater in upper river catfish. While many studies have examined common carp for signs of endocrine disruption, little has been documented for channel catfish populations. Both species serve economic and recreational purposes throughout the Illinois River. As declining population trends of these fishes are shown through long-term data, it may be essential to examine the reproductive health of Illinois River fishes and the future significance of feminization of male fish.

Keywords: EDC, Illinois River, intersex, common carp, channel catfish

SPATIAL AND TEMPORAL PATTERNS BETWEEN THE INVASIVE SNAIL *BITHYNIA TENTACULATA* AND SUBMERSED AQUATIC VEGETATION IN POOL 8 OF THE UPPER MISSISSIPPI RIVER

***Alicia M. Weeks[1,2]**, Nathan R. De Jager[1], Roger J. Haro[2],and Gregory J. Sandland[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602. [2]River Studies Center, University of Wisconsin-La Crosse, La Crosse, WI 54601.

Bithynia tentaculata is an invasive faucet snail that was first reported in Lake Michigan in 1871 and has since been rapidly spreading through the Nation's waters. This invasion has been extremely problematic in the Upper Mississippi River, specifically Pools 7 and 8 as this area serves as part of the major migratory flyway. As an intermediate host for several exotic trematode parasites, *B. tentaculata* is associated with severe regional waterfowl mortality. This study was designed to assess the abundance and distribution of *B. tentaculata* relative to submersed aquatic vegetation (SAV) as this provides adequate nesting and food sources for waterfowl. Past studies have shown that SAV has increased dramatically in Pool 8 since 2005 as a result of decreased discharge levels. It is possible that snail abundances have increased as well although, to date, no study has quantified whether *B. tentaculata* abundances have increased over time. Temporal patterns at specific locations were assessed from 2007 to 2015 using data that was collected as part of the Long-Term Resource Monitoring Program. A stratified random sampling design and rake score method were used to survey vegetation and snail densities. Data suggests that *B. tentaculata* densities have nearly tripled since 2007 despite minor changes in vegetation abundance, distribution, and composition. Quantile regression revealed a unimodal association between total SAV abundance and the abundance of *B. tentaculata* for sites in the 95th quantile. Hence, *B. tentaculata* tended to be most abundant at sites with intermediate amounts of SAV, and other environmental variables may limit *B. tentaculata* abundances in areas of very low or very high SAV abundance. Electivity indices showed that *B. tentaculata* is positively associated with *Vallisneria americana*, suggesting that this particular species could play a role in the distribution of *B. tentaculata*. Understanding the spatial distribution of *B. tentaculata* in relation to other habitat features, including submersed vegetation, and quantifying any further changes in the abundance and distribution of *B. tentaculata* over time will be important for understanding the potential risks of disease transmission to waterfowl.

Keywords: faucet snail, *Bithynia tentaculata*, Mississippi River, macrophyte, waterfowl

GRASS CARP POPULATION DYNAMICS IN THE MIDDLE MISSISSIPPI RIVER

***Michael C. Wolf[1]** and Quinton E. Phelps[2]. [1]Southeast Missouri State University. [2]Missouri Department of Conservation.

Fish are sometimes imported to a new region of the world for to perform a specific function where they may have the opportunity to become invasive. Grass Carp (*Ctenopharyngodon idella*) are an invasive fish in the Mississippi River Basin. Potential control of invasive fish relies on knowledge of specific population dynamics. It is commonly assumed that Grass Carp

share characteristics (i.e., fast growth and high mortality) with Asian carp (i.e., Bighead Carp *Hypophthalmichthys nobilis* and Silver Carp *Hypophthalmichthys molitrix*) but our findings suggest they are more similar to Common Carp (*Cyprinus carpio*) in terms of growth and mortality. Over 100 Grass Carp were collected from the Middle Mississippi River between 2014 and 2015. Lengths ranged 328 mm to 117 5mm and weights from 0.34 kg to 26.80 kg. Results suggest that total annual mortality is approximately 6.8% with a theoretical maximum age of 41 years. Based on spawning potential ratio models, 28% exploitation of Grass Carp greater than 700mm could possibly recruitment overfish the population. Studies have shown that this invasive fish can consume high quantities of aquatic macrophytes. Aquatic macrophytes are a highly important aspect in some systems connected to the Middle Mississippi River (i.e., the Upper Mississippi River pools). The fact that these fish can consume large amounts of vegetation especially at large sizes coupled with their long-lived nature makes management imperative for sustaining current ecosystems. Evaluating the population dynamics of Grass Carp should provide insight for river management actions.

Keywords: Asian carp, invasive, grass carp, population dynamics

ZOOPLANKTON RESPONSE TO ASIAN CARP HARVESTING IN ILLINOIS RIVER BACKWATERS

***Brian Zalay[1,2]**, Andrew F. Casper[2,3]. [1]Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, Il 61820. [2] Illinois Natural History Survey, Illinois River Biological Station, Havana, Il 62644. [3]Illinois Natural History Survey, University of Illinois at Urbana-Champaign, Champaign, Il 61820.

Since Asian carp (*Hypophthalmichthys nobilis* and *Hypophthalmichthys molitrix*) have arrived in the Illinois River, they appear to have a major negative impact on zooplankton. In an effort to protect the Great Lakes by keeping the Asian carp population low and thus to reduce the pressure on the electric barrier, the Illinois DNR has contracted ten commercial fishing crews to conduct regular Asian carp removals. The objectives of this study are to understand the zooplankton ecological response to the reduction of Asian carp and thus determine the effectiveness of Asian carp harvesting for ecosystem recovery. The fishing crews harvested bimonthly at select backwaters of the upper reaches of the Illinois River. The hypothesis is that zooplankton, a major food source for Asian carp and other fish, may respond positively to the harvesting. Although zooplankton have recovered from other types of disturbances in different ecosystems, it is not known how zooplankton might respond to planktivore harvesting in a large river system. Zooplankton samples were collected over four months at ten backwaters during the summer of 2015. The macrozoolankton community was primarily copepod nauplii followed by cladocerans and copepods. I will compare the zooplankton community structure between a spectrum of Illinois River backwaters with harvesting of Asian carp at different frequencies and intensities.

Keywords: Zooplankton, Asian carp, harvesting, Illinois River, ecological response

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

EFFECTS OF CO_2 ON NON-TARGET JUVENILE UNIONID MUSSELS (*LAMPSILIS SILIQUIODEA*)

Michelle Bartsch[1], Diane Waller[1], Matthew Barbour[1], Todd Severson[1], Jeremy Wise[1] and Riley Buley[1]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

Several species of invasive bivalves, including zebra mussels (*Dreissena polymorpha*) and Asian clams (*Corbicula fluminea*), have shown sensitivity to carbon dioxide which may have utility as a control tool. However, limited data are available on the lethal and sub-lethal effects of CO_2 on native unionid mussels, particularly juveniles. We evaluated the effects of CO_2 on survival, byssal thread formation, and narcotization behavior of juvenile *Lampsilis siliquoidea* and adult zebra mussels (a companion test) under cool water conditions (~12 °C). Juvenile unionids were placed into test aquaria in trays containing washed sand substrate (~1.5 cm depth) to allow them to bury. They were exposed to CO_2 concentrations ranging between 198 and 500 mg/L for 96 h, followed by a one week post-exposure in untreated well water. During the exposure period, our results indicate that CO_2 induces narcotization of juveniles within 24 h, as evidenced by mussels lying on the substrate surface with gapped valves. After 96 h of exposure to CO_2, byssal thread formation was reduced in all treatments, except the controls. Interestingly, there was no juvenile mortality in any treatment during the 96 h CO_2 exposure. Juvenile behavior and byssal thread formation were re-assessed at one week post-exposure; no juveniles were gapped in any treatment, with ≥ 40% of the treated juveniles buried, and there was evidence of byssal thread formation. Our results indicate that juvenile unionids may not be as sensitive to CO_2 as zebra mussels, particularly in cool water. Therefore, scheduling control efforts for zebra mussels during the late fall or early winter may be an effective mechanism to protect non-target unionids.

Keywords: CO_2 toxicity, non-target juvenile unionids, *Lampsilis siliquoidea*, survival and behavior, 96 h laboratory exposure

ARE THERE INTERACTIONS BETWEEN BENTHIC INVERTEBRATES AND ZOOPLANKTON COMMUNITIES IN SLACKWATER HABITATS OF A FLOODPLAIN RIVER ECOSYSTEM?

***Trevor Bowers[1]**, and Michael D. Delong[1]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

Biotic interactions are an integral component in shaping community composition and diversity. These interactions however, have not been studied extensively within habitats of floodplain-river ecosystems. The objective of this study is to determine if interactions between benthic invertebrates and zooplankton communities influences community composition within

slackwater habitats of a floodplain river. Study sites consisted of five slackwater habitats in the Upper Mississippi River near Winona, Minnesota. Benthic invertebrates were collected using dip nets with three samples taken at each site. Three samples were taken at each site for zooplankton using a 64-µm Wisconsin net. Benthic invertebrates were sorted and identified to the lowest practical taxonomic level. Volume of zooplankton samples were standardized to a uniform volume following standard procedures. Zooplankton were identified using a compound microscope. Abundance, number of taxa, and species diversity were determined for both communities. Species diversity was lowest at site 77. *Hyallela azteca* dominated the community of site 77 by comprising 73% of individuals, followed by *Asellus sp.* (4.2%). Site HSI4 exhibited greater diversity but fewer taxa than site 77. *Gammarus fasciatus* was the most abundant taxon (66%), followed by *Physella*, which made up 9.6% of the community. Site 80 had the highest number of taxa unique to a site as well as a large number of taxa (22) and relatively high diversity (1.85) compared to the other sites. An initial conclusion can be made that there were differences in the invertebrate communities of these slackwater sites. Additional analysis will compare zooplankton between sites to determine if there biotic interactions occur between benthic and pelagic invertebrates across these habitats.

Keywords: biotic interaction, backwaters, floodplain lakes, patch, riverine landscape

COMPARISON OF SPECIES DIVERSITY IN THE ILLINOIS RIVER THROUGHOUT A 2,000 YEAR TEMPORAL SPAN

***Curtis Dopson[1]**, Carol E. Colaninno[2], John H. Chick[3]. [1]University of West Georgia, Department of Anthropology, Carrollton, GA 30118. [2]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [3]Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

Terrestrial and freshwater diversity is high at the confluence of the Mississippi and Illinois Rivers. With human habitation and varying climatic changes influencing the environments of these rivers, their diversity may have changed over long temporal spans (Messerli 2000). The goal of our interdisciplinary research project was to test for differences in the diversity of fishes among three time periods using archeological and ecological data from Middle Woodland, Late Woodland, and Modern (i.e., present day). Our results indicate that there was a significant difference in diversity between modern and archeological time periods, but no difference within archeological time periods (Middle and Late Woodland).

Keywords: interdisciplinary, diversity of fish, temporal spans, Middle Woodland, Late Woodland

INTERSEX CONDITION IN MALE LARGEMOUTH BASS, BLUEGILL, AND BLACK CRAPPIE FROM THE ILLINOIS RIVER WATERWAY

Mark W. Fritts[1], Andrea K. Fritts[1], Jason A. DeBoer[1], Richard M. Pendleton[1], Levi E. Solomon[1], T.D. VanMiddlesworth[1], and Andrew F. Casper[1]. [1] Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois-Urbana Champaign.

Intersex condition, the presence of both male and female characteristics in individuals of a normally gonochoristic species, has been documented in many watersheds among a diverse variety of fishes. Previous researchers indicated that a suite of endocrine disrupting chemicals are strongly associated with the occurrence of intersex. Although natural rates of intersex condition in wild fishes vary substantially, additional studies in highly developed, mixed-use watersheds are important to our understanding of this condition in riverine fishes. The Illinois River Watershed is subject to the effects of urban development in its headwaters located in the Chicago Metropolitan Area, and to intense agricultural cultivation throughout the rest of the watershed. Despite the negative effects of pollution on aquatic life during the early 20th century, environmental reforms during the last 50 years have led to improved water quality in the Upper Illinois River Waterway (IRW) and the native fish community has responded favorably. However, developing understandings of new threats—like contaminants of emerging concern—pose new questions about the sustainability of riverine fish populations and safe consumption standards for human users. Our objective was to survey the occurrence and severity of intersex in male Largemouth Bass, Bluegill, and Black Crappie from a riverine gradient extending from Joliet to Bath, IL. Early histological assessments indicated that testicular oocytes were present in 41% of Largemouth Bass collected from the Upper Illinois River Waterway. Our study represents an important contribution to the understandng of riverine fish reproductive ecology, particularly in ecosystems with a history of environmental disturbance and recovery such as the IRW.

Keywords: Sportfish, Ecotoxicology, Reproduction

THE EFFECTS OF URBANIZATION ON LEAF BREAKDOWN RATES IN A ROCK ISLAND WATERSHED

Laura Becker[1], Kourtney Hix[1], ***Jillian Jesperson[1]**, and Kevin Geedey[1]. [1]Augustana College, Rock Island, IL, 61201.

The ability of streams to break down leaves is widely used as an indicator of stream health. In this study, a series of six streams within the Rock Island watershed (Rock Island, IL), which were similar in discharge, order, temperature, and pH, were categorized as healthy or unhealthy based on chloride levels. This study was part of a broader study of the Rock Island watershed by Augustana College. Maple leaves were collected shortly after abscission, weighed, packaged in mesh bags (approximately 5g per bag), and deployed in the streams for two and four week periods. After each time period, the leaves were removed, dried, weighed, and the mass loss was calculated as well as overall leaf decomposition rate. The healthy streams decomposed

leaves significantly faster than the unhealthy streams. These results suggest that streams in close proximity to impervious surfaces (the unhealthy streams) experienced a loss of the ecosystem service of leaf decomposition perhaps due to a loss of invertebrate shredders because of high chloride levels associated with urbanization.

Keywords: leaf decomposition, streams

WATER QUALITY AND MEIOFAUNA IN THE ROCK ISLAND WATERSHED

Sean Blais[1], ***Tayvian Johnson[1], *Suhaiba Mohiuddin[1]**, and Kevin Geedey[1]. [1]Augustana College, Rock Island, IL, 61201.

The relationship between freshwater meiofauna and stream water quality remains largely unexplored. This study represents a preliminary survey of meiofauna in an urbanized watershed in Rock, Island, Illinois, and was part of a broader project to characterize water quality in the Rock Island watershed conducted by Augustana College. Six sites representing different levels of urbanization were arbitrarily selected for sampling. Cups of surface sediment were collected at each site, and processed in the field via a swirl and decant method. 399 individual animals, representing 14 taxa were identified, and nematodes, annelids, and chironomids represented over 70% of the taxa encountered. The Simpsons diversity of meiofauna was negatively correlated with both phosphate and FPOM levels in the streams. Sediment type was also significant, as more meiofauna were found in sandy sites relative to mud or silt. These results suggest that meiofauna may be a useful addition to the study of urbanized streams.

Keywords: Meiofauna, Water quality

HISTORICAL CONTAMINANTS IN THE MIXED AGRICULTURE AND URBAN USE CATFISH CREEK WATERSHED, IOWA, USA

***Wade M. Gibson[1]** and Adam R. Hoffman[1]. [1]Department of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

Water quality is fundamental for good river health. Water quality sustains ecological processes that support native fish populations, vegetation, wetlands and birdlife. Similarly, many of our own uses depend on water quality that is suitable for irrigation, watering stock, drinking, fishing and recreation, and to meet cultural and spiritual needs. Water quality is closely linked to the surrounding environment and land use. Human activities impact watersheds and waterways on a scale that varies both temporally and spatially. Trace metals in surface water have been studied heavily in the past as indicators of polluted water from both natural and anthropogenic sources. Previous studies have examined the prevalence of metals in surface freshwater around the country. However, temporal and spatial studies of heavy metals in systems of varying land use patterns are lacking. Sites in the Catfish Creek Watershed in Iowa with varying land use (urban and agricultural) were sampled for select metals and physical chemical properties. High chloride concentrations were noted in the watershed study sites classified as urban. Spatial analysis determined no initial significant threshold exceedance,

according to EPA standards. Nitrate analysis showed differences in concentrations between urban and rural landscapes. One site was at the EPA's maximum containment level for drinking water,10 mg/l. More temporal sample datasets will show patterns and changes in the chemistry of the watershed. All of the sites sampled eventually discharge into the Mississippi River which is considered one of the most valuable resources in the United States. Regression analysis was used to compare the spatial variation in metal concentrations. In high concentrations metals can impact aquatic organisms, thus affecting the entire ecosystem. Implications regarding the impacts of nutrient and metals on the plant, animal, and human communities in and along the Mississippi river will be discussed.

Keywords: Water Quality, Catfish Creek Watershed, Heavy Metals, Nitrates

THE LEGACY OF LEAD SHOT IN MYRICK MARSH: ESTIMATING LEAD FLUX FROM EMERGENT CADDISFLY ADULTS AND ITS LONG TERM CONSEQUENCES

Roger Haro[1,2], Suzanne Ryan[2], Gretchen Gerrish[1,2], Colin Belby[1,3], and Jacob Ogorek[4]. [1]The River Studies Center, University of Wisconsin – La Crosse, La Crosse, WI 54601. [2]Department of Biology, University of Wisconsin – La Crosse, La Crosse, WI 54601. [3]Department of Geography and Earth Sciences, University of Wisconsin – La Crosse, La Crosse, WI 54601. [4]Wisconsin Water Science Center, USGS, Middleton, WI 53562.

In 2002 a question was asked, "Does anything else come from Myrick Marsh other than mosquitoes?" Local aquatic ecologists were at a loss to respond because of a lack of data on aquatic insect emergence. Samples collected from Myrick Marsh in the spring and summer of 2002 suggested that the aquatic macroinvertebrate community was relatively diverse and was not dominated by mosquito larvae. Instead the samples contained large numbers of the larval long-horned caddisfly, *Leptocerus amercanus* (Leptoceridae: Trichoptera). In June 2003, emergence traps (0.25 m^2) were deployed at 25 locations in the marsh across a gradient of water depth (0.18 m – 0.82 m) and submerged aquatic vegetation (SAV) levels. Declining water levels permitted only 15 traps to be sampled daily over the complete 32 d *Leptocerus* emergence period. *Leptocerus* emergence represented 45% of the total insect emergence over the sampling period. The mean (± SE) biomass of an individual female (0.57± 0.01 mg dwt) was significantly greater than for a male (0.47 ± 0.01 mg dwt). Mean (± SE) daily *Leptocerus* emergence across traps ranged from 0 to 120.0 ± 19.7 mg dwt/m^2.

In 2013, a new study was conducted examining legacy concentrations of lead (Pb) from a trapshooting target range that operated along the south shore of Myrick Marsh from 1926 to 1963. An extensive set of sediment samples were collected and analyzed for Pb concentration in a 13.7 ha area of Myrick Marsh. In addition, *Leptocerus* larvae and emergent adults were collected and analyzed for Pb concentration from locations close to the 2003 emergence trap positions. Statistical Pb-transfer models were developed to predict 1) the concentration of Pb in larvae from sediment Pb concentration and 2) the concentration of Pb in emerging adults from larval Pb concentration. To estimate the flux of Pb associated with the *Leptocerus* adult emergence we linked the 2003 emergence data set with Pb transfer models. To derive low,

intermediate and high emergence rates across the affected area, daily estimates of the mean and standard deviation of the emergence quartiles (i.e., the 25th, 50th, and 75th percentiles) were computed using a boot strap simulation design. One thousand samples with n = 15 (i.e., 15 traps) were generated for each day of the emergence period by randomly sampling (with replacement) the original 2003 daily emergence data. Quartile means (± SD) for total annual Pb flux in the *Leptocerus* emergence from the affected area of Myrick Marsh were estimated at 239 ± 167 mg, 693 ± 456 mg, and 1940 ± 1020 mg, respectively.

Keywords: lead, Trichoptera, emergence, contaminant

EFFECTS OF BIOLOGICAL SOIL CRUSTS ON CHEMICAL AND PHYSICAL SOIL PROPERTIES IN A WISCONSIN SAND PRAIRIE

***Brittany Harried [1]**, Todd Osmundson[1], Tom Volk[1], Meredith Thomsen[1]. [1]Department of Biology, University of Wisconsin - La Crosse, La Crosse, WI 54601.

Sand prairies are a unique variant of the North American tallgrass prairie, found on sandy glacial and riverine deposits in the Upper Mississippi River floodplain and elsewhere in the upper Midwest. Biological soil crusts (BSC) -- communities of bacteria, fungi, cyanobacteria, archaea, mosses, and microalgae living within the top 3-14 mm of the soil -- are known to provide important ecosystems services in sandy habitats worldwide. However, very little is known about BSCs in Midwestern sand prairie ecosystems. To quantify the effects of BSCs on a sand prairie in Wisconsin, soil samples were collected as matched pairs from open sand areas (uncrusted) and nearby areas with BSC intact (crusted). Soil samples were analyzed for organic material (OM), total nitrogen (TN), total organic carbon (TOC), phosphorus (P), and available nitrogen (AN). Soil cores were collected to test for water holding capacity (WHC) and erosion resistance (ER) between uncrusted and crusted samples. Crusted samples had significantly higher OM, TN, and TOC than uncrusted samples. Furthermore, crusted samples were more resistant to erosion than uncrusted samples. However, there was no difference between uncrusted and crusted samples for P, AN, and WHC. Together these results indicate the positive effect of BSCs on sand prairie habitat. Crusted areas with greater erosion resistance and increased amounts of OM, TN, and TOC would allow for greater soil stability and fertility for vascular plant establishment. The similarities between uncrusted and crusted sites for P and AN are likely due to P and nitrogen sequestration by BSC organisms. Additionally, the positive effects associated with the presence of BSCs could be useful in restoration of sand prairie within the Upper Mississippi River floodplain and other sand prairie are.

Keywords: Biological soil crust, sand prairie, conservation

THE EFFECTS OF URBANIZATION ON AMPHIBIAN DIVERSITY

***Daniel J. Herrera[1]**, Megan Lipke[1]. [1]Augustana College Upper Mississippi Center.

Around the world amphibian populations have been in decline. In the United States amphibian population decline has become such a prevalent issue that the National Parks Service has listed

it as one of their top priorities in research. Amphibian populations have been in decline while urbanization has increased. There is speculation that the rise in urbanization has been the cause of the decreased amphibian populations. This project aimed to find a correlation between the level of urbanization and the diversity of amphibians in specific urban forests.

Keywords: Amphibian, Diversity, Urbanization

MERCURY CONCENTRATIONS IN LARVAL DRAGONFLIES FROM STREAMS DRAINING DIFFERENT LAND COVER CONDITIONS IN THE BLACK RIVER WATERSHED, WI.

***Megan C. Hess[1]**, Roger J. Haro[1,2], and Mark B. Sandheinrich[1,2]. [1]University of Wisconsin - La Crosse, Biology Department, La Crosse, WI 54601. [2]River Studies Center, University of Wisconsin - La Crosse, La Crosse, WI 54601.

Coal burning industries within the Midwest emit fumes containing mercury (Hg2+). Inorganic Hg is deposited across terrestrial and aquatic landscapes where it can then be methylated to form methylmercury (MeHg), a known neurotoxin. In this organic state, MeHg can be taken up by aquatic organisms and subsequently transferred up the food chain to fish and ultimately to humans. Although coal burning alone can introduce Hg into our aquatic system, other anthropogenic activities, such as agricultural, can further exacerbate the methylation process. I examined streams in the Black River Watershed of west-central Wisconsin to evaluate the relationship between upstream land cover and total mercury (THg) concentration in larval dragonflies. Results demonstrate a clear gradient in dragonfly Hg levels with higher concentrations in the northern peat-lands to lower concentrations in the southeastern trout streams, which are dominated by agricultural land covers. For the Green-striped darner species of dragonfly, *Aeshna verticalis*, the average concentration of total mercury in the north was 276 ng/g dry weight. The mean percent MeHg in dragonfly larvae, calculated as the fraction of THg present as MeHg, is typically around 80%. Dragonflies containing these levels of THg in lakes correspond with predatory fish containing Hg concentrations that exceed EPA consumption limits. The dominance of peatland in the northern region of the Black River Watershed may explain why the larval dragonflies have higher THg concentrations than those found in the southern agricultural streams of the watershed. These peatlands tributaries drain into the Black River and may transport Hg into the Mississippi River.

Keywords: Total mercury, Larval dragonflies, Peat-lands, Land cover, Black River

FISH SIZE WITHIN THE LOWER ILLINOIS AND UPPER MISSISSIPPI RIVER SYSTEMS

***Tom Higgins**[1], Ariana O. Enzerink[1], Carol E. Colaninno[2], John H. Chick[3]. [1]Oberlin College, Department of Anthropology and Department of Biology, Oberlin, OH 44074, [2]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704, [3]Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

Anthropogenic forces impact rivers and landscapes. These forces have occurred throughout the duration of human occupation of our river systems and their effects currently are ongoing and observable within river systems today. We tested for differences in the size distributions of Lower Illinois River System (LIRS) fishes among time periods using both archeological data and modern ecological data. There is a temporally related change in fish sizes between the two genera we tested, channel catfishes (*Ictalurus* spp.*)* and buffalo suckers (*Ictiobus* spp.*),* which may be attributed to anthropogenic influences, although other factors may also impact the observed temporal trends.

Keywords: Interdisciplinary research, Fish size distributions, Anthropogenic, Multivariate statistics, Archeological dataset

CHANGES IN LARGEMOUTH BASS POPULATIONS WITHIN THE LA GRANGE REACH OF THE ILLINOIS RIVER FROM 1993-2015

Jacob I. Huey[1], Rich M. Pendleton[1], Levi Solomon[1], and Andrew Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

Upper Mississippi River fishes are the subject of commercial and recreational fisheries, both of which contribute substantially to local economies. For example, recreation on the Upper Mississippi River alone has been estimated to provide 18,000 jobs and generate $1.2 billion for the economy per year; recreational fishing for several fish species is a key component of this economic activity. An area of the Upper Mississippi River System that has received extensive research over the past 22 years is the LaGrange Reach of the Illinois River. Within this reach, Largemouth Bass (*Micropterus salmoides*) have been monitored through extensive fish community sampling conducted by the Long Term Resource Monitoring (LTRM) element of the Upper Mississippi River Restoration Program using a multi-gear stratified random sampling (SRS) design since 1993. Using LTRM data, we investigate trends in proportional size distribution (PSD), catch per unit effort (CPUE), and relative weight (Wr) of Largemouth Bass over time. Based on data from day electro-fishing in connected backwater areas, catch per unit effort has declined more drastically for preferred and quality PSD categories, when compared to stock and sub-stock PSD categories. However, trends in relative weight have remained stable across all PSD categories. Declines in CPUE observed over time could be due to competition with invasive species, altered river hydrology, or lack of habitat needed at critical life stages of the Largemouth Bass. Further analysis of long-term monitoring data may reveal direct causes for these declines and may provide managers essential information regarding the status and trends of this recreational fish species.

Keywords: Largemouth bass, La Grange reach, proportional size distribution, catch per unit effort, relative weight

INFLUENCE OF URBAN DISTURBANCES, SOIL PROPERTIES, AND OTHER ABIOTIC AND BIOTIC FACTORS ON *L. MAACKII* OF REMNANT URBAN RIPARIAN HARDWOOD FORESTS

***Taylor Johnson [1]**. [1] Upper Mississippi Center, Augustana College, Rock Island, IL 61201.

Urbanization is a global demographic trend that may have significant and detrimental effects on adjacent urban ecosystems. *Lonicer maackii* (*L. maackii*), commonly referred to as Amur honeysuckle, is an invasive shrub that has invaded the remnant temperate hardwood forests of Rock Island County, IL. The goal of this study was to examine the effects of urbanization and urban soil properties on the degree of *L. maackii* invasion throughout this county next to the Mississippi river. Soil samples were tested at 36 forest sites for Soil Organic Matter and Soil texture. Linear regression models were ran on the results of these tests between *L. maackii* cover and other abiotic and biotic site variables. The results of this study indicate that there is no single driver of *L. maackii* invasion. However, specific soil properties and abiotic and biotic site variables may increase the likelihood of *L. maackii* establishment and dominance. Multiple properties and variables attributed to *L. maackii* cover identified in this study include % forest cover, % green and other open space, garbage levels, % impervious surface, % total urban canopy cover, total invasive cover, % clay soil texture, forest floor litter levels, and % slope. The identified properties and variables that may increase *L. maackii* establishment and dominance are associated with urban-related disturbances. Understanding the interaction between urban-related disturbances and *L. maackii* cover may allow for better land use planning and city management procedures in the future.

Keywords: Urbanization, *Lonicera Maackii*, Urban-soils, Urban-forests

RELATIONSHIP BETWEEN PHYSICAL HABITAT COMPLEXITY AND FISH COMMUNITY COMPOSITION BASED ON FEEDING GUILDS

***Alex V. Karan[1]** and Michael D. Delong[1]. [1]Large Rivers Study Center Biology Department Winona State University, Winona, MN 55987.

Food web theory proposes that greater complexity in physical characteristics of habitats opens the possibility for more niches. Floodplain rivers are complex systems with a diversity of habitats. These habitats, including slackwaters, also exhibit differences in their physical characteristics. The objective of this study was to determine if there was a relationship between physical habitat complexity and fish community composition based on feeding guilds. The study used five slackwater habitats in the Upper Mississippi River near Winona, MN. Measures of physical complexity of each site included: area, mean width, standard deviation of width, mean length, standard deviation of depth, and shoreline development. Standard deviation (SD) of depth was determined by recording depth at 1-m intervals across 3 transects. The remaining measures were measured using Google Earth Pro. Fish were collected using a boat electrofisher with 2 – 3 passes of 5 – 10 minute intervals at each site. Fish were identified to species and placing into feeding guilds based on published dietary information. Multivariate analysis was used to identify which physical variable(s) explained the pattern of abundance of fish in guilds.

Mean length of sites explained 66% of the variation in fish communities of slackwater habitats. Standard deviation of depth and mean length of site explained 34% of variation the number of species present for each guild. The greatest difference in both abundance and number of species/guild was seen in invertivorous fishes. This study demonstrates that attributes of physical habitat complexity of slackwaters within a floodplain river do influence the trophic composition of fishes. Furthermore, the guilds most influenced by physical characteristics of habitats are intermediate predators, which have been found to play a key role in shaping food web organization, including food chain length in ecosystems.

Keywords: food web, trophic, physical complexity, patch attributes, fish

SHIFTS IN RELATIVE ABUNDANCE OF BACKWATER FISHES IN THE LOWER ILLINOIS RIVER VALLEY THROUGH MILLENNIA

***Nigel Knutzen[1]**, Lilian Ward[2], Carol E. Colaninno[3], John H. Chick[4]. [1] Southern Illinois University Edwardsville, Department of Anthropology, Edwardsville, IL 62025. [2]Aquinas College, Department of Biology, Grand Rapids, MI 49506. [3]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [4]Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

To investigate recent anthropogenic impacts on backwater dependent fishes we collected and synthesized the relative abundance of fishes represented in archeofaunal and modern ecological collections. We grouped fishes into two categories based on their preferred habitat: backwaters and main channel. Through time, two fishes dependent on backwaters, bowfin and bass and sunfish, display contradictory trends: bowfin decrease in abundance, while bass and sunfish increase. The abundance of main channel fishes have undergone less variation. Through this research we developed a deep-time perspective of the ecology of backwater lakes and how people used these habitats.

Keywords: Fishes, population change, deep-time, interdisciplinary

ASSESSING POTENTIAL FOOD WEB IMPACTS OF *HYPOPHTHALMICHTHYS* SPP. USING CARBON AND NITROGEN STABLE ISOTOPE ANALYSIS OF NATIVE PLANKTIVORES AMONG MAIN CHANNEL AND BACKWATER HABITATS OF THE ILLINOIS (LAGRANGE), MISSISSIPPI (POOLS 19 AND 2), AND ST. CROIX RIVERS

Toben D. Lafrancois[1], Brent C. Knights[2], Byron N. Karns[3]. [1]Northland College, Ashland, WI 54806. [2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602. [3]St. Croix National Scenic Riverway, St. Croix Falls, WI 54024.

Bighead and silver carp (*Hypophthalmichthys nobilis* and *molitrix*) are invading the Upper Mississippi River Basin and now reproduce as far upstream as Pool 16 near Muscatine (IA). Pioneer individuals have been captured in Pool 2 near St. Paul (MN) and the St. Croix River near Hudson (WI). These fishes present high risk to normal ecosystem functioning because they

feed at the base of the food web and reach high densities. As part of an effort to assess their impacts on food in the Upper Mississippi and St. Croix Rivers, we measured stable isotopes of carbon and nitrogen at multiple trophic levels across a gradient of Asian carp abundance. In 2013 and 2014, we sampled three paired main channel and backwater sites on the Illinois River (LaGrange) and Mississippi River (Pools 19 and 2), three pools within Lake St. Croix, and three main channel reaches on the lower St. Croix River (WI). Of multiple trophic guilds studied, we focus here gizzard shad (*Dorosoma cepedianum*) and young of year bluegill (*Lepomis macrochirus*) to represent common planktivores. Carbon isotope ratios showed the St. Croix River food webs had consistently more pelagic sources of carbon (autochthonous) than other areas. Young of year bluegill exhibited between site differences in isotope signatures than the more vagile gizzard shad. On the other hand YOY bluegill showed greatest differences in isotope ratios between similar habitat types, indicating prey switching from plankton more benthic sources. Mixing models prove problematic in areas where *Hypophthalmichthys* are abundant, with d15N values of planktivorous fish sometimes lower than pelagic filter feeders. Nonetheless, it appears that trophic position of native planktivores were lower by a factor of 1 to 1.5 in areas with established *Hypophthalmichthys* spp. Silver and bighead carp trophic position did not overlap with that of YOY bluegill on except for populations in Lake St. Croix. Silver carp trophic position overlapped gizzard shad from similar areas, while bighead carp appeared to shift diets toward the current trophic positions of gizzard shad as bighead move to upriver sites on the Mississippi and Lake St. Croix. The native Bigmouth buffalo (*Ictiobus cyprinellas*) we found in Mississippi Pool 2 overlapped in trophic position with gizzard shad. Our results confirm that invasion by silver and bighead carp have significant implications for native planktivores in the St. Croix and Mississippi Rivers. We discuss other forthcoming results from this project and how they inform carp management.

Keywords: *Hypophthalmichthys*, planktivorous fishes, food web, invasive species

MOVEMENT OF PADDLEFISH IN THE UPPER MISSISSIPPI RIVER

John L. Ethen[1], William A. Granholm[1], and **Joshua J. Lallaman[1]**. [1] Saint Mary's University of MN, Department of Biology, Winona, MN 55987.

Paddlefish (*Polyodon spathula*) are listed as endangered or of special concern in the States of Minnesota and Wisconsin. The unique life history and migratory needs of these species makes them especially vulnerable to overharvest, habitat alteration, and competition from invasive species. Our objectives were to analyze movement of paddlefish in the Upper Mississippi River to better understand migration and habitat needs. Five Vemco acoustic transmitters were surgically implanted into five paddlefish captured in Pool 5a during the summer of 2014. Manual tracking of paddlefish in Pool 5a was conducted during the summers of 2014 & 2015. Additional locations were obtained from stationary VR2 receivers placed by the Minnesota Department of Natural Resources and US Fish and Wildlife Service. Preliminary analysis of paddlefish movement has revealed both upstream and downstream movements of tagged individuals. Movement is characterized by periods of minimal dispersal followed by large dispersal events into new areas. Although all fish were tagged and captured in Pool 5a, we have

not observed any return to this area suggesting that paddlefish populations in the Upper Mississippi River may be composed of complex and intermixing metapopulations.

Keywords: Paddlefish, Telemetry, Movement

A COMPARISON OF FISH COMMUNITIES IN CONTIGUOUS BACKWATER AND VEGETATED IMPOUNDED AREAS OF POOL 19, UPPER MISSISSIPPI RIVER

***Eli G. Lampo[1]**, James T. Lamer[1], Brent Knights[2], Jon Vallaza[2], James H. Larson[2]. [1]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455. [2]U.S Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54602.

Lock and dam 19 on the Upper Mississippi River has impounded over 9 m of sediment since 1913, which has created a unique shallow-water ecosystem in pool 19 that is dominated by floating-leaf and submersed aquatic vegetation. The importance of these post-impoundment, vegetated areas for fish is not well understood. To increase our understanding, we compared the community structure, composition, and size structure of fish between vegetated impounded areas and non-vegetated, contiguous backwaters in Pool 19. We sampled 180 randomly stratified sites for four, 6-week periods from May 19th- Oct 31st, 2014. We fished paired sets of tandem fyke (1/4 in. diameter mesh) and mini-fyke nets (1/8 in. diameter mesh) using LTRM standardized methods. We sampled 63,503 fish representing 64 species (48,879 fishes and 50 species from impounded sites and 14,624 fishes and 55 species from contiguous backwater sites). Species composition and structure were highest in the impounded areas. These results suggest that as sediment continues to accumulate and the size of vegetation beds increases in Pool 19, the resultant aquatic vegetation and associated habitat for catastomids and cyprinids will likely expand.

Keywords: Large River Ecology, Fish Communities

EXAMINING *ICTALURUS* SPP. AND *AMEIURUS* SPP. SIZE DISTRIBUTION IN THE LOWER ILLINOIS RIVER OVER 2,000 YEARS

***Paula Long**[1], Abigail T. Uehling [2], Carol E. Colaninno [3], John H. Chick [4]. [1] University of Central Arkansas, Department of Anthropology, Conway, AR 72034 [2]Hamilton College, Department of Biology, Clinton, NY 13323. [3]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [4] Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

The Mississippi and Illinois rivers are managed through dams and levees altering floodplain connectivity patterns and habitats of native fishes. To assess recent river modifications, we examined the relative abundance of fish total lengths of both modern and archeological specimens from two catfish genera: bullhead catfish (*Ameiurus* spp.) and channel catfish (*Ictalurus* spp.). These two genera differ in habitats preferences: bullheads prefer slow-moving habitats, while channel catfish are more frequent to fast-moving waters. Examining the relative size distribution of specimens from these two genera over a long temporal span, approximately

2,000 years, may provide indication of deep-time river dynamics. The relative frequency of channel catfish sizes are significantly different between archeological and current times, but not among archeological periods. The relative frequency of bullhead catfish sizes does not differ significantly through time. Although recent anthropogenic water management practices may account for the documented changes, other factors currently cannot be discounted.

Keywords: Ictaluridae, fish size, interdisciplinary research, temporal investigations, anthropogenic modifications

COMMON SNAPPING TURTLE SPORTFISH MONITORING AND ASSESMENT IN ILLINOIS

***Katie E. Mainor[1]**, James T. Lamer PhD[1], Emily Szott [1], Mike McClelland [2]. [1] University Circle, Western Illinois University, Macomb IL, 61455. [2]Illinois Natural History Survey 700 S. 10th Street Havana, IL 62644.

Common snapping turtles (*Chelydra serpentina*) inhabit waterways throughout Illinois and are harvested recreationally for sport and consumption. Seasons and bag limits are in place, but additional data are needed to identify management objectives for common snapping turtle harvest in Illinois. We will use mark and recapture (survival), size structure, sex ratio, and fecundity data to populate stage-based life tables needed to inform better management practices and harvest regulations for common snapping turtles in Illinois. We measured carapace and plastron dimensions, recorded sex and weight, and marked all trapped turtles (n=207) with passive integrated transponder (PIT) tags from two backwaters in Illinois from May 21st to August 7th in 2015. Turtles in the Swan Lake population sample of Brussels, IL were comprised of 41% females, 54% males, and 5% juveniles. Turtles in The New Crystal Lake Gun Club population sample of Gulfport, IL were comprised of 46% females, 50% males, and 4% juveniles. Additional data will be collected in 2016 from other populations throughout Illinois. Data from 2015-2016 will be presented using stage-based life tables, mark-recapture population estimates, and population prediction models based on the demographic rates of each population. The models will be made to replicate long term impacts of harvest scenarios.

Keywords: Population, demographics, snapping turtles, management

LOOKING FOR BATS IN ALL THE RIGHT PLACES: SPATIAL PATTERNS AT EFFIGY MOUNDS NATIONAL MONUMENT

***Kayla McLaughlin[1]**, Francis Tillman[1], and Gerald L. Zuercher[1]. [1]Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001.

We were asked to survey bats at Effigy Mounds National Monument in northeastern Iowa with special emphasis on detections of Federally Threatened northern long-eared bats (*Myotis septentrionalis*) and Federally Endangered Indiana bats (*M. sodalis.)* We sampled bats with acoustic detectors (Wildlife Acoustics SM3) and with mist-nets. Acoustic detectors were randomly deployed throughout the park and provided guidance on where to set mist-nets to

enhance our capture success. Through Kaleidoscope Pro 3.0, acoustic files were initially identified to species. For myotine bat species, each file was examined to determine the correct bat species. Seven bat species were confirmed including northern long-eared bats. Our acoustic files strongly suggest that Indiana bats are present in the southern portion of the park. All captured bats were processed and DNA samples were obtained from the facial region using Isohelix® DNA swabs; these samples were used to test for the presence of *Pseudogymnoascus destructans*, the fungus that causes White-Nose Syndrome. In total, seven bat species were captured with northern long-eared bats being most common followed by little brown bats and big brown bats (*Eptesicus fuscus*). Some spatial patterns have emerged with northern long-eared bat captures occurring throughout the park and little brown bat captures only occurring in the northern sample sites. Silver-haired (*Lasionycteris noctivagans*) captures have occurred only in upland prairie-forest interface locations while captures for all other bat species were concentrated in lowland floodplain locations. At present, Effigy Mounds National Monument appears to be an important site for bats, especially northern long-eared bats.

Keywords: acoustic survey, bats, Effigy Mounds National Monument, mist-netting, *Pseudogymnoascus destructans*

TRENDS IN THE POPULATIONS OF WHITE AND YELLOW BASS OVER 21 YEARS WITHIN THE ILLINOIS RIVER.

Jacob McQuaid[1], Rich Pendleton[1], Levi Solomon[1], and Andrew Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois

White Bass (*Morone chrysops*) and Yellow Bass (*Morone mississippiensis*), to a lesser degree, are recreationally valued fishes within the Upper Mississippi River System (UMRS). The Illinois River is a major tributary of the UMRS, in which, the Upper Mississippi River Restoration Program's Long Term Resource Monitoring (LTRM) element has consistently collected data on these species since 1993. LTRM data from the La Grange Reach of the Illinois River were used to evaluate the status and trends of both White and Yellow Bass by calculating relative weight (Wr), catch-per-unit-effort (CPUE), and proportional size distribution (PSD). In addition, otoliths were collected from 2012-2015 to evaluate age structure and length-at-age of both species. Trends in relative weight revealed no discernable pattern over time for either species. However, the overall CPUE, accounting for fishes of all sizes, indicated that both species are in decline, with White Bass experiencing a greater decline compared to Yellow Bass. The cause of these trends is difficult to pinpoint due to the multitude of stressors acting on the system, such as siltation, invasive species, pollution, and the continued impacts of navigation. Trends in CPUE among different PSD categories, in addition to age structure information, may help clarify the overall declines observed in CPUE. Overall, these results indicate populations of White and Yellow Bass are in decline and highlight the importance of long-term data when assessing populations of sport fishes.

Keywords: White Bass Yellow Bass LTRM Illinois River

A SURVEY FOR THE PRESENCE OF ANTIBIOTICS IN THE WATERS AND SOILS OF STREAMS SURROUNDING GUTTENBERG, DUBUQUE, AND BELLEVUE, IOWA

***Kayla Neff[1]**, Michael Kennedy[1], and Mark Sinton[1]. [1] Dept. of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

Water and soil samples from twelve streams encompassing an area from the north of Guttenberg, Iowa, to the south of Bellevue, Iowa, and that empty into the Mississippi River, were surveyed for the presence of five antibiotics commonly used in agriculture: ampicillin, ciprofloxacin, sulfadiazine, sulfamethazine, and tetracycline. Only three out of twenty-four water samples had a detectable amount of antibiotic, while all of the soil samples (forty-eight, in total) contained one or more of these compounds. These data suggest that, while there may be little antibiotic content in water in this area of the country, stream soils are an antibiotic sink.

Keywords: antibiotics, water, sediment, streams

VARIATION IN THE RELATIVE ABUNDANCE OF COMMON FISHES ACROSS ARCHEOLOGICAL AND MODERN TIME PERIODS.

***Paige L. Ottenfeld [2]**, Stevie Goesmann [1], Carol E. Colaninno [3], John H. Chick [4, 2]. [1] Blackburn College, Department of Biology, Carlinville, IL 62626. [2]Tennessee Technological University, College of Arts and Sciences, Cookeville, TN 38505. [3]Arkansas Archeological Survey, University of Arkansas, Fayetteville, AR 72704. [4] Illinois Natural History Survey, University of Illinois Urbana-Champaign 1 Confluence Way, East Alton, IL 62024.

Throughout the course of human occupation in the lower Illinois River Valley, people fished rivers, possibly modifying fish community and population structure. We aim to address some of these changes in fish populations. We examined the relative frequency of nine fish taxa in both archeofaunal collections and modern assemblages with particular focus on temporal changes in the abundance in which these nine taxa contribute to archeological and modern collections. Our temporal range spans from the Middle Woodland (50 B.C.) to present day. Differences were seen between archeological and modern time, but there were no significant difference among collections that are from archeological deposits. Differences in the modern and archeological datasets could indicate relatively modern changes in the way people impact river systems. Additional analysis of the archeological samples is required to understand the ways archeological populations, living in the lower Illinois River Valley may have impacted, or not impacted this river system.

Keywords: Interdisciplinary Research, Fish Relative Abundance, Temporal Investigation, Lower Illinois River Valley, Multivariate Analysis

THE EVALUATION OF A COST-EFFECTIVE, DIGITAL APPROACH TO ESTIMATE FECUNDITY IN FRESHWATER FISHES

Rich Pendleton[1], Andrew Casper[1], Jason DeBoer[1], Andrea Fritts[1], Mark Fritts[1], Nikolai Klibansky[2], Levi Solomon[1], and T.D. VanMiddlesworth[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois-Urbana Champaign. [2]Southeast Fisheries Science Center, National Marine Fisheries Service, NOAA, Beaufort Lab.

Determining the basic life-history of organisms enhances our ecological understanding and ability to conserve or manage species. However, oftentimes the resources and time needed to document expression of life-history traits can hinder our ability to understand the ecology of a species. Studies of species reproductive traits, such as fecundity, inform researchers and managers of the reproductive potential of a species and offer insight into population dynamics. However, traditional gravimetric methods of estimating fecundity in fishes can be costly and laborious. Using methodology developed for marine fishes, we evaluate a cost-effective, digital approach (i.e. auto-diametric) to estimate fecundity using free ImageJ software to determine the validity and accuracy of auto-diametric estimates relative to gravimetric estimates within freshwater systems. We collected three freshwater fishes within an environmentally heterogeneous watershed to determine if estimation methodology (auto-diametric vs. gravimetric) is influenced by species, size of individual, or location. Strong correlations between methods existed for medium- to large-sized bluegill and largemouth bass, however, little to no correlation existed between the methods for black crappie. Location influenced the strength of the relationship between counting methods, but was predominately an artifact of the size of individuals collected within each location. Currently, auto-diametric methodology provides a quicker and relatively accurate way to estimate fecundity for bluegill and largemouth bass, yet refinements must be made to account for smaller individuals and potential differences in ovary physiology and/or egg development among species.

AN ASSESSMENT OF STORMWATER QUALITY IN AN URBANIZED WATERSHED

***Brittany A. Poynor[1]**, Tara M. Cullison[1], Kelsey Self[1], Michael Reisner[1], Kevin Geedey[1], Reuben Heine[1], and Tierney Brosius[1]. [1] Augustana College, Rock Island, IL 61201.

Growths of urban areas have resulted in the increase of high impervious surfaces and developmental pressures that increase pollution and runoff, which leads to degradation of urban streams and public waterways. Previous water quality studies within 13 urban watersheds in Rock Island and Moline, IL have yielded little explanation of stormwater pollution. One watershed was selected in Rock Island and 21 sampling points were identified in an effort to better explain urban stormwater quality drivers. The purpose of this study was to assess the current pollution concentrations in the urban streams and test for correlations between pollutants and land use types. Measuring the effectiveness of these ecosystems to provide services will generate a scientific base to support more sustainable management of such systems. To quantitatively assess the potential of ravines and green spaces to filter out

sediments, nutrients, and pollutants, several water samples were taken at each sampling location. At each sampling location on site measurements of temperature, pH, specific conductance, dissolved oxygen, chloride, and nitrate and were taken using YSI Professional-Plus Multi-parameter Instruments. Water samples were collected at each site and transported back to the lab for ammonia, phosphate, total suspended solids, and biological oxygen demand analysis. In addition, fecal coliform samples were sent to the City of Rock Island's lab for analysis. Data collection took place from June to September in 2015. Multiple samples were taken over the course of four months in order to capture both dry and storm conditions at each site. Nitrate, chloride, TDS, ammonia, and phosphate concentrations were often lower in the ravine and confluence sites than in the headwater sites. These preliminary results suggest that the watershed is providing ecosystem services and land use may be a contributing factor. Further data analysis will investigate any land use and pollution concentration correlation

Keywords: stormwater, water quality, urbanization, impervious surface, pollution

USING RECIRCULATING CHAMBERS TO MEASURE SUBSTRATE SPECIFIC PHOSPHORUS UPTAKE RATES IN A DRIFTLESS AREA STREAM

***Alisha M. Saley[1]** and Eric A. Strauss[1,2]. [1]University of Wisconsin-La Crosse, La Crosse, WI. [2]River Studies Center, La Crosse, WI.

The limiting nutrient in many freshwater systems is phosphorus (P), which means these habitats are highly vulnerable to eutrophication when presented with nutrient pollution. Specifically, streams in the Driftless Area are cold-water habitats, which is crucial for maintaining populations of trout that stimulate a large economic income. Whole-stream studies of P utilization and uptake typically measure general uptake, however, do not identify specific substrates where P uptake is high and/or low. The goal of this study was to explore the relative uptake rates of P in Spring Coulee Creek in western Wisconsin. My experimental units were 30-L recirculating chambers (n=3) incubated in the stream, which contained stream water and common stream substrates (filamentous algae, macrophytes, periphyton, and sand). Another chamber contained stream water only, as a control. Phosphorus was added to each chamber at 50 μg P/L above ambient and the decline in P concentration was measured throughout a 3-hour incubation. The decline in P concentration was modeled using an exponential decay mathematical relationship ($P_t = P_0 e^{-rt}$). The decay rate coefficient (r) was considered the P uptake rate. Uptake rates were then normalized using Ash Free Dry Mass (AFDM) to account for organic matter differences in the chambers. Data suggests that Filamentous algae P uptake rates were significantly higher ($p<0.05$, One-way ANOVA with Tukey posthoc) than uptakes rates in periphyton or sand.

Keywords: substrate, phosphorus, nutrient uptake, Driftless Area stream

PHYSICAL HABITAT COMPLEXITY AS A DRIVER OF COMMUNITY STRUCTURE IN A FLOODPLAIN RIVER

***Briana M. Skufca[1]** and Michael D. Delong[1]. [1]Large River Studies Center, Biology Department, Winona State University, Winona, MN 55987.

Floodplain rivers are characterized by a diverse arrangement of habitats that form a mosaic across the riverine landscape. The type, arrangement, and structure of these habitats is important given that many species require specific or multiple habitats as part of their life history. Limited consideration, however, has been given to the importance of the physical habitat complexity within each habitat and its implications for community structure. This study examines how attributes of physical habitat complexity influence community structure in a floodplain river. Samples were taken from backwaters and floodplain lakes of the Upper Mississippi River during summer 2015. Fish were collected using a boat electrofisher and were identified to species and counted. Invertebrates were collected using dipnets and identified to lowest practical taxonomic level. Physical variables of the sites (area, width, standard deviation of width, length, shoreline length, standard deviation of depth, and shoreline development index) were measured both at each site and by using Google Earth Pro. Fish and invertebrate communities were compared against measures of physical habitat characteristics using BEST procedure in Primer. Mean length of sites explained 66% of the pattern of fish community structure. Standard deviation of width explained 64% of invertebrate community structure. From these results, it can be concluded that attributes of physical complexity are key drivers of community composition and that different components of physical complexity influence the composition of different communities.

Keywords: physical complexity, patch, multivariate, community structure, slackwaters

THE SPATIAL DISTRIBUTION AND DENSITY OF THE EMERALD ASH BORER INFESTATION IN ROCK ISLAND AND MOLINE ILL

***Kendall Smith [1]**, Victoria Lason [1], Morgan Conley [1], Tierney Brosius[1], Michael Reisner[1]. Department of Environmental Studies, Augustana College. Upper Mississippi Center, Augustana College Rock Island, IL 61201.

The Emerald Ash Borer (EAB) *Agrilus planipennis* Fairmaire (*Copleoptera: Buprestidae*) is a destructive colonizer of ash trees that arrived in the United States in 2002. Since then, EAB has been detected in 22 states and two Canadian provinces, and has proven to be a complicated management issue for many cities including Rock Island. The purpose of this study was to determine the spatial distribution and density of the EAB infestation in Rock Island, Ill and to identify potential correlations between host larval densities and visual symptoms. A continuation of spatial distribution was determined through a tree survey examining specific species of Ash trees, canopy health, and epicormic shoots in conjunction with the City of Rock Island Public Works. All information collected was sent to ArcGIS electronically through an iPhone Application (Collector App) and later analyzed the use of GIS (Geographic Information System). Larval density and potential correlations with visual symptoms were determined by removing two 50 cm branch segments from ash trees. Branch segments were whittled in 1mm thick sheets until the cambium was reached while recording the number of larvae and galleries. Visual symptoms including ash canopy rating, bark splitting, epicormic shooting and exit holes were assessed for each tree used in the trapping survey and branch sampling. No EAB beetles were found outside the invasion epicenter at Hasselroth Park in Rock Island, Ill. Similarly to the

data that was collected (last Summer of 2014), the larval density in sampled branches was insignificant, concluding that there were no significant relationships between larval density and the presence of any visual symptoms.

Keywords: Emerald Ash Borer, Invasive Species, Illinois, GIS

ONTOGENETIC DIET SHIFTS OF BLUE CATFISH (*ICTALURUS FURCATUS*) AND FLATHEAD CATFISH (*PYLODICTIS OLIVARIS*)

***Ashley L Stanley [1]**, James T Lamer[1], and Mark W. Fritt[2]. [1] Kibbe Field Station, Western Illinois University. [2] Illinois River Biological Station, Illinois Natural History Survey.

Blue catfish (*Ictalurus furcatus*) and flathead catfish (*Pylodictis olivaris*) are native to the Mississippi River Basin and are primarily piscivorous as large adults but consume a variety of diet items as juveniles and young adults. Traditional diet analyses are useful, but are often limited by temporal and spatial variation in diet, empty stomachs, lethal or intrusive techniques used to extract diets, and time investment required to quantify diets. Here, we use stable isotopes (δ13C and δ15N) to characterize the ontogenetic diet shifts in blue catfish and flathead catfish in the Mississippi River Basin. We collected and biopsied dorsal muscle tissue from blue catfish (200 mm-1300 mm) and flathead catfish (100 mm- 1200 mm) from pools 20, 21, 26 and open river conditions on the Mississippi River using tournament trails, commercial harvest and hoop nets. We dried and ground the muscle biopsies into a fine powder and will analyze for δ13C and δ15N stable isotope ratios using a mass spectrometer. Using size ranges from juvenile to adult, we will be able to determine the length diet shifts occur during the life of blue catfish and flathead catfish.

Keywords: blue catfish, flathead catfish, diets, stable isotopes

UPPER MISSISSIPPI RIVER SYSTEM TOPOBATHY

Jenny L. Hanson[1], **Jayme M. Stone[1]**. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI 54603.

Bathymetry and lidar data were obtained by the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program Long Term Resource Monitoring (LTRM) element for most of the Upper Mississippi River and Illinois River floodplains. Both datasets are equally beneficial as single entities, but can provide considerably more information when merged as a seamless, topobathy layer. Currently, hydrodynamic models used to predict flow and inundation have been limited to predictions in low water conditions. A topobathy product is an important tool in modeling connectivity across a range of flow conditions over time. Topobathy is also important for habitat restoration planning, landscape modeling, and ecological research of floodplain communities. A topobathy data layer is vital to improve the scientific understanding of the river ecosystem, the processes that drive habitat patterns, and the ecological responses to natural and anthropogenic forces. The methodology to merge lidar and bathymetry consists of extracting near-shore lidar data, georeferencing bathymetric data to

terrestrial lidar products, interpolating the bathymetry data, merging bathymetry with lidar datasets, and a final quality assurance/quality control step. Once complete, a systemic topobathy layer will exist for the Upper Mississippi River System (UMRS), filling a much needed information gap in large river restoration efforts.

Keywords: Topobathy, Lidar, Bathymetry, Research, Upper Mississippi River System

A RIVER OF SAND: DREDGING, RECREATION AND COMMERCIAL NAVIGATION ON THE UMRS

Sara Strassman[1]. [1]Wisconsin Department of Natural Resources, La Crosse, WI 54601.

Commercial navigation has been a key driver of management decisions on the Upper Mississippi River since the early 1800s. The waterway transportation industry generated $676 million in revenues (2013) and employed 850 people in the UMRS. Today, the river retains the imprint of early modifications, but is also continually dredged to support navigation. In the St. Paul District of the Corps of Engineers, roughly 1 million cubic yards of sand are dredged each year. Finding suitable placement sites for this material is an ongoing challenge. The Corps of Engineers works with state and federal agencies in a partnership that seeks beneficial use of the dredged material, including habitat projects and recreational enhancements. While equivalent recognition for the ecosystem of the UMRS took much longer to develop, there is little question of its economic value. The Upper Mississippi River National Wildlife & Fish Refuge is the most visited refuge of any in the U.S. and Wisconsin alone receives $681 million in tourism related expenditures in the UMR corridor, which supports 7,100 jobs.

Keywords: dredging, navigation, recreation, economics

QUANTIFICATION OF DAILY OTOLITH INCREMENTS IN YOUNG OF YEAR ASIAN CARP

***Emily A. Szott [1]**, James T. Lamer[1], James H. Larson[2], Brent Knights[2], John Vallazza[2], Levi Solomon[3], Rich Pendleton[3], and Andrew Casper[3]. [1] Department of Biological Sciences, Western Illinois University, Macomb, IL 61455. [2]Upper Midwest Environmental Sciences Center, United States Geological Survey, La Crosse, WI 54603. [3]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

Silver and bighead carp are invasive species that have become established throughout the Mississippi River Basin. A large body of research and resources has been dedicated to their management. Despite these efforts, information on hydrological spawning triggers and growth of young of year Asian carp is lacking. Here, daily incremental growth annuli from sagittal and lapillus otoliths are used to estimate birth and growth of young of year Asian carp. We collected juvenile Asian carp from the LaGrange Reach of the Illinois River following a large spawning event in August 2014. Total length was measured, and the lapillus and sagittal otoliths removed from each individual. A 0.5 cm x 0.5 cm piece of caudal fin tissue was excised for later genetic analysis. Otoliths were aged from up to 20 fish per 5 mm length group (15-79 mm). The

extracted otoliths were mounted to slides with cyanoacrylate, polished, photographed, and aged. Otolith microstructure was validated using juvenile Asian carp from Chinese aquaculture. Aging the juvenile Asian carp gives valuable information on the growth of this poorly studied life history stage. Preliminary results show that the collected Asian carp range from 26 to 45 days old, putting their days of birth between June 22 and July 11, 2014. Further study of age will help determine spawning periodicity and hydrological conditions responsible for spawning. Ultimately, the ability to determine daily growth rates of young of year Asian carp will help in the management of these invasive species.

Keywords: Asian carp, otoliths, microstructure, age, growth

INSECT DIVERSITY IN DIFFERENTLY MANAGED FORESTS IN DUBUQUE COUNTY, IOWA

***Jake M. Theis [1]**, David E. Koch[1]. [1]Dept. of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

Insects are a ubiquitous and important part of terrestrial ecosystems worldwide, thus their diversity and abundance makes them ideal for investigating different habitats. Using pit-fall traps, sweep-netting, as well as hand capturing we collected insects at three forested sites in North Dubuque County. These sites were chosen specifically based on the level of management; unmanaged, replanted tree field, and actively managed. The insects were keyed to order and the sites compared using the Shannon diversity index. After comparing the three sites only slight differences have been observed between the sites. Along with looking at the differences between forest management, this insect survey will serve as a baseline for the regions as well as a starting point four future research in this forested area of the state.

Keywords: Insect, Forest, Diversity, Management

AN INVESTIGATION OF BUTTERFLY SPECIES DIVERSITY ALONG AN URBAN GRADIENT IN ROCK ISLAND/MOLINE, IL

***Kassandra D. Tyra[1],** Reisner, M[1]. [1]Augustana College, Rock Island, IL 61201.

Urbanization rates are increasing dramatically - the UN estimates that between 2 and 3 billion people will be added to the world population by the year 2050. As urbanization trends continue, it is becoming increasingly important to understand and mitigate our impact on urban ecosystems. The purpose of this study was to observe trends in butterfly diversity across an urbanization gradient at 3 forest plots in Rock Island/Moline, IL. Butterfly surveys were conducted according to the standard Pollard walk. Results of this study indicated that butterfly abundance and diversity are negatively impacted by urbanization, as has been found in other studies. Recommendations for future studies include performing surveys at more sites and also increasing the number of transects at each site to increase the strength of statistical analysis.

Keywords: Butterfly, biodiversity, urbanization, edge effect

ESTIMATING POPULATION SIZE OF SELECT INDICATOR FISH SPECIES AT THE NATURE CONSERVANCY'S EMIQUON NATURE PRESERVE PRIOR TO ILLINOIS RIVER RECONNECTION

Todd D. VanMiddlesworth[1], Jason A. DeBoer[1], Andrea K. Fritts[1], Mark W. Fritts[1], Doyn M. Kellerhals[1], Richard M. Pendleton[1], Levi E. Solomon[1], and Andrew F. Casper[1]. [1]Illinois River Biological Station, Illinois Natural History Survey, Havana, IL 62644.

Largemouth Bass (*Micropterus salmoides*) and Black Crappie (*Pomoxis nigromaculatus*) are popular sportfish species, making their study and management a priority for many natural resource agencies and organizations. These species can be used as bioindicators of the relative quality of aquatic habitats, making them an invaluable resource for both managers and researchers assessing the effects of natural and anthropogenic disturbance in aquatic systems. As such, the Upper Mississippi River Restoration program has labeled both species indicators of ecosystem health, and the Illinois Department of Natural Resources monitors these species in lakes and reservoirs throughout the state, including a large disconnected floodplain restoration project known as The Nature Conservancy's (TNC) Emiquon Nature Preserve. Emiquon has been disconnected from the Illinois River since the early 1900's, drained and put into agricultural production until 2000, and then restored back to a floodplain lake beginning in 2007. TNC began construction of a water control structure in 2015 that will result in a managed reconnection with the Illinois River. The objective of this research was to establish pre-reconnection population estimates for Largemouth Bass and Black Crappie to benefit TNC managers by allowing them to more precisely evaluate the status of sportfish populations within the Emiquon Preserve. These data will allow for post-reconnection comparisons with the Illinois River and subsequent water level management.

Keywords: sportfish, bioindicator, population, floodplain, restoration

COMPARISON OF RIVER TURTLE COMMUNITIES BETWEEN THE MISSISSIPPI RIVER AND A TRIBUTARY STREAM

***Anthony M Vorwald [1]**, David E Koch[1]. [1] Dept. of Natural and Applied Sciences, University of Dubuque, Dubuque, IA 52001.

This project compares species dynamics of sympatric turtle species found in different aquatic habitat types in the same geographic region. Site A (9-mile island region of Pool 12 in the Mississippi River) near Dubuque IA. Site B a representative tributary of the Mississippi River (Lytle's Creek, southwest of Dubuque, in northern Jackson County). We compared species diversity and composition between the two sites and compared population dynamics turtle species found within both sites. In total, 67 individuals were caught, 61 from site A, and 6 from site B. Three species were trapped at site A. *C. picta*, *G. geographica*, and *C. serpentina*. Two species were trapped at site B. *C. serpentina* and *A. spinifera*. The only turtle species found in common between sites was *C. serpentina*. This project continues a long term study conducted

by the University of Dubuque on turtle communities in the backwater area of 9-mile Island. Of the turtles caught during this project 27 were recaptures from previous years.

Keywords: turtles, habitat comparison, tributary, Snapping turtle

EVALUATION OF CO_2 AS A DREISSENID MUSSEL CONTROL TOOL

Diane Waller[1], Michelle Bartsch[1], Matthew Barbour[1], Jeremy Wise[1], Todd Severson[1], and Riley Buley[1]. [1]USGS – Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI 54603.

Control technology for dreissenid mussels currently relies heavily on chemical molluscicides that can be both costly and ecologically harmful. There is a need to develop more environmentally neutral control tools to manage dreissenid mussels, particularly in cooler water. Carbon dioxide has been shown to be toxic to several species of invasive bivalves, including zebra mussels (*Dreissena polymorpha*) and Asian clams (*Corbicula fluminea*). We evaluated the effects of CO_2 on narcotization, byssal thread formation, and narcotization behavior of zebra mussels. Adult zebra mussels were exposed to CO_2 concentrations ranging between 198 and 500 mg/L for 24, 48, or 96 h. Carbon dioxide induces narcotization of mussels which was evidenced by valve gaping and/or foot extension with no response to probing. Mussels that appeared dead immediately after exposure often recovered after 24 h in clean water. Therefore, mortality was determined after 1 week post-exposure in clean water. Two independent groups of zebra mussels were used to measure effects of CO_2 on byssus formation and attachment. In the first group, byssal threads of each mussel were cut immediately before placement into the treatment tanks. In the second group, mussels that had previously established byssus attachments to a petri plate were placed into the treatment tank. In both groups, the number of attached mussels was counted at 96 h and again at 1 week post-exposure. Our results indicate that CO_2 induces narcotization of mussels within 24 h at the concentrations that we tested. Byssal thread formation was inhibited in all treatment groups, except the control. CO_2 also caused the loss of byssal attachment and the threads that remained were reduced to a single attachment. Mortality showed a dose and time dependent response with >90% mortality in concentrations >250 mg/L CO_2 for 96 h. Our results indicate that elevated CO_2 may be effective for removal of dreissenids in cool water. Scheduling control efforts for dreissenids in the late fall or winter may minimize impact to nontarget organisms, such as unionid mussels and larval fish, which are buried or less abundant at that time.

Keywords: Zebra mussel, dreissenid, carbon dioxide, control

COMMON CARP AGE AND GROWTH TRENDS FROM THE ILLINOIS RIVER

Ryan Ward[1], Madeleine VanMiddlesworth[1], Jason DeBoer[1], Rich Pendleton[1]. [1] INHS - Illinois River Biological Station.

The common carp was first introduced into the Illinois River in the late 1800s and has contributed substantially to the commercial fishing industry. However, by 1920 the commercial

catch of carp started to show a decline and by 1950 fewer carp appeared to be reaching maturity. In 1983, the Illinois Natural History Survey (INHS) conducted an age analysis of Illinois River carp, compared them to other populations in Midwestern river systems, and attributed a young age structure and slower growth of Illinois carp to lack of food and backwater habitat. In more recent surveys, large, presumably older carp have remained present while young carp have become less prevalent, particularly in collections conducted in the Upper River closest to the Metropolitan Chicago area. This led us to explore the current age and growth trends of carp throughout the Illinois River to determine spatial and temporal differences in population structures. We collected carp at 3 upper river sites (n=93), 7 lower river sites (n=118), and 1 reference site (n=29) at The Nature Conservancy's (TNC) Emiquon Preserve, a restored and disconnected backwater of the Illinois River. We recorded total length (mm), weight (g), gonad weight (g), total fecundity and extracted dorsal spines for ageing. We cut the dorsal spines above the basal attachment, placed them under a dissecting microscope, and aged them utilizing side-emitting light to illuminate age rings. This poster will highlight current spatial and temporal differences in carp population structure and will allow us to compare it to past research. Results found from comparing data may help propel future research on Illinois carp ecology and result in better management for the common carp.

Keywords: Common Carp, Illinois River, Age, Growth

MISSISSIPPI RIVER RESEARCH CONSORTIUM
TREASURER'S REPORT – SUBMITTED BY NEAL D. MUNDAHL
1 MARCH 2016

Accounts as of 30 June 2013	$16,601.27
Accounts as of 30 June 2014	$14,234.80

Transactions, 1 July 2014 to 30 June 2015

INCOME		
	2015 Registration and dues	11877.23
	2015 Raffle/silent auction proceeds	1338.00
	Interest	6.03
Total		13221.26
EXPENSES		
	2015 meeting (Radisson)	9731.74
	2015 Proceedings	659.00
	2015 Awards	154.00
	2015 Student Travel awards	800.00
	2015 Raffle costs	300.00
	Meeting momento	362.34
	2015 Keynote expenses and honoraria	0.00
Total		12007.08

Accounts as of 30 June 2015	$15,448.98

Transactions, 1 July 2015 to 1 March 2016

INCOME		
	Interest	3.04
Total		3.04
EXPENSES		
	None	0.00
Total		0.00
Accounts as of 1 March 2015		$15,452.02
Accounts		
	Checking account	9412.90
	Savings account	6039.12
Total		15452.02

MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC

2016 BUSINESS MEETING AGENDA

Radisson Hotel, La Crosse, Wisconsin

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1. Call to Order

2. President's Report
    - Acknowledgments
    - Approval of the 2015 Minutes and Proceedings
    - 2016 attendance/participation growth information
    - Awards
    - Change in Registration Fees

3. Treasurer's Report - Neal Mundahl

4. Old Business
    - Amendment to bylaws to include meeting coordinator
    - Future Meeting Dates
      -April 26-28, 2017 La Crosse, WI
      -April 25-27, 2018 (TBA – 50th Anniversary Discussion)

5. New Business
    - Executive board nominations
    - Election of officers
    - Passing of the Presidency
    - Other new business

6. Adjournment

2015 BUSINESS MEETING MINUTES

The 2015 annual business meeting was called to order by President Andrew Casper at 11:50 a.m. on Friday, April 24th.

Andy acknowledged and thanked John Manier for providing all of the IT equipment, loading talks and running all of the AV for the entire meeting. John did a fantastic job and we all appreciate it very much. He then acknowledged all of the moderators for their help in keeping all of the talks on schedule. Andy noted that it takes an entire team of folks to pull off a successful meeting every year and everyone's help is appreciated. He thanked all of the officers and the front desk help for putting on the meeting.

Tom Claflin was then introduced and Roger Haro and Tom Claflin came up to the podium. Roger talked a bit about the Tom Claflin Award and spoke of the local Natural History Day focusing on the history of the river and environmental leadership. Helena Wier from West Salem Middle School was then introduced. She wrote a paper on Aldo Leopold and was the recipient of the Tom Claflin Award. Tom presented Helena an award on behalf of MRRC and recognized her accomplishment. Tom spoke about the history of the MRRC and noted that it was created to help students and foster an environment wherein students could present their research and interact with professionals in the biological sciences.

President Andy Casper then presented the Best Student Poster Award to Brittany Maul of UW – La Crosse. Andy also presented the Best Student Platform Presentation Award to Whitney Swanson of UW – La Crosse. This would designate Whitney as the new MRRC Student Rep. She did indicate that she would be moving away from the area, but may still be able to serve in this capacity remotely.

Andy presented the recent finance issues to the group with a short power point presentation. He noted that the registration cost went up this year due to the group no longer having tax exempt status. He conveyed that Neal Mundahl, Treasurer, indicated it was way too costly for us to maintain the tax exempt status. Basically, we need enough money to hold the meeting, not to make a profit. Changes are always occurring in the organization and MRRC is growing. Andy presented slides on the financial issues with info about where folks come from and diversity in the attendees. We are growing and we are up from several years ago with a more diverse group coming to the MRRC. We have room for about 30 platform presentations (1/3 of which were students this year). Posters were at 50 this year, and they were split out in two nights, which worked very well. Talks about registration cost of the meetings ensued, and Andy indicated that we want to keep costs as low as we can, and still encourage participation.

Nate De Jager mentioned that bigger participation means a bigger work load on Board Members, and that it is very important to have someone local in the La Crosse area to work with the Radisson.

Andy noted that we are very happy with the Radisson this year and the way they worked with us to keep costs down and cut us some breaks even though we no longer qualified for some of the state per diem rates for catering due to the tax exempt loss. The Radisson wants to keep us there and is willing to work with us in the future as well.

It was then noted that some form of online abstract submission would be extremely valuable and save the vice-president considerable work in formatting and putting together the proceedings, as this process is very time consuming and very tedious for the VP.

A discussion ensued about the Board of Directors and their duties, and it was noted that the MRRC Board is made up of a President, Vice President, Secretary and Treasurer, as well as a Student Representative. A few of the duties were mentioned but it was noted that a more specific list of these duties may need to be put into the Bylaws as the duties are very vague in the Bylaws, and the workload for each officer seems to be growing.

John Chick suggested an At-Large member that could help take up some of the slack and assist with added workload, or who could be assigned specific jobs to reduce workload on existing officers.

Nate De Jager made a motion to amend the Bylaws to allow the Board of Directors to put into place a new member at large to assist the existing board, and noted that this person may be put into place and the position may end and be removed at the discretion of the board. Bill Richardson seconded the motion.

Michelle Bartsch opens up discussion of this and how it would work. She notes that in the Bylaws it is already stated that the Board can add members as needed and vote on such additions and can remove at a time or discretion of the Board as needed. This may need to be exercised as we grow and jobs and responsibilities increase. Michelle notes that everything she did as VP was extremely time exhaustive including putting the proceedings together, getting them printed, working with the Radisson on local arrangements and what she took on for the raffle. Eric Strauss talked about the idea of having a past President possibly stay on with that title for one year to assist in the transition for new people coming in to office and to help with the workload. April Burgett noted that this year the proceedings, raffle, agenda, local arrangements, etc. were way too much for the Vice President to take on.

Nate De Jager talked about the workload of the raffle, and that Cammy had done the raffle for several years, and now that Cammy is gone, Michelle did it this year, but someone else may need to be designated as raffle coordinator as that is not in the scope of work for the VP. Roger Haro also indicates that another person on the Board would be beneficial.

Discussion ensued regarding the student presentations and posters. It was noted that the judges were organized ahead of time this year which was very helpful. A new judging form and rubric was used that allows for feedback to the students. Michelle mentioned that in the past the forms were geared toward feedback; however, we never returned the forms to the students and that is changing. The student will benefit greatly by getting back their scores and comments.

Michelle noted what a big effort the raffle was this year as we changed it up and tried to revamp and have a bigger raffle. She noted that the Romanos have done a great job the past several years and before that Terry Dukerschein did a great job. Michelle got a great response from La Crosse businesses and donations by the membership were great! Current Designs and the Sanborne Canoe Company were very generous donors and worked with us as sponsors giving large discounts on their items.

Ron Rada mentioned that the Bylaws indicate the Board has the power to add a member or create a committee if needed. Mike Delong mentions that maybe people in the local area may be interested in helping. There were a few ideas that stood out in this discussion and they were:

1. Add a Member-at-Large
2. Retain Past President as a one year position
3. The option to not alter the Bylaws but add a person designated by the Board

The membership decided to table the discussion until next year's business meeting and go with option 3 at this point. The Board can add a member at its discretion as needed between now and the next meeting.

At this point in the meeting, April Burgett presented the Treasurer's Report on behalf of Neal Mundahl, Treasuer who was absent. She referred to page 78 in the Proceedings for the full detailed breakdown and Treasurer's Report and simply presented the highlights and yearend total to the membership. She noted that the Board hoped that with the increased registration fee we would simply be able to cover the cost of the meeting and remain even with our year end dollars. She also noted that the Board hoped to net at least $1000 on the raffle to pay for 5 student scholarship awards next year. John Chick made a motion to accept the Treasurer's Report, it was seconded by a member, and the Treasurer's Report was accepted.

The future meeting dates were then discussed. Michelle Bartsch noted that she had signed the next contract with the Radisson for the 2016 meeting. No contract has yet been signed for the 2017 meeting.

In New Business: Andy reports that the new Vice President will be Gretchen Gerrish. The ballots were counted and she was voted in as the new VP for the 2015-2016 time frame. Andy implored the group to think about future nominations for the Board of Directors offices, and noted that for the VP we typically alternate yearly between university and government employees.

Jeff Houser brings up the full ExComm and notes that the VP workload does seem to be growing and that we need to be sure that the information is passed on to each new officer as efficiently and complete as possible, maybe on a flash drive. Michelle Bartsch stepped in and indicated she did receive files from Andy when she took over as VP. She then thanked all of the judges for posters and platform presentations. She stressed again the amount of workload of the Proceedings and that online abstract submission needs to happen. Michelle apologized for all of the errors in the proceedings and she will pass all of her files on to Gretchen as the new VP. Michelle also indicated that she now has electronic copies of all of the past contracts with the Radisson for reference and for our permanent records. Andy indicates that the Proceedings have been extremely helpful as a point of reference as well.

2018 MRRC meeting will be the 50th anniversary meeting. Roger Haro then presented a slide on MRRC and its objectives as stated in the Bylaws, and talked about public outreach and harboring relationships with young students, as well as schools and the public and community. Gretchen Gerrish commented about local outreach and area schools and students who present

posters at an Earth Day event that is during the same time frame each year as the MRRC meeting. We need to figure out how we can support outreach and be involved without taking over or having tons of responsibilities with it. Chick talks about outreach specialists and environmental educators and bringing someone in to help with MRRC outreach events.

Ron Rada brings up the International Society for River Science meeting in August and about a special session that will be done on outreach and environmental education. An online survey might be a good idea to see what people want by way of MRRC outreach involvement.

Eric Strauss makes a motion and Chick seconds the motion to explore the possibility of and establish a committee on outreach. Motion is carried by the membership.

Andy Casper passed the Office of President to Michelle Bartsch. She presented Andy Casper with a Certificate of Appreciation for serving as President.

Andy Casper reported the raffle proceeds for the meeting. Raffle sales were $1,338 which was possibly a record high and $300 was spent on the kayak for a net proceed of $1,038, which will fund five student travel scholarships for the 2016 meeting. This year we were only able to fund four.

Patty Ries was the Student Rep for the 2015 meeting, and she will coordinate with the new incoming student rep as well as Michelle Bartsch on that transition.

There were 130 people who pre-registered for the conference and six on site registrants this year for a total meeting attendance of 136. There were approximately 50 people present for the business meeting and lunch/raffle drawing.

Michelle indicated that we would draw for the raffle items during lunch which was immediately after the meeting adjourned. Michelle called for any other new business, and hearing none, a motion was made and seconded to adjourn the meeting and the 2015 MRRC business meeting was adjourned at 12:50 p.m.

Respectfully Submitted,

April M. Burgett, Secretary, MRRC

CONSTITUTION OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM,

INC. ARTICLE I. NAME AND OBJECT

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

2. The objective of this organization shall be:

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

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

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

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

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

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

ARTICLE II. ORGANIZATION

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

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

ARTICLE III. MEMBERSHIP AND DUES

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

organization.

ARTICLE IV. AMENDMENTS

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

BYLAWS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM, INC.

ARTICLE I: NAME, PURPOSES AND DUTIES

1.1 Incarnation

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

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

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

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

1.2 Purpose

The purposes of the organization shall be as follows:

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

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

(c) To provide an annual meeting where research results can be

presented, common problems can be discussed, information can be disseminated, and where river researchers can become acquainted with each other.

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

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

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

ARTICLE 2: OFFICES

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

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

ARTICLE 3: OFFICERS AND BOARD OF DIRECTORS

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

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

elected in 1991 will be for one year. The term for the treasurer elected in 1991 will be for two years. The vice-president elected in 1991 will become president in 1992. The term of each officer begins at the annual meeting.

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

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

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

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

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

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

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

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

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

The vice-president shall:

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

The secretary shall:

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

The treasurer shall:

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

3.11 Student Representative on Board of Directors.
The student representative on the Board of Directors shall be a one-year appointed position to provide a student's perspective to the consortium. The student representative shall serve as a point of contact for all undergraduate and graduate student consortium members and shall also assist with the preparation of the meeting proceedings and organization of the conference. A new representative shall be appointed at each year's board meeting by the new Vice President. The primary criterion for selecting the student representative shall be if the student plans to attend the next annual meeting (e.g., an undergraduate junior or a senior entering a graduate program). The position will first be offered to the student who wins the award for best student oral presentation, given that the above criterion is met, and next offered to the student who wins the best student poster award if the above criterion is not met. If neither award winner is eligible or willing to serve as student representative, the Vice President will use her/his best judgment to select the student representative.

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

ARTICLE 4: MEMBERSHIP AND DUES

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

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

ARTICLE 5: COMMITTEES

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

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

ARTICLE 6: MEETING OF MEMBERSHIP

6.01 Annual Meeting.

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

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

> *6.01b. Student Travel Awards* - The Board of Directors shall advertise for and select

graduate and undergraduate students for travel awards for attending the annual meeting and presenting a platform presentation. Criteria of selection of students for the awards shall be based on academic achievements and the scientific contribution of the student's project to the field of river ecology. The number of awards provided shall be determined each year based on the applicant pool and annual budget.

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

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

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

ARTICLE 7: AMENDMENTS

7.01 By The Membership.

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

PAST RECIPEINTS 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

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

Meeting	Year	Location	President
1st	1968*	St. Mary's College, Winona, MN	Brother George Pahl
2nd	1969	Wisconsin State Univ., La Crosse, WI	Dr. Thomas Claflin
3rd	1970	Winona State College, Winona, MN	Dr. Calvin Fremling
4th	1971	St. Cloud State College, St. Cloud, MN	Dr. Joseph Hopwood
5th	1972	Loras College, Dubuque, IA	Dr. Joesph Kapler
6th	1973	Quincy College, Quincy, IL	Rev. John Ostdiek
7th	1974	No Meeting	----------
8th	1975	Monmouth College, Monmouth, IL	Dr. Jacob Verduin
9th	1976	St. Mary's College, Winona, MN	Mr. Rory Vose
10th	1977	Winona State University, Winona, MN	Dr. Dennis Nielsen
11th	1978	Univ. Wisconsin-La Crosse, La Crosse, WI	Dr. Ronald Rada
12th	1979	Cancelled	Dr. Edward Cawley
13th	1980	Loras College, Dubuque, IA	Dr. Edward Cawley
14th	1981	Ramada Inn, La Crosse, WI	Mr. Michael Vanderford
			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

* 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.

ACKNOWLEDGMENTS 2016

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Local Meeting Arrangements, Meeting Announcements, and Mailings

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

Gretchen Gerrish, River Studies Center, University of Wisconsin – La Crosse, La Crosse, WI

Michelle Bartsch, US Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

Andrew Casper, Illinois River Biological Station, Illinois Natural History Survey, Havana, IL

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

Program and Proceedings

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

Gretchen Gerrish, River Studies Center, University of Wisconsin – La Crosse, La Crosse, WI

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

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

Registration Table

Kim Dunnigan, Dickson Mounds State Museum, Lewistown, IL

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

Poster Boards

Winona State University

Visual Aids, Poster Arrangements, and Awards

John Manier, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

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

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

Susan Romano, Western Illinois University, Macomb, IL

Sales and Arrangements (Raffle)

Patty Ries, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

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

Becky Kreiling, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

Website

Eric Strauss, River Studies Center, University of Wisconsin – La Crosse, La Crosse, WI

Platform Session Moderators

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

Gretchen Gerrish, University of Wisconsin-La Crosse, La Crosse, WI

Michael Delong, Winona State University, Winona, MN

Mark Sandheinrich, University of Wisconsin-La Crosse, La Crosse, WI

Molly Van Appledorn, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

Andrew Casper, Illinois River Biological Station, Illinois Natural History Survey, Havana, IL

Photography

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

Kim Dunnigan, Dickson Mounds State Museum, Lewistown, IL

2016 Meeting Logo

Daniel (Tim) Gerber, University of Wisconsin-La Crosse, La Crosse, WI

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