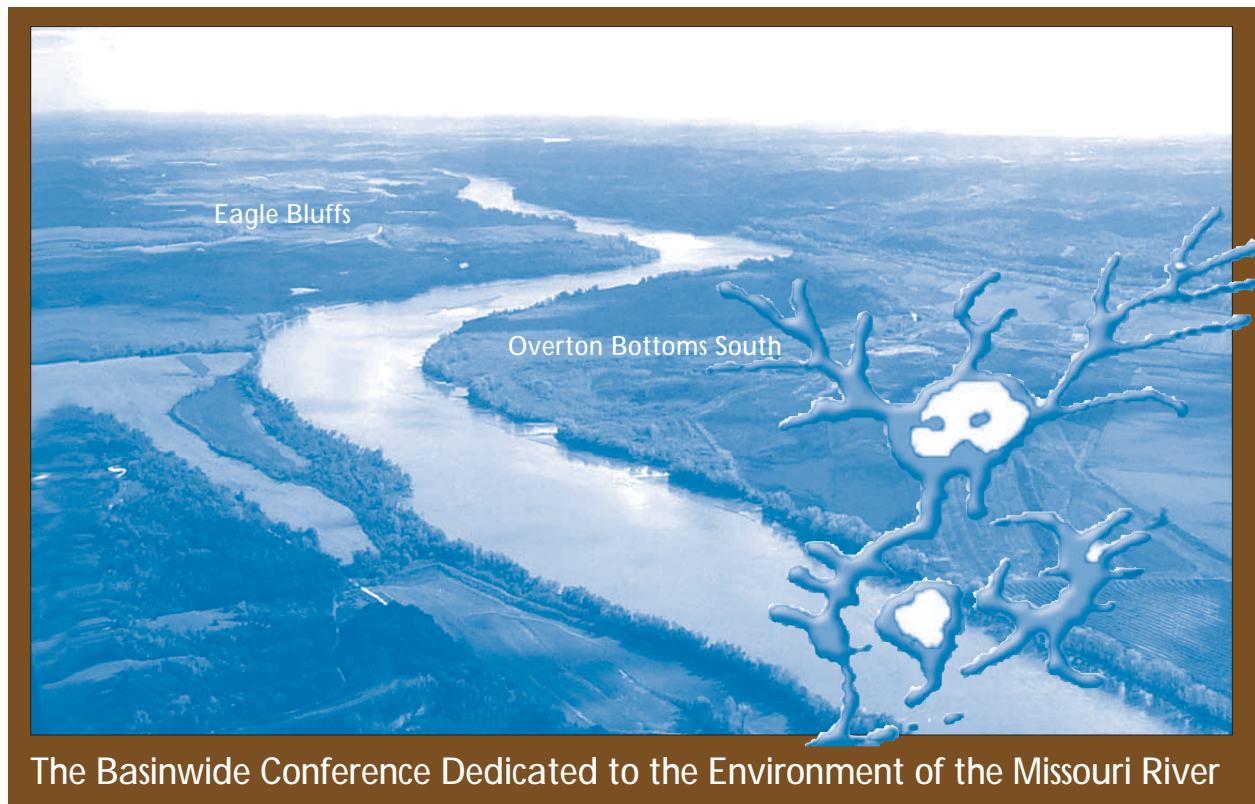


Rediscovering Missouri River CONNECTIONS



PROGRAM

May 23-26, 2004
Manitou Bluffs Region
Columbia, Missouri



The Basinwide Conference Dedicated to the Environment of the Missouri River



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Rediscovering Missouri River CONNECTIONS

A FORUM for
Missouri River
stakeholders to
EXCHANGE
information,
SHARE
perspectives,
SOLVE
problems.

Welcome to the 8th Annual Missouri River Natural Resources Conference! This year's conference theme, *Rediscovering Missouri River Connections*, highlights ways that we can work together toward a mutually beneficial Missouri River of many uses. From floating and fishing to irrigation, transportation and hydropower, the Missouri River means many things to many people. This conference is a perfect example of how people with different ideas, interests and disciplines can come together to discuss Missouri River management.

As we commemorate the 200th anniversary of the Lewis and Clark Corps of Discovery, modern Missouri River explorers are rediscovering how to live in harmony with the river. Missouri River stakeholders are part of a world wide endeavor to connect with each other and their unique river to discover resource management solutions that merge ecosystem health with multiple human uses.

Today, as we answer management questions based on the scientific principles underlying this large river's ecosystem, we look to the Lewis and Clark historical records as one snapshot in time of a constantly changing river. Modern scientific exploration involves not only recording the river's natural resources, but providing unbiased interpretation of the science and collaborating with others to conduct research that contributes to making management decisions.

At this year's conference, we explore new ways to make connections and share visions of how to move forward with Missouri River resource management. I challenge you to get involved, renew old friendships, make new friends, and work with others to achieve your river management goals. Thank you for participating and have a great conference!

Brian Canaday, Conference Chairman
Missouri Department of Conservation

Conference Organizers

Brian Canaday (Conference Chairman)
Missouri Department of Conservation
Jefferson City, Missouri

Robert Bacon and Joe Engeln
Missouri Department of Natural Resources
Jefferson City, Missouri

Tom Bell, Maureen Gallagher, and Tim Haller
Big Muddy National Fish and Wildlife Refuge
U.S. Fish and Wildlife Service
Columbia, Missouri

Jim Berkley (Program Co-chair)
U.S. Environmental Protection Agency
Denver, Colorado

Michael Chapman (River Trip Chair)
U.S. Army Corps of Engineers
Kansas City, Missouri

Mike Cooper
Missouri River Communities Network
Columbia, Missouri

David Galat
USGS Cooperative Research Unit,
Department of Fish and Wildlife,
University of Missouri-Columbia
Columbia, Missouri

Jeanne Heuser (Promotion Chair)
and Carl Korschgen
U.S. Geological Survey
Columbia Environmental Research Center
Columbia, Missouri

Jane Ledwin (Program Co-chair)
Ecological Services
U.S. Fish and Wildlife Service
Columbia, Missouri

Mike LeValley (Business Chair)
Missouri River Natural Resources Committee
U.S. Fish and Wildlife Service
Missouri Valley, Iowa

Mike Olson
U.S. Fish and Wildlife Service
Bismarck, North Dakota

Tony Prato
Center for Agricultural, Resource, and
Environmental Systems
University of Missouri-Columbia
Columbia, Missouri

Chad Smith
American Rivers
Lincoln, Nebraska

Michael Snyder and Jeff Turner
HDR Engineering, Inc.
Kansas City, Missouri

Vince Travnichek
Missouri Department of Conservation
St. Joe, Missouri

Financial Supporters

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U.S. Army Corps of Engineers

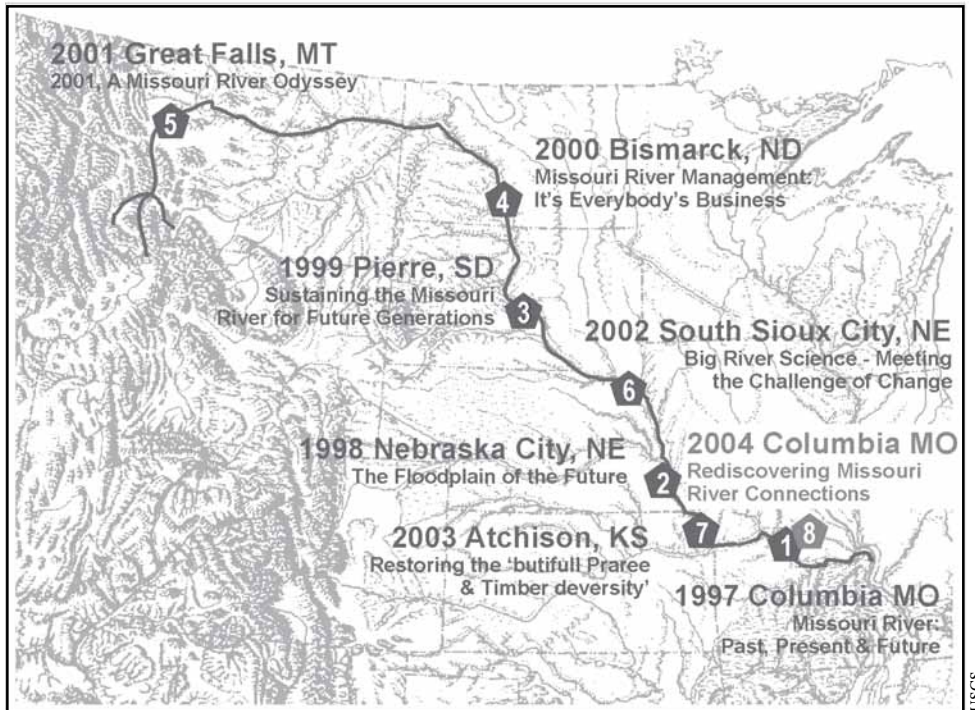
U.S. Geological Survey, Columbia
Environmental Research Center

U.S. Geological Survey Cooperative
Research Unit, Department of Fisheries
and Wildlife Sciences, University of
Missouri-Columbia.

Prize Donators

Mary Palmer • Scott Faiman • Columbia
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The Mid-Missouri Mavericks Baseball
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Conservation • Cabelas • Missouri
Department of Natural Resources • Word
of Mouth Catering • Gene Gardner •
Kansas City Chiefs • Missouri Chapter of
the American Fisheries Society •
Columbia Area Chamber of Commerce

Conference Begins New Cycle



All previous Missouri River Natural Resources Conference locations and themes.

In 2004, the Missouri River Natural Resources Conference returns to Columbia, Missouri, where it originated in 1997. As we begin a new cycle for this basinwide event, we need you to share your thoughts on future directions. You will receive a short survey during the conference, which we hope you will complete. To “inspire” you, when you turn the survey in at the registration desk, you will receive a gift and a chance to win a prize at the Wednesday luncheon.

Since the conference began eight years ago, much has changed along the river and in the world. One thing remaining unchanged is the desire of the Missouri River Natural Resources Committee (MRNRC) and U.S. Geological Survey (USGS), conference founders, to offer this scientific forum to Missouri River stakeholders.

The MRNRC is a non-profit association of state fish and wildlife agency representatives whose mission is to implement a systems approach to managing Missouri River natural resources. The USGS is a federal agency within the Department of Interior with a mission of providing scientific information to describe and understand the Earth.

The USGS provides much of the organizational work for the conference, while the MRNRC delegate in the host state serves as the conference chairperson. The change in location each year allows the host to highlight their unique river ecology and management issues. One of the questions in the survey is about this annual location change.

Numerous agencies and organizations contribute to the conference by serving on the planning committee or providing funds that help keep registration fees quite low for a conference of this type. The survey also quizzes you on fees and how to solve the problem of ever increasing costs.

The original conference goal was to include all Missouri River stakeholders in a forum for information exchange on the stewardship, ecology, and management of the Missouri River. The survey asks if you think the conference accomplishes the goal.

These types of questions will help us clarify whether the conference is meeting your needs. Thanks in advance for helping us determine the future of the Missouri River Natural Resources Conference.

Missouri River Manitou Bluffs Region



USGS



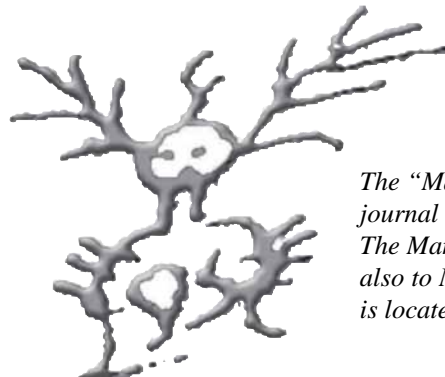
Missouri River Communities Network

The Manitou Bluffs Region of the Missouri River extends about 55 river miles (RM) from Jefferson City (RM 143) to Boonville (RM 198).

In June 1804, the Lewis and Clark Corps of Discovery passed between the limestone bluffs that line the river near modern-day Rocheport, Missouri. Clark saw pictographs painted on the bluffs and recorded these 'manitous' in his journal. The Manitou lends its name to the region today.

The Missouri River naturally narrows between the bluffs in this region referred to as the Ozark Border Woodland/Forest Hills land type. Characterized by high dissection and local relief over 200 feet, the area has typical Ozark Mountain karst features such as sinkholes, caves, and springs.

After the Midwest Flood of 1993, thousands of floodplain acres in the Manitou Bluffs Region were bought by public agencies to provide natural areas for flood dispersal, reduce repeated damage payments, and rehabilitate fish and wildlife habitat.



The "Manitou" recorded in William Clark's journal is a representation of the Great Spirit. The Manitou lends its name to the region and also to Moniteau County where Plowboy Bend is located (see map, page 12).

Schedule Overview

Holiday Inn Select

Sunday, May 23

- Noon Registration - poster and exhibit set-up - *Expo Center*
- 1:00 p.m. Down by the River Trip: *Overton Outing* - (p6)*
- 5:00 p.m. Welcoming Social - *Expo Center*
- 7:00 p.m. *Sharing the Challenge: Ten Years After* by Gerald Galloway (p6) - *Windsor I & II*

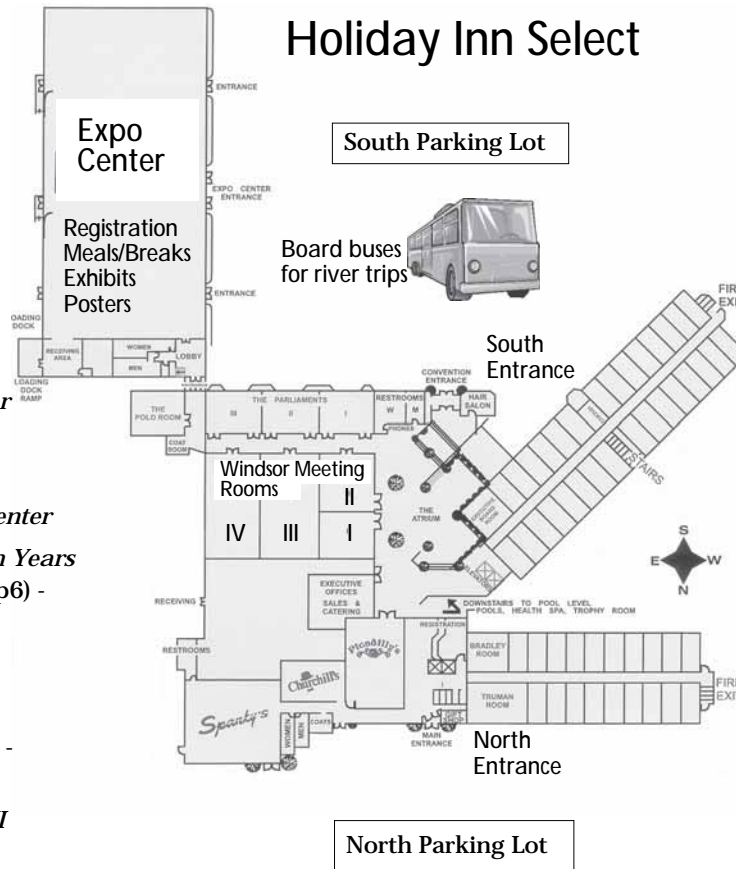
Monday, May 24

- 6:30 a.m. Registration and Breakfast - *Expo Center*
- 8:00 a.m. Plenary (p7) - *Windsor I & II*
- 10:00 a.m. Break - *Expo Center*
- 10:30 a.m. **Session 1 - Linking Habitats with Species** (p7) - *Windsor II*
Session 2 - Hydrology and Water Quality (p7) - *Windsor I*
- Noon Lunch - *Expo Center*
- 1:00 p.m. Down by the River Trips (p12) - *south parking lot*
- 5:30 p.m. BBQ Supper at Les Bourgeois Winery (p8) - *arrive directly from river trip*

Tuesday, May 25

- 6:30 a.m. Breakfast - *Expo Center*
- 8:00 a.m. Plenary (p8) - *Windsor I & II*
- 9:15 a.m. Break - *Expo Center*
- 10:00 a.m. **Session 1 - River Users** (p9) - *Windsor II*
Session 2 - Biotic Habitat Interactions (p9) - *Windsor I*
- 11:40 a.m. Lunch and presentation - *Expo Center*
- 1:00 p.m. Down by the River Trips (p12) - *south parking lot*
- 5:30 p.m. Fish Fry at Cooper's Landing (p9) - *arrive directly from river trip*

* (p6) - represents page number where details can be found on the activity



- ◆ **Meals:** All hotel food served in Expo Center.
- ◆ **Breakfast:** 6:30-8:00 a.m.
- ◆ **River trips:** Board buses in south parking lot.

Wednesday, May 26

- 7:00 a.m. Breakfast - *Expo Center*
- 8:00 a.m. **Session 1 - Habitat Rehabilitation** (p10) - *Windsor III*
Session 2 - Biotic Habitat Interactions (p10) - *Windsor IV*
- 9:40 a.m. Break - *Expo Center*
- 10:10 a.m. **Session 1 - Public/Private Partnerships** (p10) - *Windsor III*
Session 2 - Fisheries Resources (p10) - *Windsor IV*
- Noon Lunch and presentation (p11) *Expo Center - Prize giveaways!*
- 1:30 p.m. Main Conference ends
- 1:30 p.m. Workshop - *Windsor IV*
Independent Science Review (p11)

Thursday, May 27

- 8:00 a.m. - *(continued)*
- Noon Workshop - *Windsor IV*
Independent Science Review (p11)

Sunday, May 23

- Noon Registration - Poster and exhibit set-up - *Expo Center*
- 1:00 p.m. Down by the River: Overton Outing (p12-15)
- 5:00 p.m. Welcoming Social - *Expo Center*
Poster and Exhibit Session
Book Signing
- 7:00 p.m. ***Sharing the Challenge: Ten Years After***
Gerald Galloway (p26) - *Windsor I & II*

SPECIAL THANKS to
HDR Engineering, Inc. for
supporting the Sunday
evening social.

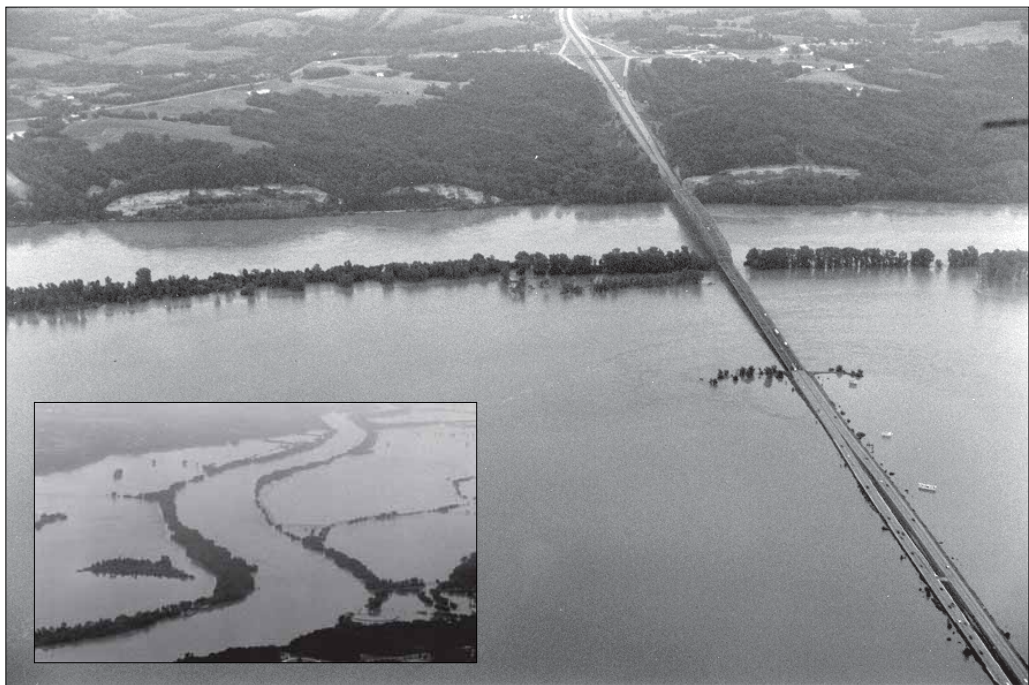


Gerald Galloway

Many in the Missouri River basin are familiar with Retired Brigadier General Gerald Galloway from his lead on *Sharing the Challenge: Floodplain Management into the 21st Century*, the important post-1993 Midwest Flood report. A major recommendation from that report was to remove towns and farms from the floodplain to reduce repeated flood damage expense. In the Manitou Bluffs Region, this recommendation was implemented and today thousands of acres are now in public ownership and will be highlighted during river trips.

In 2001, General Galloway served the Missouri River again by working on the National Research Council study, *The Missouri River Ecosystem: Exploring Prospects for Recovery*. His appreciation for the resource management dilemmas facing Missouri River stakeholders makes him well suited to provide a vision for the future of the Big Muddy.

Retired General Galloway's presentation is sponsored by the USGS Cooperative Research Unit, Department of Fisheries and Wildlife Sciences, University of Missouri-Columbia.



The entire floodplain in the Manitou Bluffs Region was submerged in the 1993 Midwest Flood. Interstate 70, linking St. Louis and Kansas City, crosses over the Missouri River at Rocheport and Overton Bottoms, where water lapped at the edge of the highway.

Monday, May 24

6:30 a.m. Registration and Breakfast -
Expo Center

8:00 a.m. Plenary (p27) - *Windsor I & II*
Welcome

John Hoskins, Director
Brian Canaday, Conference Chairman
Missouri Department of Conservation
Jefferson City, MO

Plenary Presentation Introductions

Jim Berkley, U.S. Environmental Protection
Agency, Denver, CO

***From Pelican Island to the Missouri Basin:
Collaboration and Resource Management***

Dr. Steven Yaffee
University of Michigan, Ann Arbor, MI

Independent Science Review

Dr. Deborah Brosnan
Sustainable Ecosystem Institute, Portland, OR



Steven Yaffee



Deborah Brosnan

10:00 a.m. Break - *Expo Center*

10:30 a.m. Concurrent Sessions

Session 1 - Windsor II
Linking Habitats with Species
Moderator: Maureen Gallagher, USFWS

Session 2 - Windsor I
Hydrology and Water Quality
Moderator: Joe Engeln, MDNR

10:30 *Habitat Availability Contributions of Side-Channel Chutes.* Robert Jacobson, U.S. Geological Survey, Columbia MO (p30)

Ground Water Flow in the Missouri River Alluvial Aquifer Near Ft. Leavenworth, Kansas. Brian P. Kelly, U.S. Geological Survey, Lee's Summit MO (p32)

10:50 *Fish Community Assessment of Lower Missouri River Side Channels.* Louise Mauldin, U.S. Fish and Wildlife Service, Columbia MO (p30)

Hydrology of Artificial Flooding on the Eagle Bluffs Conservation Area - Where Does All That Water Go? Matthew F. Knowlton, University of Missouri, Columbia MO (p32)

11:10 *Waterbird Abundance on Side-Channel Habitats Along the Lower Missouri River.* John M. (Jack) Finley, University of Missouri, Columbia MO (p31)

Water Quality and Ground Water Flow at Eagle Bluffs Wetlands and McBaine Bottoms. Brenda J. Smith, U.S. Geological Survey, Rolla MO (p33)

11:30 *Linking Habitat with Species: Integrating Science to Adaptively Manage the Big Muddy Refuge.* Maureen A. Gallagher, U.S. Fish and Wildlife Service, Columbia MO (p31)

QUAL-W2 Two-Dimensional Hydrodynamic and Water Quality Modeling on the Main Stem. William Doan, U.S. Army Corps of Engineers, Omaha NE (p33)

Monday, May 24

Noon Lunch - *Expo Center*

People leaving on the Lisbon Bottom River Trip pick-up a box lunch in the Expo Center and head right out to the bus. Others stay for the buffet lunch and leave at 1:00 for river trips.

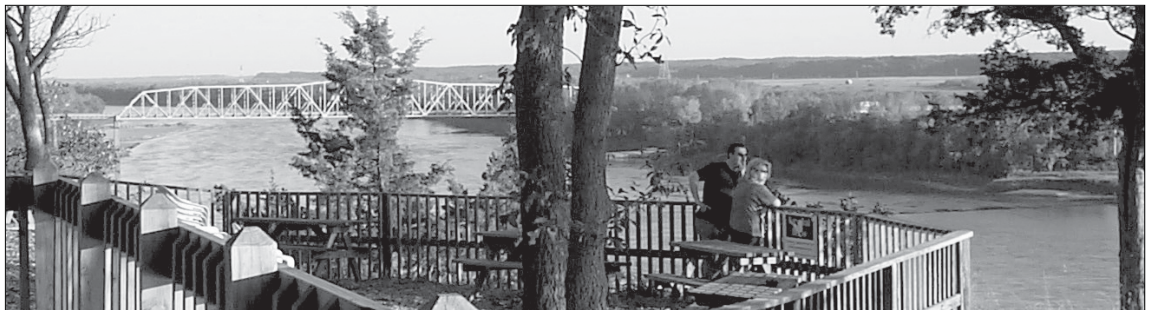
1:00 p.m. Down by the River Trips (p12)

5:30 p.m. BBQ Supper at Les Bourgeois Winery, Rocheport, MO

Down by the River Trips

Your conference registration receipt and nametag designate which river trips you may attend.

Please prepare for the weather with appropriate clothing, sunscreen, insect repellent, etc.



The vantage point from Monday night's BBQ supper at Les Bourgeois Winery in Rocheport, Missouri provides a bird's eye view of Overton Bottoms and its constructed side-channel chute. The Winery is just above the popular Missouri Department of Natural Resources' *Katy Trail State Park*, a former railroad turned

into a hiking and biking trail that runs along the banks of the river for the entire 55 miles of the Manitou Bluffs region. Access to the Trail is available just down the road from the Winery in the historic river town of Rocheport. Music at the BBQ is provided by *Union Label*.

Tuesday, May 25

6:30 a.m. Breakfast - *Expo Center*

8:00 a.m. Plenary (p28)
Windsor I & II
Introduction
Tony Prato, University of Missouri - Columbia

Best Practice Governance of River Basins: Implications for Large Rivers like the Missouri

Dr. Bruce Hooper
Southern Illinois University,
Carbondale, IL

9:15 a.m. Break - *Expo Center*

Bruce Hooper worked on the Australian Murray-Darling River basin prior to his move to the United States.



Darling River at Walgett

Tuesday, May 25 *continued*

10:00 a.m. Concurrent Sessions

Session 1 - Windsor II
River Users
 Moderator: Rochelle Renken, MDC

Session 2 - Windsor I
Biotic Habitat Interactions - Part I
 Moderator: Jeff Turner, HDR, Inc.

10:00 *Tow Boat Utilization of the Channelized Missouri River.* Eugene J. Zuerlein, NE Game and Parks Commission, Lincoln NE (p34)

Evapotranspiration Rates and Water Balance of Platte River Riparian Woodlands. Matthew Landon, U.S. Geological Survey, Lincoln NE (p37)

10:20 *Missouri River Public Use Assessment: Overview and Study Design.* Steven L. Sheriff, Missouri Department of Conservation, Columbia MO (p35)

Analysis of Soils and Chute Reconstruction Success at Tobacco Island Bend. Jolene M. Hulsing, University of Nebraska at Omaha, U.S. Army Corps of Engineers, Omaha NE (p38)

10:40 *Recreational Use Issues at the Dawn of the 200th Anniversary.* David L. Miller, State University of New York College at Cortland, Cortland NY (p35)

The Environmental Monitoring and Assessment Program for Great River Ecosystems. Ted Angradi, U. S. Environmental Protection Agency, Denver CO (p38)

11:00 *Rivers of Change - Variety, Voices and Two Centuries of Altering our Rivers and Lives.* Tom Mullen, Author, Malibu CA (p36)

Detailed Surficial Geological Mapping of the Missouri River Valley: River Management Implications. John Holbrook, Southeast Missouri State University, Cape Girardeau MO (p39)

11:20 *A Strategy to Prevent Zebra Mussels Invasion on Boats during the Lewis and Clark Bicentennial.* Bill Zook, Pacific States Marine Fisheries Commission, Shelton WA (p36)

11:40 a.m. Lunch and presentation - *Expo Center*

Quest for the Missouri River Source (p28)
 John R. LaRondeau
 U.S. Army Corps of Engineers, Omaha NE



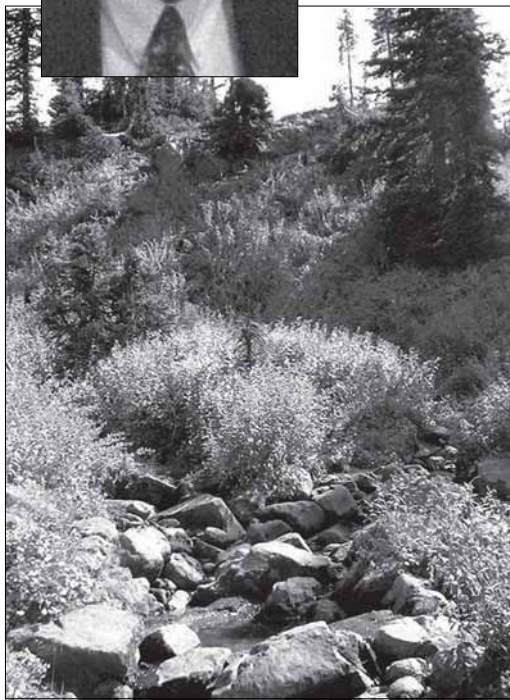
John LaRondeau

1:00 p.m. Down by the River Trips (p12-15) - south parking lot

5:30 p.m. Fish Fry at Cooper's Landing with a special 'roast' for Jim Milligan who recently retired from the U.S. Fish and Wildlife Service, Columbia, MO



Jim Milligan



John LaRondeau

The Missouri River Source

Wednesday, May 26

Concurrent Presentations

<p><i>Session 1 - Windsor III</i> Habitat Rehabilitation Moderator: Glenn Covington, USACE</p>	<p><i>Session 2 - Windsor IV</i> Biotic Habitat Interactions - Part II Moderator: Tim Fobes, HDR, Inc.</p>
<p>8:00 a.m. <i>Current Implementation Plan, Corps Fish and Wildlife Mitigation Project.</i> Kelly Ryan, U.S. Army Corps of Engineers, Kansas City MO (p40)</p>	<p><i>Waterbird and Invertebrate Response During Spring to Previously vs. Newly Flooded Habitats.</i> Amanda McColpin, Missouri Department of Conservation, Rothville MO (p43)</p>
<p>8:20 a.m. <i>The Big Muddy National Fish and Wildlife Refuge.</i> Tom Bell, U.S. Fish and Wildlife Service, Columbia, MO (p40)</p>	<p><i>Evaluation of Avian Use in the Missouri River and Floodplain.</i> Andrew H. Raedeke, Missouri Department of Conservation, Columbia MO (p44)</p>
<p>8:40 a.m. <i>Songbird Use of Early Successional Bottomland Habitats along the Lower Missouri River.</i> Brian G. Root, Missouri Department of Conservation, Columbia MO (p41)</p>	<p><i>Nursery Habitat for Larval Fishes in the Lower Missouri River.</i> Kerry Reeves, University of Missouri, Columbia MO (p44)</p>
<p>9:00 a.m. <i>Integrated Investigations of Ecological Responses to Rehabilitation at Overton Bottoms, MO.</i> Carol Finn, U.S. Geological Survey, Rolla MO (p41)</p>	<p><i>Spawning Periods and Growth of Larval Gizzard Shad from the Lower Missouri River.</i> Lori D. Patton, University of Missouri, Columbia MO (p45)</p>
<p>9:20 a.m. <i>Restoration Modeling for Edward (Ted) and Pat Jones - Confluence Point State Park.</i> Ken McCarty, Missouri Department of Natural Resources, Jefferson City MO (p42)</p>	<p><i>200 Year Missouri River History [1803-2003] of the Least Tern and Piping Plover.</i> Bill Beacom, Sioux City IA (p45)</p>
<p>9:40 a.m. Break</p>	
<p><i>Session 1 - Window III</i> Public/Private Partnerships Moderator: Jane Ledwin, USFWS</p>	<p><i>Session 2 - Windsor IV</i> Fisheries Resources Moderator: Mark Drobish, USACE</p>
<p>10:10 a.m. <i>The Wetland Reserve Program Along the Missouri River and Major Tributaries.</i> Douglas L. Helmers, USDA-Natural Resources Conservation Service, Chillicothe MO (p46)</p>	<p><i>Analysis of the Missouri River Natural Hydrograph as Sioux City, Iowa.</i> Donald Jorgensen, Siouxland Chamber of Commerce, Jefferson SD (p49)</p>
<p>10:30 a.m. <i>The Two Rivers Project of Fremont County, Iowa.</i> David Carter, Fremont Soil and Water Conservation District, Tabor IA (p46)</p>	<p><i>Identification of Hard Spawning Substrates on the Lower Missouri River.</i> Robert Jacobson, U.S. Geological Survey, Columbia MO (p49)</p>
<p>10:50 a.m. <i>Democratizing Science, Management, and Public Policy in the Missouri River Ecosystem.</i> Meghan Sittler, University of Nebraska, Lincoln NE (p47)</p>	<p><i>Annual Reproductive Hormone Levels in Shovelnose Sturgeon from the Missouri River.</i> Diana Papoulias, U.S. Geological Survey, Columbia MO (p50)</p>
<p>11:10 a.m. <i>Important Bird Areas and the Missouri River: A Project Vision.</i> Roger Still, Audubon Missouri, Columbia MO (p47)</p>	<p><i>Effectiveness of Ultrasound for Estimating Fecundity of Missouri River Shovelnose Sturgeon.</i> Janice L. Bryan, Columbia MO (p50)</p>
<p>11:30 a.m. <i>Potential for Reducing Nutrient Loading to Rivers with Nutrient Farming/Trading.</i> Tony Prato, University of Missouri-Columbia, Columbia MO (p48)</p>	<p><i>Movements and Habitat Selection of Bighead and Silver Carp in the Lower Missouri River.</i> Duane Chapman, U.S. Geological Survey, Columbia MO (p51)</p>

Wednesday, May 26

Noon - Lunch and Presentation - *Expo Center*

Prize giveaways to those attending the luncheon!
Be there to get yours!

***The Lewis and Clark Expedition and
the Lower Missouri River:***

Running the First Gauntlet (p29)

Jim Denny, Historian

Missouri Department of Natural Resources,
Division of State Parks, Jefferson City, MO



Jim Denny

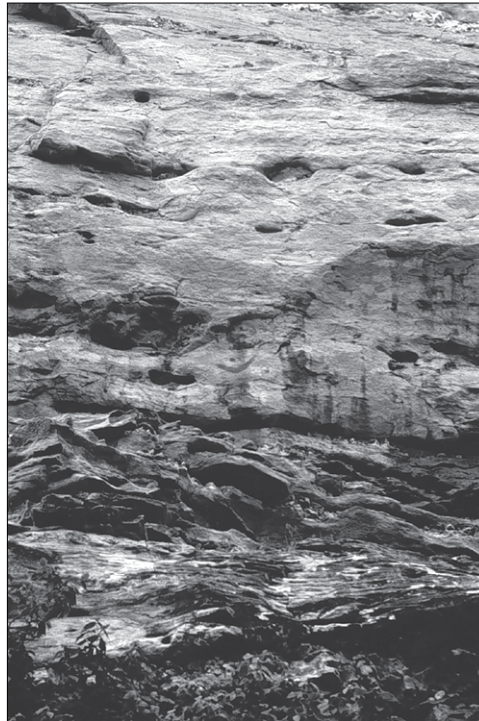
1:30 - 5:00 p.m. Workshop - Windsor IV

**Independent Science Review:
Towards a Fair Way to Judge Science
in the Missouri River Basin**

Science is an important guiding light for decision making in the Missouri Basin, but often times there is conflict about the science, its objectivity and usefulness. This one-day workshop, led by Dr. Steven Yaffee and Dr. Deborah Brosnan, explores how other river basins have used independent science review as a fair way to judge science and how it might be used to help the Missouri Basin move from “science wars” to decision making. Financial support for the workshop is provided by the U.S. Army Corps of Engineers.

Workshop continued:

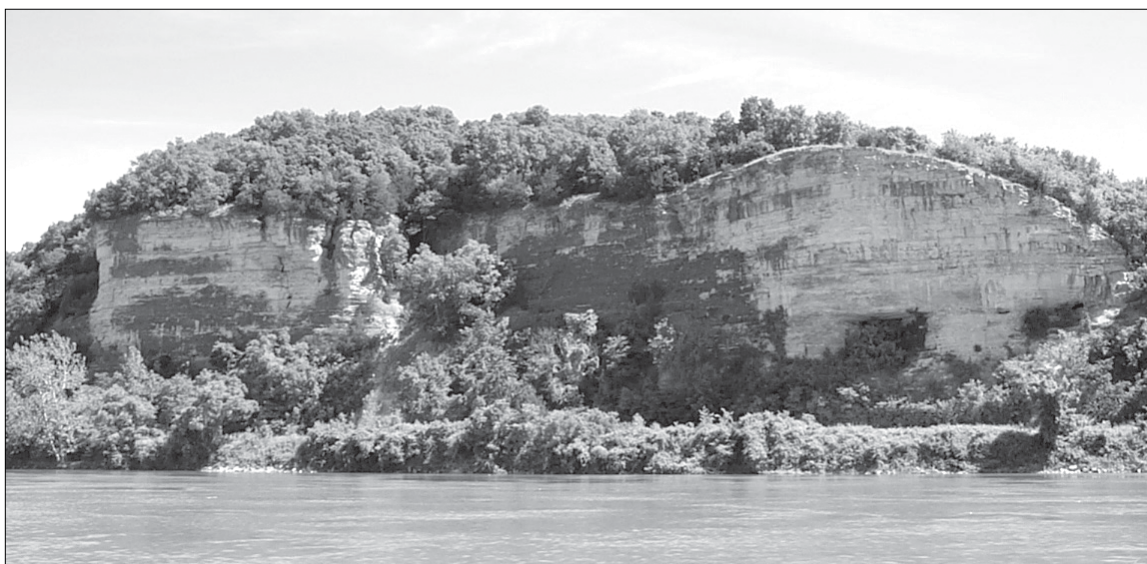
Thursday, May 27, 8 a.m. - Noon
Windsor IV



Jim Denny

*Bluff face in the Manitou Bluffs Region.
Can you see the pictograph?*

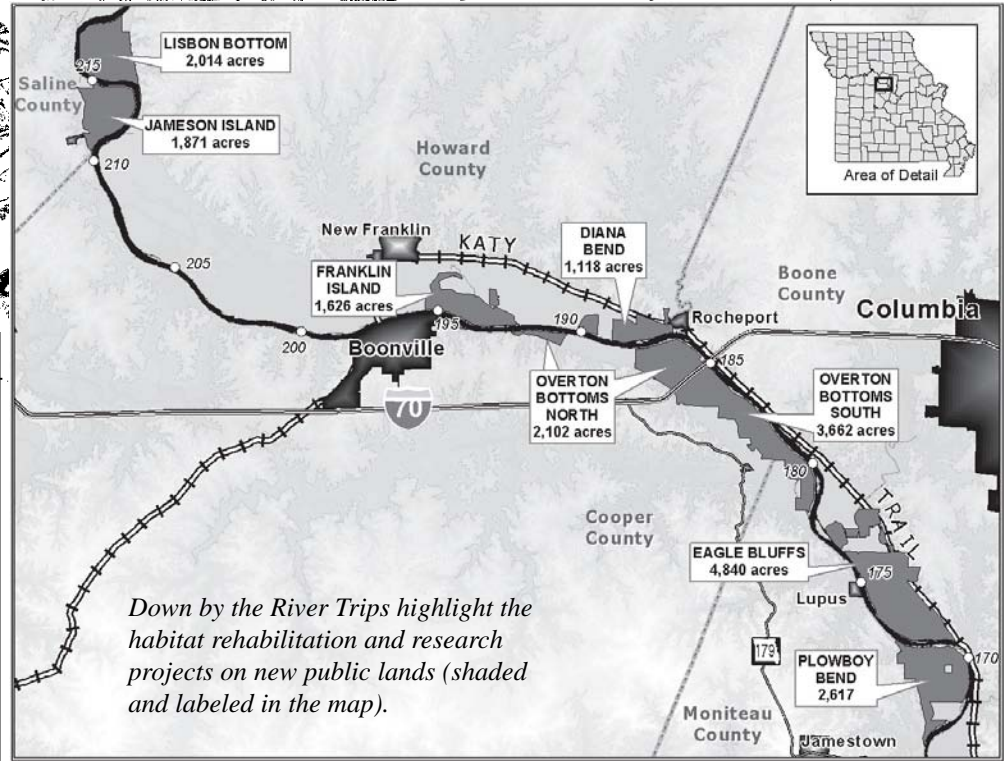
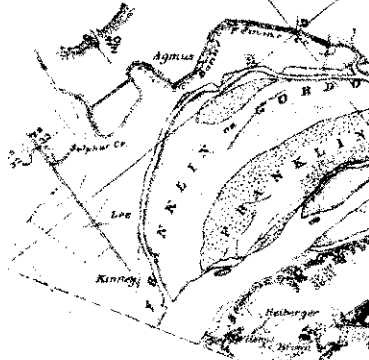
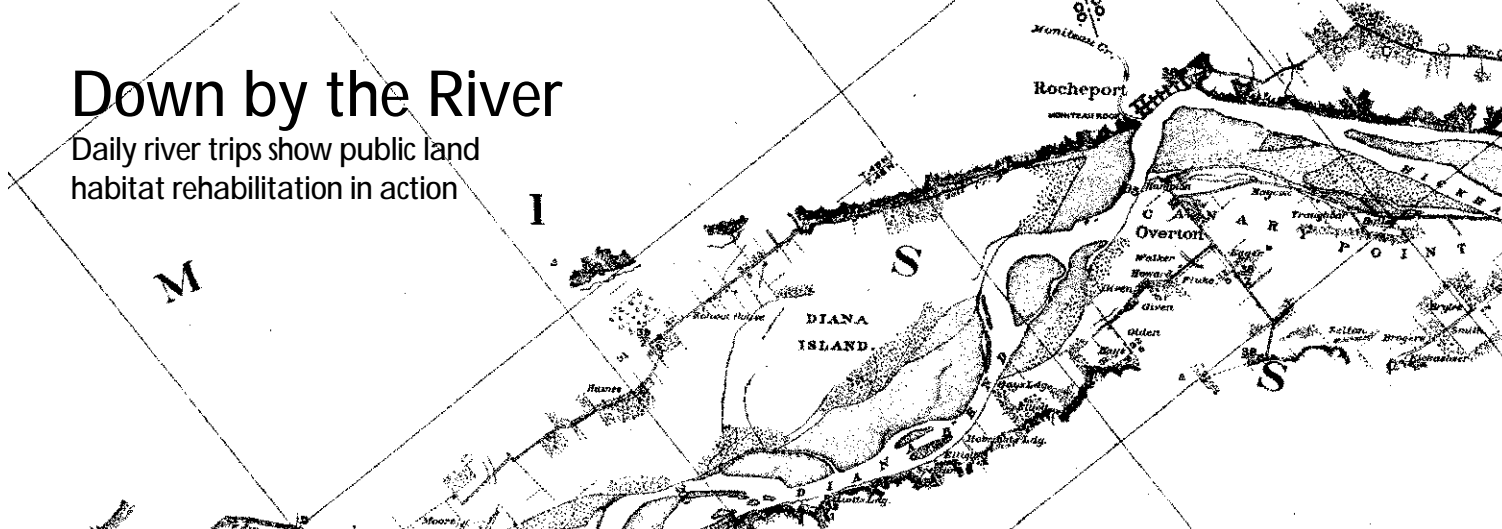
(Hint: look for a smile.)



The Manitou Bluffs

Down by the River

Daily river trips show public land habitat rehabilitation in action



The Missouri River Commission (MRC) map above was created in 1893 and shows the river from Boonville (left) to the north end of Plowboy Bend (right).
 MRC map courtesy of U.S. Army Corps of Engineers.

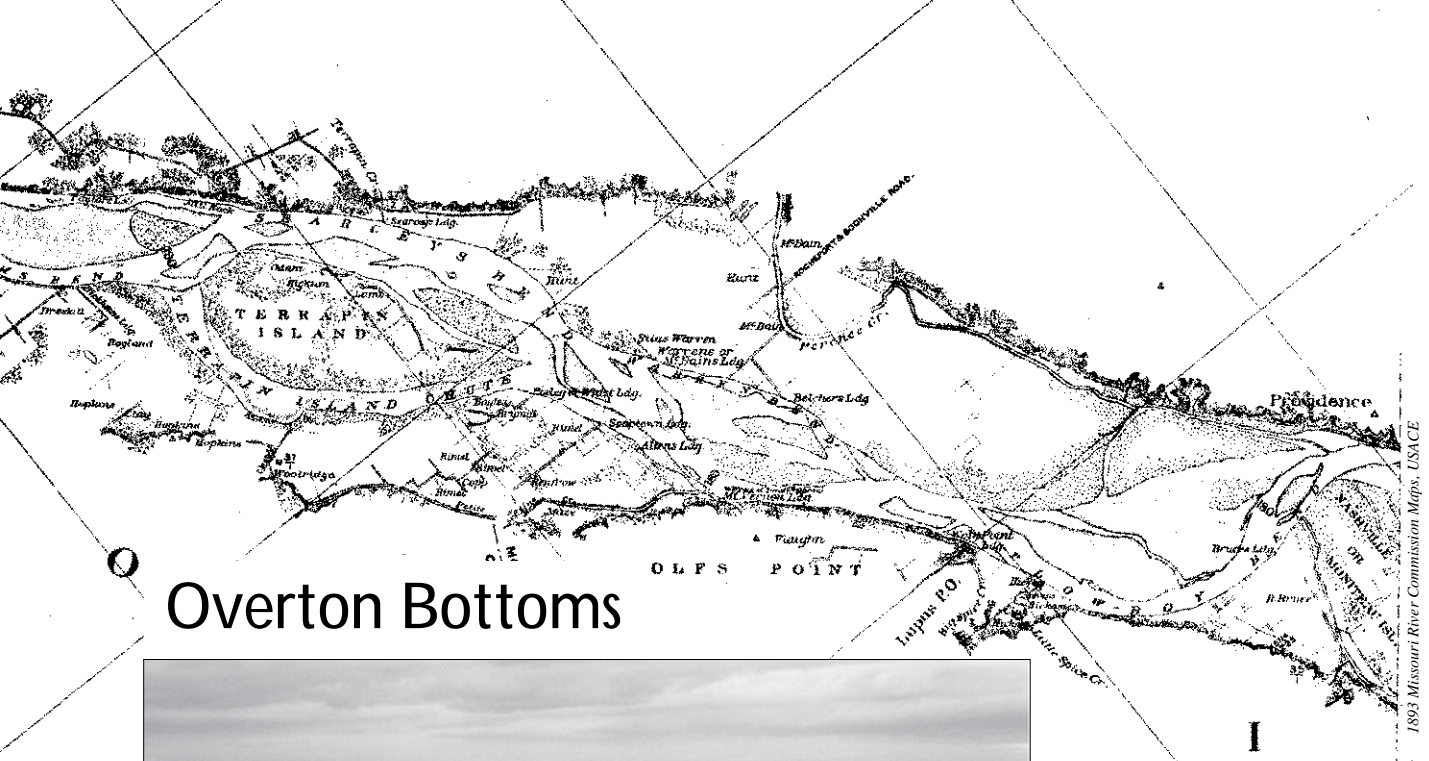
Down by the River Trips highlight the habitat rehabilitation and research projects on new public lands (shaded and labeled in the map).

The shaded areas represent thousands of floodplain acres acquired as public lands since the 1993 Midwest Flood. These areas are now undergoing fish and wildlife rehabilitation by multiple public agencies.



Eagle Bluffs

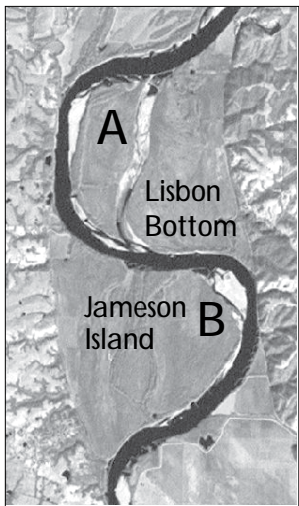
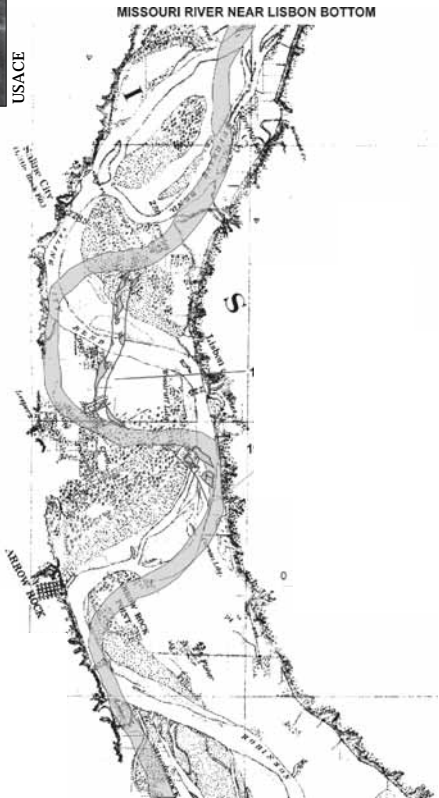
May is the peak of shorebird migration at the innovative Eagle Bluffs Conservation Area where 1,600 acres of constructed wetlands are maintained with water from two sources: Missouri River water pumped into the wetlands and the City of Columbia wastewater. The wastewater is treated with traditional treatment and then run through city-owned constructed wetlands before entering Eagle Bluffs. Eagle Bluffs is owned by the Missouri Department of Conservation and was initially designed to provide wetland habitat for migratory birds. A recent addition has potential to also help restore fish populations.



Overton Bottoms



Overton Bottoms has over 5,000 acres of floodplain undergoing habitat rehabilitation. The photo demonstrates co-existing uses of the floodplain south of Interstate 70 with the setback levee on the left protecting farmland adjacent to fish and wildlife habitat. These lands are part of the U.S. Army Corps of Engineers' *Missouri River Fish and Wildlife Mitigation Project* and are managed by the Missouri Department of Conservation. Lands north of I70 are part of the *Big Muddy National Fish and Wildlife Refuge*.



Lisbon Bottom

Lisbon Bottom provides a wealth of information for managers and scientists learning how to rehabilitate fish and wildlife habitats in a large river system. The naturally formed side channel chute at Lisbon Bottom (A) was created by floods between 1993-97. Wing dike modifications on the northeast edge of Jameson Island (B) by the U.S. Army Corps of Engineers are creating new sandbar habitat. Lisbon Bottom and Jameson Island are part of the U.S. Fish and Wildlife Service *Big Muddy National Fish and Wildlife Refuge*.

Missouri River Commission map overlaid with the current river channel at Lisbon Bottom
 Courtesy of USGS

Down by the River Trip Presenters

Overton Outing Barge Trip - Sunday

Living Lands and Waters

Chad Pregracke - river clean-ups

Missouri Department of Natural Resources

Jim Denny - Lewis and Clark history

Bryan Hopkins - Missouri River education

U.S. Army Corps of Engineers

Mike Chapman, Glenn Covington - shallow-water habitat

Kelly Ryan - Fish and Wildlife Mitigation Project

U.S. Fish and Wildlife Service

Big Muddy National Fish and wildlife Refuge

Tom Bell - Refuge manager

Maureen Gallagher - turtle biology

U.S. Geological Survey

Duane Chapman - Asian carp

Robb Jacobson - geomorphology/hydrology

Barry Poulton - benthic invertebrates

Aaron DeLonay - pallid sturgeon

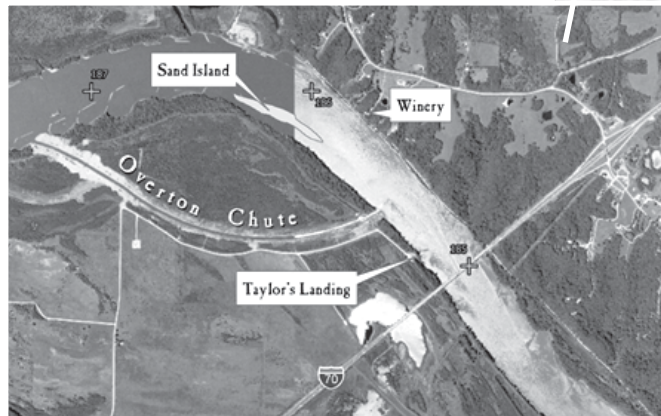
Jeanne Heuser - information

University of Missouri - Columbia

Emily Tracy - sandbar habitats

Kerry Reeves - larval fish

Overton barge and boat trips travel south from Taylor's Landing. The Overton constructed chute is highlighted on most of the river trips.



Overton Boat Trip Monday

Missouri Department of Conservation

Craig Gemming and Tim Grace - sturgeon

U.S. Army Corps of Engineers

Glenn Covington, Jeremiah Szynskie -

Overton habitats

U.S. Fish and Wildlife Service

Louise Mauldin - fisheries

U.S. Geological Survey

Dave Gaeuman - geomorphology/hydrology

Barry Poulton - benthic invertebrates

University of Missouri - Columbia

Emily Tracy - sandbar habitats

Kerry Reeves - larval fish

Jack Finley - shorebirds



Lisbon Barge Trip Monday

Missouri Department of Natural Resources
Bryan Hopkins - Missouri River education

U.S. Army Corps of Engineers
Mike Chapman - shallow-water habitat

U.S. Fish and Wildlife Service
Big Muddy National Fish and Wildlife
Refuge
Tom Bell - refuge manager

U.S. Geological Survey
Robb Jacobson - geomorphology/hydrology



On Tuesday, all field trips end at Cooper's Landing across from Plowboy Bend for a fish fry.

Eagle Bluffs/Bat Cave Tuesday

Missouri Department of Conservation
Jim Loveless, Tim Smith - Eagle Bluffs

Please note that there may be changes to presenters and schedules of river trips depending on weather conditions. Also, additional presenters might be added.

Overton Land Trip Tuesday

Missouri Department of Conservation
Kent Korthas, Frank Drummond, Leon Borgess, Steven Noll - Overton Bottoms land rehabilitation

SE Missouri State University
John Holbrook - surficial stratigraphy

U.S. Army Corps of Engineers
Bob Dimmitt - Overton habitats

U.S. Fish and Wildlife Service
Maureen Gallager - turtles
Barb Moran - vegetation

U.S. Geological Survey
Robb Jacobson - geomorphology/hydrology
Brian Kelly - ground water

University of Missouri - Columbia
Amanda Hassler - water quality
Jack Finley - shorebirds

Overton-Plowboy Barge Trip Tuesday

Missouri Department of Natural Resources
Jim Denny - Lewis and Clark history

U.S. Army Corps of Engineers
Mike Chapman - shallow-water habitat

U.S. Fish and Wildlife Service
Big Muddy National Fish and wildlife Refuge
Tom Bell - Refuge manager

U.S. Geological Survey
Duane Chapman - Asian carp
Dave Gaeuman - geomorphology/hydrology

Exhibitors

ESRI-St. Louis

Stephen Kinzy
820 South Main St.
St. Charles, MO 63301
636-949-6620 - skinzy@esri.com
<http://www.esri.com>

Friends of the Big Muddy

Troy Gordon
P.O. Box 58
Columbia, MO 65205
573-445-0086
friends@friendsofbigmuddy.org
<http://www.friendsofbigmuddy.org/index1.htm>

HDR Engineering, Inc.

Jeff Turner
4435 Main Street, Suite 1000
Kansas City, MO 64111
816-360-2769 - jturner@hdrinc.com
<http://www.hdrinc.com>

Hydrolab / OTT —

Hach Company Brands

Steve Fischer
1012 Coho Court
Columbia, MO 65203
573-447-1163 - sfischer@hach.com
<http://www.hydrolab.com/>

American Fisheries Society - MO Chapter

<http://www.fisheries.org/html/index.shtml>
Contact: Brian Canaday, below

Missouri Department of Conservation

Brian Canaday
2901 W. Truman Blvd.
Jefferson City, MO 65102
573-522-4115, ext. 3371
brian.canaday@mdc.mo.gov
<http://www.conservation.state.mo.us/>

Montana State University

Taralyn Fisher
101 Linfield Hall
Bozeman, MT 59717
406-994-7329 - tfisher@montana.edu

The Nature Conservancy

Jason Skold
1019 Leavenworth Street, Suite 100
Omaha, NE 68102
402-342-0282 - jskold@tnc.org
<http://nature.org/>

U.S. Army Corps of Engineers

Kelly Ryan
601 East 12th Street
Kansas City, MO 64106
816-983-3324
kelly.ryan@usace.army.mil
<http://www.nwk.usace.army.mil/projects/mitigation/>

U.S. Fish and Wildlife Service

Big Muddy National Fish and Wildlife Refuge

Tim Haller
4200 New Haven Road
Columbia, MO 65201
573-876-2799 - tim_haller@fws.gov
<http://midwest.fws.gov/BigMuddy/>

Ecological Services

Jane Ledwin
101 Park DeVille, Suite A
Columbia, MO 65201
573-234-2132 - jane_ledwin@fws.gov
<http://midwest.fws.gov/ColumbiaES/>

Fisheries Research Office

Louise Mauldin
101 Park DeVille Suite A
Columbia, MO 65203
573-234-2132 - louise_mauldin@fws.gov
<http://midwest.fws.gov/columbiafisheries/>

U.S. Geological Survey

Columbia Environmental Research Center

Missouri River InfoLINK

Jeanne Heuser
4200 New Haven Road
Columbia, MO 65201
573-876-1876 - jheuser@usgs.gov
<http://infolink.cr.usgs.gov>

Eros Data Center

Carrie Jucht
Mundt Federal Building
Sioux Falls, SD 57198-0001
605-594-6800 - cjucht@usgs.gov
<http://edcwww.cr.usgs.gov/>

Lewis and Clark Commemoration

Mark Newell
Independence Ave.
Rolla, MO 65401
573-308-3850 - mnewell@usgs.gov

Poster Presentations

Listed alphabetically by title. Detailed poster descriptions on pages 18-25.

Analysis of Soils and Chute Reconstruction Success at Tobacco Island Bend.

Jolene M. Hulsing, University of Nebraska at Omaha, U.S. Army Corps of Engineers, Omaha NE (p18)

Changes in Distribution and Abundance of Songbirds in Floodplain Habitats of the Lower Missouri River Watershed.

Neal Young, University of Missouri and Big Muddy National Fish and Wildlife Refuge, Columbia MO (p18)

Chemical Contaminants in Sediments of the Lower Missouri River.

Carl Orazio, U.S. Geological Survey, Columbia MO (p19)

Claims Versus Fact: Missouri River Commercial Navigation.

Eugene J. Zuerlein, Nebraska Game and Parks Commission, Lincoln NE (p19)

Developing Vegetative Cover Types for the Big Muddy National Fish and Wildlife Refuge Using the National Vegetation Classification System.

Maureen A. Gallagher, U.S. Fish and Wildlife Service, Columbia MO (p20)

Effects of Discharge on Sandbar Morphometry between Two Types of Sandbars.

Emily K. Tracy, Missouri Cooperative Fish and Wildlife Research Unit, University of Missouri, Columbia MO (p21)

Influence of Hydrologic Events on Least Tern and Piping Plover Nesting in the Lower Niobrara River, NE.

Stephen K Wilson, National Park Service, Missouri National Recreational River, Yankton SD (p21)

Integrative Samplers Used to Provide a Holistic Assessment of Aquatic Contaminants.

David Alvarez, U.S. Geological Survey, Columbia MO (p22)

Invertebrate Composition and Availability as Food for Migratory Shorebirds and their Microhabitats on Sandbars in the Lower Missouri River.

Jessica Lee, South Dakota State University and Big Muddy National Fish and Wildlife Refuge, Brookings SD (p22)

Multi-disciplinary Investigations of Sturgeon Behavior and Habitat Requirements in the Lower Missouri River.

Aaron DeLonay, U.S. Geological Survey, Columbia MO (p23)

The Effect of Age and Hydrology on Tree Species Composition in Bottomland Forests.

Thomas McCullough Faust, University of Missouri, Columbia, MO (p24)

The Kansas City - Missouri River Relationship: In Love, Out of Love, Back in Love?

Amahia Mallea, University of Missouri-Columbia, Columbia MO (p24)

Upper and Middle Mississippi Valley Cooperative Ecosystem Studies Unit.

Daniel Zerr, CARES, University of Missouri, Columbia MO (p25)

Water Quality and Ground Water Flow of the Columbia/Eagle Bluffs Wetland Complex and McBaine Bottoms.

Brenda J. Smith, U.S. Geological Survey, Rolla MO (p25)

Posters

Posters are listed alphabetically

Poster directory on page 17

Analysis of Soils and Chute Reconstruction Success at Tobacco Island Bend

Jolene M. Hulsing
University of Nebraska at Omaha, U.S. Army Corps of Engineers Omaha District
6 South 15th Street, Omaha, NE 68102-1618
402-221-4506; jolene.m.hulsing@usace.army.mil

Tobacco Island Bend project is part of the *Missouri River Fish and Wildlife Mitigation Project*. The chute was reopened in December 2001 to return floodplain farmland to fish and wildlife habitat.

The purpose of this study is to first determine if soils collected at Tobacco Island, Plattsmouth NE differ from the U.S. Army Corps of Engineers (USACE) description used in the detailed project report of 1994. Secondly, predict if the chute will erode as predicted by USACE based on particle size analysis of collected soil cores. Lastly, observe possible trends comparing recently accreted sediments (since the 1940s) with older accreted sediments (pre-1890s) using GIS layering of historical survey data.

At Tobacco Island Bend, eight sampling sites were located using GIS (ArcView Ver. 3.2). The sites were chosen using three criteria: the presence of a water surface in both the 1890s and 1947 survey data overlaid on 1994 digital imagery, the presence of land surface in the 1890s and 1947 survey data overlaid on 1994 digital imagery, and the location within the proposed extent of erosion along the chute. At each of the eight locations, undisturbed continuous soil cores were collected using a Giddings truck mounted soil probe. Each core was described, recorded, stratified, and sub sampled for later particle size, sieve, calcium carbonate, and organic carbon analysis. Recommendations will be made to USACE for more soils analysis in future detailed plans of chute reconstruction.

Bio: Jolene Hulsing is a Masters of Arts student in the Geography/Geology Department at the University of Nebraska at Omaha, graduating this May. She also works as a hydrologic technician in the Sedimentation & Channel Stabilization Section for the U.S. Army Corps of Engineers, Omaha District. She has spent the last 3 years studying and working with the *Missouri River Fish and Wildlife Mitigation Project*.

Changes in Distribution and Abundance of Songbirds in Floodplain Habitats of the Lower Missouri River Watershed

Neal Young
University of Missouri - Columbia and Big Muddy National Fish and Wildlife Refuge, 4200 New Haven Road, Columbia, MO 65203
573-441-2948; nealyoung500@yahoo.com

Co-Author: Maureen A. Gallagher, Big Muddy National Fish and Wildlife Refuge, 4200 New Haven Road., Columbia, MO

After two years of a three-year study, research on this project is suggesting that songbird communities are affected by slight changes in the hydrology, flood regime, and vegetation in the Lower Missouri River floodplain.

During the pilot year of 2002, bird communities in three distinct habitat types were sampled on the Big Muddy, Swan Lake, and Squaw Creek National Wildlife Refuges and selected state conservation areas in the Lower Missouri River watershed. Early succession forest, mature bottomland hardwood, and wet prairie habitats were sampled in order to determine the distribution and abundance of migrant and breeding birds.

In 2003, the same points were again sampled to compare the bird communities. Early results suggest that lower river levels meant habitat was more readily available in 2003, and thus territories could be established earlier. These findings require more statistical analysis, which will be finished by the end of January. This study is supported by the U. S. Fish and Wildlife Service, U.S. Army Corps of Engineers, University of Missouri-School of Natural Resources, and Missouri Department of Conservation to aid in landscape scale habitat management for the benefit of migratory birds and other declining species of the Missouri River.

Bio: Neal Young earned a B.S. degree and an M.S. in Wildlife Biology from Southeast Missouri State. For his Master's thesis, he studied the effect of habitat on nest site selection and nesting success in eastern phoebes (*Sayornis phoebe*) in southeast Missouri. Neal has worked on many songbird projects across the country and has been the senior research specialist on the songbird project at Big Muddy National Fish and Wildlife Refuge since March 2002.

Chemical Contaminants in Sediments of the Lower Missouri River

Carl Orazio

U.S. Geological Survey

4200 New Haven Road, Columbia, MO 65201

573-876-1823; corazio@usgs.gov

Co-Authors: Kathy Echols, Bill Brumbaugh, Tom May and Barry Poulton, U.S. Geological Survey, Columbia, MO

A study was conducted to determine the spatial distribution of persistent organic pollutants and certain toxic metals in sediments of the Lower Missouri River. Chemical parameters derived from collection of sediments can indicate both current as well as historical anthropogenic contamination.

Sediments from nineteen sites along the river from near Omaha, NE to Jefferson City, MO were collected using Petite Ponar samplers. In addition to receiving contaminants from upstream activities, this stretch of river has several potential point and non-point sources from industrial, urban and agricultural activities. The following toxic chemicals were measured: PCBs, thirty organochlorine pesticides such as chlordane and DDT, and current-use pesticides, namely trifluralin, diazinon, chlorpyrifos, and permethrin. A suite of toxic metals including copper, nickel, zinc, cadmium, and lead were also measured.

Levels of these metals did not appreciably vary among sites and levels of acid-volatile sulfide suggest a low potential for toxicity from these particular metal contaminants. Levels of PCBs ranged from 11-250 ppb (dry weight basis). Most of the organochlorine pesticides were present at low levels, i.e. below 1 ppb, although one site downstream of Kansas City near the Blue River contained up to 20 ppb total chlordane as well as other pesticides. Levels of chlorpyrifos and permethrin ranged from <1 ppb up to 5.5 and 44 ppb, respectively. We will present the spatial distribution of these metal and organic chemical contaminants along this stretch of the Lower Missouri River.

Bio: Carl Orazio has conducted research at the USGS since 1993 and is currently the chief of the Environmental Chemistry Program. In 1992 he Post-doc'ed at the European Community Research Center in Ispra, Italy. From 1983-1992 Carl conducted research on the fate and occurrence of persistent environmental pollutants at the University of Missouri's Environmental Trace Substances Research Center in Columbia, MO.

Claims versus Facts: Missouri River Commercial Navigation

Eugene J. Zuerlein

Fisheries Division, Nebraska Game and Parks Commission

2200 North 33rd Street, Lincoln, NE 68503

402-471-1542; zuerlein@ngpc.state.ne.us.

Co-Authors: Gerald Mestl, Nebraska Game and Parks Commission, Lincoln, NE

Annual commercial tonnage moved by barge on the Missouri River peaked in 1977, fourteen years before the pallid sturgeon was declared endangered. From 1977 to 2002 commercial tonnage declined from 3.3 to 1.1 million tons, while flows on the river were being managed for navigation, except during periods of flood control. Despite the fact that it has been provided a free transportation system by the American taxpayer and almost exclusive priority use of Missouri River flows, why has the Missouri River navigation industry, which claims to be more economical, efficient, environmentally friendly, safe, and critical to the economic vitality of the basin, almost ceased to exist?

We collected information provided by the navigation industry, the U.S. Army Corps of Engineers, other government agencies and the media contained in published reports, interviews, newspaper articles and web pages to answer this question. We present claims made by the navigation industry and by supporters of the navigation industry and tried to examine the basis of support for these claims. We also present new information related to these claims.

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Posters

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Moving commercial products such as grain and fertilizer on the Missouri River is not more fuel efficient when compared to other transportation alternatives. Due to the high flows on the Missouri River, multiple trips are required to move the same amount of product as can be moved in a single trip on other river systems, resulting in poor fuel efficiency. Multiple trips result in higher emissions than other transportation alternatives. The system is inefficient due to the high cost of providing empty barges to the river above Kansas City. As a result, the amount of materials shipped out of the system above Kansas City is limited to the amount of materials shipped in. Navigation does not decrease the number of trucks on our highways because like the rail industry, the navigation industry relies on trucks to move products to and from the terminals.

Because of devastating effects that the structural modifications and artificial hydrology required to support navigation have had and continue to have on Missouri River fish and wildlife resources including the pallid sturgeon, we felt that a candid look at these claims that continue to be used to justify providing this free transportation system and subsequently managing the Missouri River almost exclusively for its support, was justified.

Bio: Eugene (Gene) Zuerlein is currently the assistant Fisheries Division administrator for Nebraska Game and Parks Commission where he has over 30 years of management, research, and administrative experience in the field of fisheries and aquatic sciences. He has an M.S. in Zoology (Fisheries Science) and an M.S. in Public Administration from the University of Nebraska. Gene is the agency delegate to the Missouri River Natural Resource Committee. He serves as a member of the Missouri River Mitigation Coordination Team, Technical Committee of the Platte River Cooperative Agreement, Mississippi Interstate Cooperative Resource Association (MICRA) subcommittee on paddlefish and sturgeon and subcommittee on exotic species.

Developing Vegetative Cover Types for the Big Muddy Refuge Using the National Vegetation Classification System

Maureen A. Gallagher
U.S. Fish and Wildlife Service Big Muddy
National Fish and Wildlife Refuge
4200 New Haven Rd., Columbia, MO 65202
573-441-2788; maureen_gallagher@fws.gov

The Big Muddy National Fish and Wildlife Refuge has developed a vegetation coverage layer in ArcGIS using the *National Vegetation Classification System*. Refuge staff conducted a specified and unspecified classification of vegetation communities on the refuge.

Identification of these communities to Alliance level will assist the Refuge in making management decisions for existing tracts and help to determine future sites for acquisition. Using the national classification system allows refuge managers to compare habitat with other state and federal agencies using this system. Understanding the expanse and location of vegetative communities is of particular interest in managing for continental bird populations supported by specific communities. The level of detail studied during this project will support efforts of the USGS Mid-Continent Mapping Center to develop a model to identify plant communities as they change over time using LandSat Imagery.

Bio: For the past thirteen years, Maureen Gallagher has served as a biologist for the U. S. Fish and Wildlife Service, four of which are as the refuge biologist for the Big Muddy National Fish and Wildlife Refuge. Maureen has a B.S. in Aquatic Ecology and a B.S. in Zoology from Humboldt State University. She is currently completing an M.S. in Political Science.



Least Tern

Nebraska Game and Parks Commission

Effects of Discharge on Sandbar Morphometry between Two Types of Sandbars

Emily K. Tracy
Missouri Cooperative Fish and Wildlife
Research Unit, University of Missouri
303 ABNR, Columbia, MO 65211
573-884-8530; ekthw2@mizzou.edu

Co-Authors: David L. Galat, USGS Cooperative
Research Unit, Department of Fisheries and
Wildlife Sciences, University of Missouri -
Columbia, MO

Sandbars on the Lower Missouri River provide a variety of aquatic and terrestrial habitats important to resident and migratory fishes, invertebrates, turtles and birds. Channel modification and flow regulation have reduced sandbar number and the habitats they provide by >90%. Our objective was to examine the effects of river discharge on shallow water area, sandbar area, shoreline perimeter, and sandbar height above water for all sandbars surveyed. Primary study sites included 10 sandbars classified into two categories; five point sandbars (formed on the inside of bends) and five wing-dike sandbars (formed behind wing-dikes). Quantitative results of morphometry were compared between the two sandbar types. Documented substrate type and vegetation from field observations were also included in analysis. Exposed sandbars were mapped using conventional technologies (RTK, Total Station) beginning summer 2002 over a range of river discharges.

Arc View 3.2 GIS was used to develop topographic maps for each sandbar and to quantify physical variables at multiple river discharges. Preliminary analysis indicates there is a general negative linear relationship between discharge and sandbar area and perimeter over the observed range of discharges. Preliminary results also indicate that surface elevation complexity decreased as discharge increased, reducing the amount of potential habitat available for shorebirds and aquatic turtles. Ongoing work will compare timing of species use (i.e. migrating shorebirds, nesting turtles) to timing and duration of sandbar availability. Results can be used to further understand effects of river management on sandbar habitat availability and provide guidance in selecting future flow management alternatives to benefit this critical resource.

Bio: Emily Tracy is currently a graduate student in Fisheries and Wildlife at the University of Missouri. Her advisor is David Galat with the USGS Missouri Cooperative Fish and Wildlife Research Unit. She received her undergraduate degree in Environmental Science from the University of Florida. Prior to attending the University of Missouri, Emily worked as an intern for the USGS Biological Resources Division in Reston, Virginia.

Influence of Hydrologic Events on Least Tern and Piping Plover Nesting in the Lower Niobrara River, Nebraska

Stephen K Wilson
National Park Service
Missouri National Recreational River
P.O. Box 666, Yankton, SD 57078
402-667-5524; stephen_k_wilson@nps.gov

The lower 20 miles of the Niobrara River in north-central Nebraska are designated as critical piping plover habitat and are part of the Missouri National Recreational River which is administered by the National Park Service. While this component is generally not directly impacted by the operation of Missouri River main stem dams, Nebraska Public Power District maintains Spencer Hydro located approximately 30 miles above the National Park Service boundary. Details about the potential influence of Spencer Hydro sluicing activities on least tern and piping plover habitat is unavailable.

In addition, nesting least tern and piping plover surveys of the Lower Niobrara River have been limited. In 2003, National Park Service staff began a monitoring program modeled from protocol used by the U.S. Army Corps of Engineers. Several breeding pairs utilized this stretch of river, but were impacted by high rain/runoff events which resulted in low nesting and fledging success. Least tern and piping plover pairs typically selected further downstream nesting sandbars after nest destruction. It appears that sandbars in this reach are scoured during Spring runoff events coupled with ice, and little vegetation clearing during Fall sluicing events of Spencer Hydro.

Bio: Stephen K. Wilson is a resource management/GIS specialist at the Missouri National Recreational River, Yankton, SD.

Posters

Integrative Samplers Used to Provide a Holistic Assessment of Aquatic Contaminants

David Alvarez
U.S. Geological Survey
4200 New Haven Road, Columbia, MO 65201
573-441-2970; dalvarez@usgs.gov

Co-Authors: Jim Petty, Jim Huckins, William Brumbaugh, Walter Cranor, Jon Lebo, Tom May, Randal Clark, U.S. Geological Survey, Columbia, MO

Assessing the potential impact of contaminants to the environment from anthropogenic sources entails monitoring a wide range of chemical classes including hydrophobic and hydrophilic organics and metals. A suite of passive, integrative samplers have been developed by scientists at the USGS Columbia Environmental Research Center to provide a holistic approach to environmental monitoring.

The semipermeable membrane device (SPMD) consists of a layflat polyethylene tube containing a neutral lipid, triolein. The SPMD is capable of sampling hydrophobic organics with log K_{ow}s generally > 4 (i.e., organochlorine pesticides, PCBs, PAHs, etc.) from both water and air.

The polar organic chemical integrative sampler (POCIS) is constructed from polyethersulfone membranes encasing a mixture of solid sorbents. The POCIS effectively samples hydrophilic organics (log K_{ow}s < 4) such as polar pesticides, hormones, pharmaceuticals and personal care products from water.

The stabilized liquid membrane device (SLMD) consists of a polyethylene membrane containing a mixture of hydrophobic chelating agents which form a stable film on the membrane surface. It is designed to sequester and concentrate waterborne ionic species of metals such as Pb, Ni, Cu, Cd, Zn, etc.

The passive integrative mercury sampler (PIMS) consists of a polyethylene membrane containing an oxidative media capable of transforming the sequestered neutral mercury species into an ionic mercury species. The PIMS samples vapor phase neutral mercury and dissolved gaseous mercury species. Data from relevant field deployments will be presented.

Bio: David Alvarez received a Ph.D. in Environmental and Analytical Chemistry at the University of Missouri-Columbia. He is currently working as a research chemist on the development of passive samplers.

Invertebrate Composition and Availability as Food for Migratory Shorebirds and their Microhabitats on Sandbars in the Lower Missouri River

Jessica Lee
South Dakota State University and
Big Muddy National Fish and Wildlife Refuge
517 3rd Ave, Brookings, SD 57006
605-691-3044; Jessica_Lee@fws.gov

Co-Authors: Leigh Frederickson, South Dakota State University, Brookings, SD and Maureen Gallagher, USFWS Big Muddy National Fish and Wildlife Refuge, Columbia, MO

The Missouri River has historically been a migration route for shorebirds in both spring and fall. Usage of the river has fallen over the decade with changes in hydrologic regime and geomorphic condition. Habitat loss has led to the decline of several shorebird species and the federal listing of two species. A multimillion dollar effort is underway to recreate the necessary habitat to improve shorebird population and insure a successful migration along the Lower Missouri River. Efforts of this study will be used to sort, identify, and quantify benthic invertebrates available during shorebird migration and breeding seasons. This information can be used as a predictive model to determine the degree of influence of future habitat restoration efforts providing forage areas for shorebirds in main channel areas.

This information will be vital to the development of the Big Muddy refuge comprehensive conservation plan as well as contribute to the body of knowledge considered in the Shorebird Conservation Plan and other planning efforts under the umbrella of the North American Bird Conservation Initiative.

Bio: Jessica Lee is currently a graduate student at South Dakota State University in Wildlife and Fisheries Sciences and a SCEP student at the Big Muddy National Fish and Wildlife Refuge. Her advisor is Leigh Frederickson. She received her undergraduate degree from South Dakota State University in Wildlife and Fisheries Sciences.

Multi-disciplinary Investigations of Sturgeon Behavior and Habitat Requirements in the Lower Missouri River

Aaron J. DeLonay
 U.S. Geological Survey
 4200 New Haven Road, Columbia, MO 65201
 573-876-1878; adelonay@usgs.gov

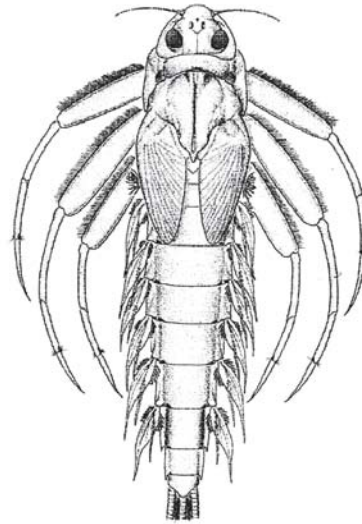
Co-authors: Robert B. Jacobson,¹ Diana M. Papoulias,¹ Mark L. Wildhaber,¹ J. Alan Allert,¹ Caroline M. Elliott,² Sabrina A. Griffith,² Janice L. Bryan,³ Mandy L. Annis² (1) U.S. Geological Survey, Columbia, MO (2) JCI, Inc., Fort Collins, CO (3) Independent Contractor

Considerable federal and state efforts are focused on restoring native, Missouri River sturgeon populations and enhancing habitat for these species. The success of these efforts will depend upon our understanding of sturgeon life-history and habitat requirements.

The U.S. Geological Survey is using ultrasonic telemetry to characterize habitat use and behavior of shovelnose sturgeon (*Scaphirhynchus platyrhynchus*) and pallid sturgeon (*Scaphirhynchus albus*) in the Lower Missouri River. Sturgeon surgically implanted with ultrasonic transmitters are also implanted with data storage tags (DSTs) equipped with temperature and depth sensors. Field and laboratory assessments of the reproductive status of implanted fish are conducted at implantation and again when the fish is recaptured to retrieve the DST devices.

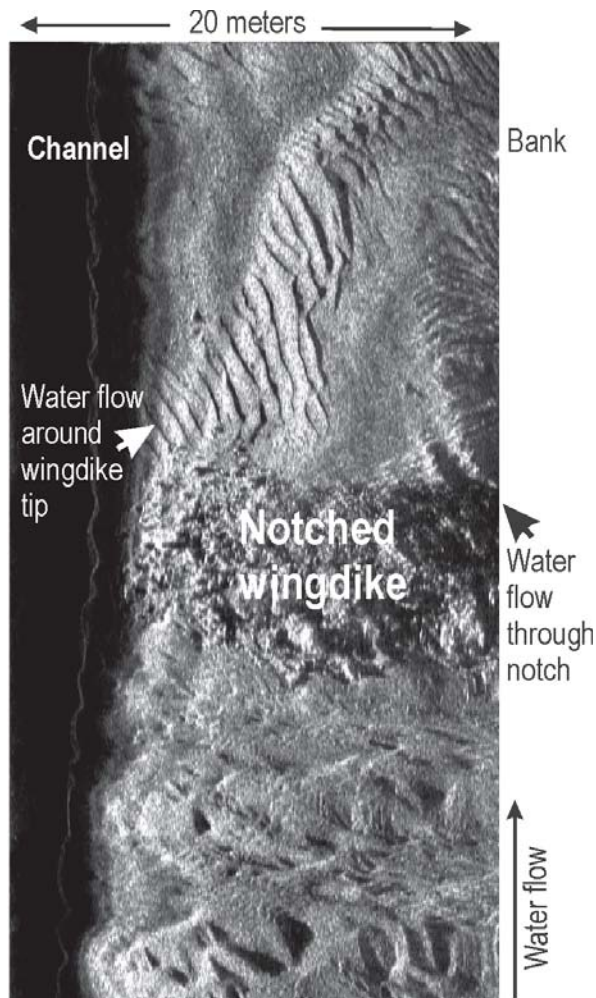
Hydroacoustic tools are used to map depths, substrates and velocities of areas frequented by sturgeon to assess habitat use and availability. Sturgeon movement, changes in reproductive status, and habitat-use data from these investigations will be used to characterize the response of sturgeon to environmental variables and to examine habitat availability and suitability for sturgeon species.

Bio: Aaron DeLonay is an ecologist at the U.S. Geological Survey. He received an M.S. in Fisheries and Wildlife from the University of Missouri- Columbia.



The mayfly (*Pseudiron centralis*) is a sand-dwelling predator restricted to large rivers, and in the Lower Missouri, it is commonly eaten by sturgeon.

Picture from Edmunds et al. 1976.



Missouri River substrate behind a notched wingdike demonstrating water flow around the tip of the wingdike and through the notch. This photo is taken from a side-scan sonar used in pallid sturgeon research at the USGS.

Posters

The Effect of Age and Hydrology on Tree Species Composition in Bottomland Forests

Thomas McCullough Faust
University of Missouri
203T ABNR, Columbia, MO 65202
tmfbpc@mizzou.ed

Co-Authors: Richard Guyette, University of Missouri, Columbia, MO and Daniel Dey, North Central Forest Station, Columbia, MO

Plant community dynamics are thought to be controlled by a wide range of processes dependent on the ecosystem to which the species are adapted. Bottomland forest dynamics are thought to be determined by the channel-flow regimes. In addition, species life-history strategies interact with forest age and the channel-flow regimes to determine species dynamics in northern Missouri bottomland forests.

We quantified the effects of time and hydrology on woody species and structural diversity in northern Missouri bottomland forests. We hypothesized that woody species richness and structural diversity will increase with increasing stand age regardless of hydrology. However, we also predicted that forests that have larger hydrological impacts (i.e., larger order streams) will have reduced woody species richness and structural diversity.

Bio: Thomas McCullough Faust is a Ph.D. student at the University of Missouri. He completed his M.S. in Conservation Biology from the University of Minnesota in 1995. From 1988-1990, Thomas was a Peace Corp volunteer in Guatemala in wildlife management.

The Kansas City - Missouri River Relationship: In Love, Out of Love, Back in Love?

Amahia Mallea
University of Missouri-Columbia
Dept. of History, 101 Read Hall, MU, Columbia, MO 65203
573-874-3419; akmbb1@mizzou.edu

This poster will use photographs to sketch the relationship between Kansas City and the Missouri River in the twentieth century. The city has transitioned in the last century from courting the river, to spurning it, to renewing its interest today.

In the Progressive Era, Kansas City was in love with the potential of the river. Commercial interests supported engineering the river to sustain navigation and boosted the future of the city through the river. The area near the river was crowded with people and industry. Meanwhile, Kansas City relied on the river to sustain its urban functions: drinking water, sewage carriage, and a garbage dump.

Through the century, Kansas City's interest turned away from the river. Although the Corps of Engineers made the river navigable, it was an insignificant boost to the economy of the region. The 1951 Flood vacated the riverfront and many businesses did not return.

Kansas City is most responsible for the shape of the Missouri River today, and yet of all the river cities, Kansas City most ignores the river. By the end of the century, Kansas City had slowly begun to consider plans to recognize its relationship with the river. A new waterfront park has opened and with the Corps of Discovery bicentennial and people are seeking out the river. In 2003, the largest River Relief project took place in Kansas City as some 600 volunteers cleaned trash from the riverbanks. Perhaps Kansas City is falling in love with the river again.

Bio: Amahia is a Ph.D. candidate in history at the University of Missouri. She studies urban and environmental history and her dissertation is on the relationship between Kansas City and the Missouri River. To better "learn" the river, she rode a bicycle 1600 miles upriver in 2003, talking to the people alongside it as she travelled.

Upper and Middle Mississippi Valley Cooperative Ecosystem Studies Unit (UMMV CESU)

Daniel Zerr

Center for Agricultural, Resource and Environmental Systems (CARES), University of Missouri
130 Mumford Hall, Columbia, MO 65203
573-884-8721; zerrd@missouri.edu

Co-Authors: Tony Prato, Director UMMV CESU,
co-Director CARES, University of Missouri -
Columbia, MO.

The UMMV CESU is part of a network of cooperative ecosystem studies units focusing on high-quality science, usable knowledge for resource managers, responsive technical assistance, continuing education, and cost-effective research programs. The UMMV CESU is a cooperative effort of sixteen institutions and four federal agencies whose goal is to focus on the objectives listed above in the geographic area of the Upper and Middle Mississippi Valley. The host institution for the UMMV CESU is the University of Missouri - Columbia.

Bio: Daniel Zerr is a research associate with the Center for Agricultural, Resource and Environmental Systems (CARES) at the University of Missouri - Columbia. He previously worked as an ecologist/GIS specialist with the USGS Northern Prairie Wildlife Research Center. He has an M.S. in environmental science from Indiana University, Bloomington, IN, and a B.S. in biology from Northern State University in Aberdeen, SD.

Water Quality and Ground Water Flow of the Columbia/Eagle Bluffs Wetland Complex and McBaine Bottoms

Brenda J. Smith

U.S. Geological Survey
1400 Independence Road, MS 100, Rolla, MO
65550
573-308-3670; bsmith@usgs.gov

Co-Authors: Joseph M. Richards, U.S. Geological
Survey, Rolla, MO

To assess the effect of constructed wetlands on ground water quality and flow, the U.S. Geological Survey, in cooperation with the City of Columbia and Missouri Department of Conservation, has collected water quality samples since 1992 in McBaine Bottoms, southwest of Columbia, from a monitoring network that included 33 ground water sites and 4 surface water sites. Water level measurements were made monthly from October 2000 through December 2002 in a monitoring network that included 88 ground water sites and 4 surface water sites to determine the ground water flow. McBaine Bottoms is the site of the Eagle Bluffs Conservation Area, the City of Columbia wastewater treatment wetlands, and the City of Columbia municipal supply well field.

Changes in major chemical constituent concentrations, including sodium, potassium, calcium, sulfate, and chloride, have been detected at several sampling sites. These changes can be correlated to the beginning of the operation of the wastewater treatment wetlands. The concentrations of these constituents plot on the mixing continuum between pre-effluent ground water as one end member and the treated effluent as the other end member. At ground water sites, statistical analyses have indicated few changes in fecal indicator bacteria density and nutrient, trace element, and organic constituent concentrations. Lateral ground water flow was dominated by the presence of a ground water high beneath the Eagle Bluffs Conservation Area and the presence of a cone of depression centered around the City of Columbia well field. Ground water flow was from the Eagle Bluffs Conservation Area toward the well field.

Bio: Brenda Smith is a hydrologist with the U.S. Geological Survey in Rolla, Missouri.

Keynote Presentations

Sharing the Challenge: Ten Years After

Gerald E. Galloway
The Titan Corporation
3877 Fairfax Ridge Road
Fairfax, VA 22030
703-383-4454
gerry.galloway@titan.com

Gerald E. Galloway is vice president, Enterprise Engineering Group of the Titan Corporation where he works at the nexus of engineering, geospatial systems, and water resources. From 1998 to 2003 he was secretary of the United States Section of the US-Canada International Joint Commission and principal advisor to the Commissioners. He has served as a consultant on a variety of water resources engineering and management issues to U.S. and international organizations and has served as a Presidential appointee to the Mississippi River Commission (1988-1995) and the American Heritage Rivers Committee (1998-2000).

In 1994, he led the White House study of the Great Mississippi Flood of 1993. He is a former dean of the Faculty and Academic Programs at the Industrial College of the Armed Forces and dean of the Academic Board of the United States Military Academy where he also was professor of Geography and first head of the Department of Geography and Environmental Engineering. He is a graduate of the Military Academy and served 38 years in the Army before retiring as a brigadier general in 1995.

Retired General Galloway has served as president of the Universities Council on Water Resources, a councilor of the American Geographical Society, a member of the Board of the Hudson River Environmental Society, and is currently a director of the Hudson River Foundation for Science and Environmental Research. He was co-Founder and chair of the AAG Water Resources Specialty Group. He is a Fellow of the American Society of Civil Engineers (ASCE) and of the Society of American Military Engineers (SAME). A geographer, civil engineer, and public administrator, he holds masters degrees from Princeton (Civil Engineering), Penn State (Public Administration, the U.S. Army Command and General Staff College (Military Art and Science) and a Ph.D. in Geography from the University of North Carolina at Chapel Hill. He is a registered professional engineer in New York.

In 1991, he was presented the SAME Bliss Medal for contributions to engineering education and, in 1995, the Silver DeFleury Medal by the Army Engineer Association. In 1998, he was given the Association of State Flood Managers' Goddard-White Award. In 2001, ASCE named him the Civil Government Engineer of the year. In 2002, ASCE presented him the Presidents' Award for service to the country. In 2004 he was elected to the National Academy of Engineering. He is a member of Phi Kappa Phi, national academic honor society.



Charles Schwartz, Wildlife Drawings, Missouri Conservation Commission

From Pelican Island to the Missouri Basin: Collaboration and Resource Management

Steven Yaffee
Ecosystem Management Initiative
School of Natural Resources & Environment
The University of Michigan
420 East University, Ann Arbor, MI 48109-1115
734-615-6431
emi.office@umich.edu
<http://www.snre.umich.edu/emi>

Steven L. Yaffee is the Theodore Roosevelt professor of Ecosystem Management and professor of Natural Resource and Environmental Policy at the University of Michigan. He also directs the School of Natural Resources and Environment's Ecosystem Management Initiative, a research, teaching and outreach center focused on promoting sustainable management of natural resources.

Dr. Yaffee has worked for more than twenty five years on federal endangered species, public lands and ecosystem management policy and is the author of *Prohibitive Policy: Implementing the Federal Endangered Species Act* (MIT Press, 1982) and *The Wisdom of the Spotted Owl: Policy Lessons for a New Century* (Island Press, 1994).

His research tracking the on-the-ground progress at more than a hundred collaborative ecosystem management initiatives was first documented in *Ecosystem Management in the United States: An Assessment of Current Experience* (Washington, D.C.: Island Press, 1996). His most recent work explores ecosystem management as a conceptual framework for managing natural resources, and multi-party, collaborative problem-solving efforts as necessary elements of an ecosystem approach. The lessons from this research are summarized in *Making Collaboration Work: Lessons from Innovation in Resource Management* (Washington, D.C.: Island Press, 2000), a book co-authored with Julia Wondolleck.

Dr. Yaffee also is a founding member of the Editorial Advisory Board for *Conservation in Practice*, and is experienced working with a variety of professional audiences on collaboration, negotiation, evaluation and adaptive management.

Dr. Yaffee's Ph.D. is from the Massachusetts Institute of Technology in environmental policy and planning. He has been a faculty member at the Kennedy School of Government at Harvard University and a Senior Fellow at World Wildlife Fund.

Independent Science Review

Deborah Brosnan
Sustainable Ecosystems Institute
2100 SW River Parkway, Suite 419, Portland,
Oregon 97280
503-246-5008
sei@sei.org
<http://www.sei.org/contact>

Deborah Brosnan, president and founder of Sustainable Ecosystems Institute, is a scientist on the front lines of science and policy, advocating for the role of science and scientists in environmental decision making.

She received her B.S. in zoology and in botany, and an M.S. in Fisheries Science from the University of Galway. She received her Ph.D. in marine ecology from Oregon State University.

Dr. Brosnan's work focuses on the interface of science and policy and includes advising national and international governments and other sectors, as well as fundamental research in ecology. Through SEI she has developed an active program in providing scientific peer review for management and policy including in the South Florida, Columbia River, and California Redwoods. She focuses primarily on how science is integrated into policy and the roles that scientists can play in advocating and integrating their science into policy.

In research Dr. Brosnan has ongoing projects on marine ecosystems. Most recently, she chaired a blue-ribbon panel to develop and review a code of scientific ethics for the Department of Interior. She is currently leading a panel of scientists to evaluate multi-species approaches to the Everglades restoration effort. She co-chaired the National Science and Policy Forum, and the Santa Barbara Group on science and peer review in the Endangered Species Act. She is author of several key papers on marine ecology and science policy, including peer review.

Dr. Brosnan serves on numerous boards including Oregon State University College of Forestry, All Species Foundation, Washington State University Science Board, UC Davis Sea Doc Society and is on the advisory group of Sea Shepherd Conservation Society. She is the recipient of the New England Biolabs Foundation award for her work in the Caribbean, a Whitley Scholarship for her book in progress on science and conservation, and the Red Cross heroism award for a humanitarian effort in a commercial plane crash.

Keynote Presentations *continued*

'Best Practice Governance of River Basins: Implications for Large Rivers like the Missouri

Bruce Hooper
Southern Illinois University
Carbondale, IL
618-453-6024
bhooper@siu.edu

Best practice' is a somewhat assuming term. However, the recent focus on the governance of river basins at the international scale (such as the 3rd World Water Forum) suggests that best practice integrated river basin governance is driven by: (a) clear and strong institutional arrangements, (b) good water related data, information and systems, (c) a package of policies, procedures and strategies, (d) communication and participation, and (e) basin sustainability indicators.

Basin organizations need to develop performance indicators that prove the effectiveness of implementing each of these five groups of practices. Dr. Bruce Hooper discusses the practices and the prescription of performance indicators. He puts forward a preliminary application to large rivers such as the Missouri.

Bio: Dr. Bruce Hooper earned his doctorate in integrated floodplain management from the University of New England, Australia. He recently moved to Southern Illinois University in Carbondale, IL, where he works as a natural resources geographer.

Dr. Hooper has extensive experience teaching integrated resources management and consulting on international water planning collaborative groups. His past involvement with the large Murray-Darling Basin in Australia provides insight into the ongoing management problems of the Missouri River.

He is the executive editor of "Water International," a peer reviewed journal of the Water Resources Association that supports sustainable management of water resources around the world.

Quest for the Missouri River Source

John LaRandeau
U.S. Army Corps of Engineers
12565 West Center Road, Omaha, NE 68144
402-697-2534;
john.r.larandeau@nwd01.usace.army.mil

The Missouri River is a unique river in that it has two major sources. When Lewis and Clark arrived to the confluences of three rivers entering the Missouri River from almost the same location and all three looking nearly the same they elected to end the named Missouri River at Three Forks, Montana. They named the two upstream rivers the Jefferson and the Madison. The river about 1 mile downstream they named the Gallatin.

Geographers generally follow the longest tributary to identify the source of rivers and streams. In the case of the Missouri River, Lewis and Clark would have had to travel to the east toward what is today Western Yellowstone Park to reach the source. East was the wrong direction, because they were headed over the mountains to the West. The journey to the source follows the Beaverhead River to Red Rock River, then Red Rock Creek to Hell Roaring Creek up Hell Roaring Canyon. Red Rock Creek forks to Hell Roaring Creek in a valley floor and enters Hell Roaring Canyon at the base of a beautiful red rock faced mountain opening or "Gates to the Source" up to elevation 8,840 feet above mean sea level to the source.

The presentation will confirm that Lewis and Clark did not reach the geographic source, describe some of the previous quests to the Missouri River geographic source and will describe the personal journey of this presenter to the geographic source on August 7, 2001.

Bio: John LaRandeau is a civil engineer. Currently he is serving as the hydropower and navigation specialist in the U.S. Army Corps of Engineers, Northwestern Division, Operations Division located in the Omaha office. His hydropower responsibilities are to provide regional interface for the Division headquarters within the Missouri River Basin. His navigation responsibilities include not only the Missouri River, but also the inland waterways of the Columbia and Snake Rivers.

The Lewis and Clark Expedition and the Lower Missouri River: Running the First Gauntlet.

James Denny

Missouri Department of Natural Resources,
Division of State Parks

P.O. 176, Jefferson City, MO 65102

573-751-8566; jim.denny@dnr.mo.gov

In order to reach the Mandan Villages, the site of their winter encampment by onset of the winter of 1804-1805, the Lewis and Clark Expedition had to run two gauntlets: the Lower Missouri River and the Indian nations that lay between the Platte River and the Mandans. Much has been written about the second of these two gauntlets and how the captains carefully prepared for the encounters with Indians. They spent much time in St. Louis gathering information and securing trade goods to win the good will of the tribes they expected to encounter.

The way in which the captains and the crew dealt with the first gauntlet, traveling up the Lower Missouri River, is less well understood. Sometimes this part of the trip is treated as a nothing more than a shakedown to harden the men of the expedition for the tougher challenges that lay ahead. Such an approach greatly underrates the fact that the Lower Missouri River was every bit the obstacle and challenge, in its own way, as the ordeals involved in the portage around the Great Falls of the Missouri or the harsh treks across the Bitterroot Mountains. Unlike these better-known ordeals, the struggle with the Lower Missouri River drug on for two and a half long months.

Early traveler accounts are filled with descriptions of the many obstacles the Lower Missouri threw in the way of boatmen. The current of the river was more rapid than that of any other large river that Lewis or Clark were familiar with. It could flow as fast as 7.5 miles per hour and produce rapids that "roared like an immense falls." And the river was filled with many dangers such as embarras, or rafts of logs, shifting sandbars, mazes of snags and sawyers, and banks that would suddenly heave into the river taking large trees with them. The river could array these obstacles before hapless rivermen in just about any combination.

The general picture that emerges is that the Missouri River was most difficult from its mouth to the entrance of the Platte River. This was the "gauntlet" section. The collective journals of the captains, sergeants, and crewmen provide by far the most vivid account we have of just how difficult it was to ascend the Lower Missouri River in the pre-steamboat era. Maps of the Missouri River as it was during this era (created by University of Missouri geographer, James D. Harlan) complete the portrait of the Missouri River as it was before the channelization of the modern era so profoundly transformed the river that the Lewis and Clark Expedition ascended during their epic trek across the continent.

Bio: Jim Denny has been a historian with the Missouri Department of Natural Resources for the past twenty-seven years. He received his education at the University of Missouri, where he received a Masters Degree in American History.

Jim is active in many aspects of the upcoming Lewis and Clark celebration. He has traveled the entire Lewis and Clark route through Missouri, both by automobile and by boat and has played an important role in the rediscovery of Lewis and Clark sites, including Sugar Loaf Rock, Pierced Rock Natural Arch, and Clark's Hill. Jim has published articles on the Manitou Bluffs region of the Missouri River, a section steeped in Lewis and Clark and other early Missouri River travel lore.

In 2000, he wrote *Lewis and Clark in the Boonslick*, a detailed account of the landmarks and activities of the expedition between the mouth of the Osage River and Rocheport. Articles on the Lewis and Clark Expedition in Missouri are also scheduled to appear in 2004 in *Gateway Heritage* and the *Missouri Historical Review*. He is co-author, with James D. Harlan, of the *Atlas of Lewis and Clark in Missouri*, which is published by the University of Missouri Press, 2003. Jim lives beside the Missouri River in Lupus, Missouri where he and his wife Sue serve as Mayor and Clerk of Lupus.

Linking Habitats with Species

Session 1 - Monday May 24, 10:30 a.m.



Freshwater Drum

Habitat Availability Contributions of Side-Channel Chutes

Robert Jacobson
U.S. Geological Survey
4200 New Haven Road, Columbia, MO 65201
573-876-1844; rjacobson@usgs.gov

Co-Authors: Harold E. Johnson, III, U.S. Geological Survey, Columbia, MO; Caroline M. Elliott, JCI, Inc, Fort Collins, CO, David A. Gaeuman, USGS/NRC, Columbia, MO

Side-channel chutes are a common habitat rehabilitation feature on the Lower Missouri River. Habitat inventories in chutes serve to evaluate project performance: how much of what kind of habitat is available at different times during the year. One measure of success of rehabilitation projects is if they increase the total diversity of elevations connected to the channel, thus making habitat availability less sensitive to flow-management decisions. Habitat may be defined in many ways, but in the Lower Missouri River habitats of interest are generalized as a) shallow, slow water, typically taken as 0-1.5 m deep and 0-0.75 m/s velocity, and b) bare sand bars. Availability of these habitats in side-channel chutes is a function of channel geometry and the hydrology of the river segment. Comparison of habitat availability in three side-channel chutes (Overton Bottoms RM 185-188, Lisbon Bottom RM 214-218, and Cranberry Bend RM 280-282) indicates that chutes contribute the most to total habitat in a river reach when they are designed to provide sandbar surfaces at elevations higher than those in the adjacent navigation channel.

Bio: Robb Jacobson is a research hydrologist with the U.S. Geological Survey in Columbia, MO. He has conducted research on habitat dynamics in the Missouri River corridor since 1993. Robb has a Ph.D. in Geography and Environmental Engineering from Johns Hopkins University.

Fish Community Assessment of Lower Missouri River Side Channels

Louise Mauldin
U.S. Fish and Wildlife Service
101 Park DeVille Suite A, Columbia, MO 65203
573-234-2132; louise_mauldin@fws.gov

Co-Authors: Joanne Grady, Wyatt Doyle, and Andy Starostka, U.S. Fish and Wildlife Service, Columbia, MO

Chutes or side channels were common off-channel habitat types in the Missouri River prior to the development of the river for water control and navigation. Few studies have addressed fish community characteristics in side channels to that of the associated main channel or examined how habitats within the side channel are utilized in relation to main channel habitats. Species composition, species richness, species diversity, and general habitat use were described across three Lower Missouri River side channels managed by the Big Muddy National Fish and Wildlife Refuge and compared to their respective main channel.

Side channels located at Cranberry Bend, Lisbon Bottom and Overton Bottoms were sampled using multiple gears during spring and summer seasons from 2001-2003. Sixty-six species were documented across the three study areas. Shiners, catfishes, and carpsuckers dominated the fish community at Cranberry Bend during the 3-year study. Shiners, freshwater drum and chubs were dominant at Lisbon Bottom, while catfishes, shiners, and gizzard shad were most abundant at Overton Bottoms. Species richness and diversity from summer sampling were significantly different between the side channel and main channel at Cranberry Bend and Lisbon Bottom.

Data gathered on fish community characteristics and habitat use by selected species of interest in these side channels and associated main channel habitats may be useful to refuge managers, serving as guides in management decisions and/or in future acquisition of side channels in the lower river.

Bio: Louise Mauldin is a fishery biologist for the U.S. Fish and Wildlife Service in Columbia, MO.

Waterbird Abundance on Side-Channel Habitats Along the Lower Missouri River

Jack Finley

University of Missouri - Columbia
302 ABNR, University of Missouri-Columbia,
Columbia, MO 65211
573-445-6795; jmf3k5@mizzou.edu

Co-Authors: Leigh H. Fredrickson, Gaylord Memorial Laboratory, University of Missouri, Puxico, MO and Maureen A. Gallagher, U.S. Fish and Wildlife Service, Columbia, MO.

This study examined waterbird use of side-channels, sandbars and wetlands in the floodplain of the Missouri River during the spring and fall migratory periods of 2002 and 2003. Side-channels present a highly dynamic suite of conditions that change over a wide range of temporal scales. Side-channels examined included those newly created by the 1990's floods (Lisbon Bottoms RM 214-218, and a side-channel downstream from Easley RM 166-167); an anthropogenic side-channel (Overton Bottoms RM 185-188); and an established natural side-channel (Cranberry Bend RM 280-282). Bird use of side-channel habitat varied with migration periods, changing hydrology, substrate exposure and vegetation communities. Shorebird use of side-channels was higher in the fall than during the spring. Our results suggest that waterbird management in the lower Missouri River Floodplain should provide a mosaic of habitats to assure that habitat conditions suitable for waterbirds are present across habitat types within and among seasons and years.

Bio: Jack Finley is a graduate student in the Department of Fisheries and Wildlife, School of Natural Resources, University of Missouri-Columbia. Formerly he was a research arborist with TruGreen Corporation. He has a B.S. in Biology from Wheaton College.

Linking Habitat with Species: Integrating Science to Adaptively Manage the Big Muddy Refuge

Maureen Gallagher

U.S. Fish and Wildlife Service
Big Muddy National Fish and Wildlife Refuge
4200 New Haven Rd., Columbia, MO 65202
573-441-2788; maureen_gallagher@fws.gov

The Big Muddy National Fish and Wildlife Refuge has been described as a "passively managed" refuge. It has also been identified as one of the most highly altered ecological systems in the country. Managers are currently developing a habitat management plan for the refuge. Integrated science linking habitat dynamics to species use will be the foundation of the management plan.

Bio: Maureen Gallagher has a B.S. in Aquatic Ecology and a B.S. in Zoology from Humboldt State University. She is currently completing an M.S. in Political Science. For the past thirteen years, Maureen has served as a biologist for the U. S. Fish and Wildlife Service, four of which are as the refuge biologist for the Big Muddy National Fish and Wildlife Refuge.



Charles Schwartz, Wildlife Drawings, Missouri Conservation Commission

Hydrology and Water Quality

Session 2 - Monday May 24, 10:30 a.m.

Ground Water Flow in the Missouri River Alluvial Aquifer Near Ft. Leavenworth, Kansas

Brian Kelly
U.S. Geological Survey
401 NW Capital Drive, Lee's Summit, MO 64086
816-554-2414; bkelly@usgs.gov

The Missouri River alluvial aquifer near Fort Leavenworth, Kansas supplies all or part of the drinking water for Fort Leavenworth, the City of Leavenworth, Kansas and the City of Weston, Missouri. Ground water at three sites within the alluvial aquifer near the Ft. Leavenworth well field is contaminated and concerns have been raised about the potential contamination of drinking water supplies. In 2001, the U.S. Geological Survey, U.S. Army Corps of Engineers and the U.S. Army began a study of ground water flow in the Missouri River alluvial aquifer near Ft. Leavenworth.

The U.S. Geological Survey used hydrogeologic data from 173 locations in the study area to construct a ground water flow model (MODFLOW-2000), and particle-tracking program (MODPATH) to determine the direction and travel time of ground water flow and contributing recharge areas for water supply well fields within the alluvial aquifer. The model was calibrated to both quasi-steady state and transient hydraulic head data collected during the study and ground water flow was simulated for five well-pumping/river-stage scenarios. Ground water from the three contaminated sites was captured by the Ft. Leavenworth well field for all well-pumping/river-stage scenarios. Ground water travel times to the Ft. Leavenworth well field for average well pumping and river stage conditions ranged from about 33 years for the closest contamination site to 70 years for the farthest contamination site. Ground water flow was induced below the Missouri River by the Ft. Leavenworth and City of Leavenworth well fields for all well-pumping/river-stage scenarios.

Bio: Brian Kelly is a hydrologist with the U.S. Geological Survey. He has conducted research on the Missouri River and Missouri River alluvial aquifer since 1991. His M.S. and B.S. degrees are from the University of Missouri at Columbia, Missouri.

Hydrology of Artificial Flooding on the Eagle Bluffs Conservation Area - Where Does All That Water Go?

Matthew Knowlton
University of Missouri, Department
of Fisheries and Wildlife Sciences
302 ABNR Bldg, Columbia, MO 65211-7240
573-882-4531; knowltonm@missouri.edu

Co-Authors: John R. Jones, University of Missouri, Department of Fisheries & Wildlife Sciences, Columbia, MO

Wetland habitat on the Eagle Bluffs Conservation Area in central Missouri is created by pumping water from the Missouri River and effluent from the City of Columbia's wastewater treatment wetlands. The annual pumping regime is dominated by heavy inputs during the fall waterfowl migration during which >10,000 ac-ft of river water and effluent are typically needed to inundate about 1000 acres of wetlands. Rapid infiltration brings the water table to the surface and creates hundreds of ground-water seeps along the banks of the boarding streams some of which have caused substantial slumping and erosion of stream banks and levees. Infiltration and groundwater dynamics are keyed to the Missouri River stage which determines the background water table elevation.

Bio: Matthew F. Knowlton is a research assistant professor and received his Ph.D. in Limnology from the University of Missouri-Columbia in 1989.

Water Quality and Ground Water Flow at Eagle Bluffs Wetlands and McBaine Bottoms

Brenda Smith
U.S. Geological Survey
1400 Independence Road, MS 100, Rolla, MO
65550
573-308-3670; bsmith@usgs.gov

Co-Author: Joe Richardson, U.S. Geological Survey, Rolla, MO

To assess the effect of constructed wetlands on ground water quality and flow, the U.S. Geological Survey, in cooperation with the City of Columbia and Missouri Department of Conservation, collected water quality samples since 1992 in McBaine Bottoms, southwest of Columbia, from a monitoring network that included 33 ground water sites and four surface-water sites. Water level measurements were made monthly from October 2000 through December 2002 in a monitoring network that included 88 ground water sites and four surface water sites to determine the ground water flow. McBaine Bottoms is the site of the Eagle Bluffs Conservation Area, the City of Columbia wastewater treatment wetlands, and the City of Columbia municipal supply well field.

Changes in major chemical constituent concentrations, including sodium, potassium, calcium, sulfate, and chloride, were detected at several sampling sites. These changes can be correlated to the beginning of the operation of the wastewater treatment wetlands. The concentrations of these constituents plot on the mixing continuum between pre-effluent ground water as one end member and the treated effluent as the other end member. At ground water sites, statistical analyses have indicated few changes in fecal indicator bacteria density and nutrient, trace element, and organic constituent concentrations. Lateral ground water flow was dominated by the presence of a ground water high beneath the Eagle Bluffs Conservation Area and the presence of a cone of depression centered around the City of Columbia well field. Ground water flow was from the Eagle Bluffs Conservation Area toward the well field.

Bio: Brenda Smith is a hydrologist with the U.S. Geological Survey in Rolla, MO.

QUAL-W2 Two-Dimensional Hydrodynamic and Water Quality Modeling on the Main Stem

William Doan
U.S. Army Corps of Engineers
106 S. 15th Street, Omaha, NE 68102-1618
402-221-4583; bill.p.doan@usace.army.mil

The QUAL-W2 Two-Dimensional Hydrodynamic and Water Quality Model has been widely applied to stratified surface water systems such as lakes, reservoirs, rivers, and estuaries. The model computes water levels, horizontal and vertical velocities, temperatures, and twenty-one other water quality parameters such as dissolved oxygen, nutrients, organic matter, algae, pH, carbonate cycle, bacteria, and dissolved and suspended solids.

QUAL-W2 has recently been used on various reaches of the Missouri River as a means to quantify the effects of reservoir operations on various warm-water and cold-water fish habitats. Specific locations and uses of QUAL-W2 include evaluating the temperature effects of Fort Peck Reservoir on critical downstream pallid sturgeon habitat and evaluating the temperature and dissolved oxygen impacts from Garrison Dam operations on cold water fisheries in Lake Sakakawea.

Potential use of a fully calibrated and verified QUAL-W2 model as a reservoir operational tool to facilitate ongoing operation and adaptive management of system projects is currently being evaluated. Potential uses of the model as a management tool include: analyses of reservoir operation impacts on water quality parameters, analyses of real-time water quality conditions, forecast future water quality conditions, and reservoir release scenario testing.

Bio: Bill Doan is an hydraulic engineer with the U.S. Army Corps of Engineers. For 20 years, he has performed hydrologic/hydraulic/water-quality analyses for flood control systems, comprehensive watershed studies, threatened and endangered species habitat analyses. Bill has a B.S. in Civil Engineering from the University of Nebraska and an M.S. in Hydrologic Science and Engineering from Colorado State University.

River Users

Session 1 - Tuesday, May 24, 10:00 a.m.

Tow Boat Utilization of the Channelized Missouri River

Eugene Zuerlein

Nebraska Game and Parks Commission
2200 North 33rd Street, Lincoln, NE 68503
402-471-1542; zuerlein@ngpc.state.ne.us

Co-Author: Gerald Mestl, Nebraska Game and Park Commission, Lincoln, NE

The independent National Research Council (2002) study entitled *The Missouri River Ecosystem, Exploring the Prospects for Change* stated that this system is in a marked state of decline and that incremental analysis of the economics of retaining various reaches for navigation would be useful for decision makers. The reach from Sioux City to Omaha was viewed as a prime candidate for efforts to restore some ecological benefits through operational changes that would compromise, but not necessarily eliminate navigational uses. The objective of this study is to increase understanding of navigation in different reaches of the channelized Missouri River between St. Louis and Sioux City, Iowa which includes portions of Missouri and Kansas, the entire eastern border of Nebraska and western Iowa.

As an indicator of economic activity, movements of tow boats operating on the Missouri River is worth understanding. Analysis of daily U.S. Army Corps of Engineers commercial (private) tow boat operator reported data for the seven year period of 1997 through 2003 revealed that the mean monthly number of commercial tow boat trips between St. Louis and Kansas City ranged from 5.9 to 12.5 during the normal eight month navigation season. For the same time period, the mean monthly number of commercial tow boat trips between Kansas City and Sioux City ranged from 2.5 to 11.8. It was during the 2003 navigation season that only 20 commercial tow boat trips (average 2.5/month) were taken above Kansas City. Although not an economic analysis per se, the sparseness of tow boat movement and or trips would seem to substantiate the belief that certain reaches of the Missouri River could be targeted to restore ecological function without unduly impacting what little commercial navigation exists.

Another way to view navigation activity is by tonnage hauled over time. Based on river miles, the Missouri River makes up 7.2% of the entire network of the U.S. Inland Waterway System and

11.3% of the Mississippi River Basin Waterway System. A review of U.S. Army Corps of Engineers, Waterborne Commerce Statistics of the United States between 1997 through 2001 revealed that domestic traffic on the Missouri River averaged 8.8 million short tons per year. From 1997 through 2001, commodities (other than sand and gravel) such as petroleum, fertilizers, manufactured goods, and food and farm products accounted for 16.6% of the total barge traffic (1.4 million short tons) on the Missouri River, 0.25% of the Mississippi River System, and 0.17% of the total national domestic tonnage.

Analysis and comparison of the reaches between Sioux City and Omaha, and Omaha to Kansas City from 1997 to 2001 revealed that commodity traffic amounted to 0.04 % and 0.06% respectively of the Mississippi River System total tonnage. In a big picture perspective, the total amount of all commodities shipped on the Missouri River by barge between Sioux City and Omaha from 1997 through 2001 could have been shipped on 12 one hundred car freight trains per year. For the same time period and the reach between Omaha and Kansas City, 18 one hundred car freight trains per year could have achieved the same result. The tonnage transported on the Missouri River by barge would further seem to substantiate the National Research Council belief that candidate reaches, such as the ones between Sioux City-Omaha and Omaha-Kansas City, deserve some priority when restoring ecological functions and benefits to the system.

Bio: Eugene (Gene) Zuerlein is currently the assistant administrator for the Nebraska Game and Parks Commission Fisheries Division where he has over 30 years of management, research, and administrative experience in the field of fisheries and aquatic sciences. He has an M.S. in Zoology (Fisheries Science) and an M.S. in Public Administration from the University of Nebraska. Gene is the agency delegate to the Missouri River Natural Resources Committee. He also serves as a member of the Missouri River Mitigation Coordination Team, Technical Committee of the Platte River Cooperative Agreement, and the Mississippi Interstate Cooperative Resource Association (MICRA) subcommittee on paddlefish and sturgeon and subcommittee on exotic species.

Missouri River Public Use Assessment: Overview and Study Design

Steven Sheriff

Missouri Department of Conservation
1110 S College Ave, Columbia, MO 65201
573-882-9909-3221; steve.sheriff@mdc.mo.gov

Co-Authors: Rochelle Renken, Missouri Department of Conservation, Resource Science Center, Columbia, MO and Gerald Mestl, Nebraska Game and Parks Commission, Lincoln, NE

Little is known about public users on the lower unimpounded portion of the Missouri River from Yankton, South Dakota to St. Louis, Missouri. Previous studies have examined the public use of smaller segments of this 811-mile portion of the river, but never has public use been measured along this entire stretch during one year. The *Missouri River Public Use Assessment* is a cooperative effort by the Missouri Department of Conservation and the Nebraska Game and Parks Commission to estimate public use along the whole lower unimpounded portion of the river from January 3, 2004 through January 28, 2005.

We will be using access methods, bus routes, and calendars to assess use by people visiting public access ramps, private ramps and any private or public bank accesses, and people who live along the river, respectively. Through these contact methods, we will estimate the number of public users. We will also determine the activities in which they engage, estimate the number of people engaged in each activity, and estimate the amount of time they spend on each activity. Estimates of the number of fish caught and kept as well as wildlife harvest by species will also be made. Economic value that the users place on the Missouri River will be estimated. The socio-characteristics of the public users will be summarized, too. An overview of the *Missouri River Public Use Assessment* and a description of the sampling scheme and methods used will be presented.

Bio: Steve Sheriff is a biometrician with the Missouri Department of Conservation at the Resource Science Center in Columbia, MO. He has over 20 years of experience conducting public use and attitude surveys. Steve's efforts for the last two years have been focused on development and implementing the *Missouri River Public Use Assessment*.



Recreational Use Issues at the Dawn of the 200th Anniversary

David Miller

State University of New York College at Cortland
P.O. Box 2000, Cortland, NY 13045
607-753-2996; millerd@coerland.edu

Today's paddlers will have to deal with many of the issues that plagued members of the Lewis and Clark Expedition 200 years ago: rapid current, snags, shallows, shoals, collapsing riverbanks, sudden squalls, bugs, and snakes. Those on the Missouri today will also have to navigate "big water" reservoirs, portage dams, and successfully co-exist with personal watercraft, powerboats, and barge traffic. Based on my 1500-mile solo kayak expedition started at Fort Benton, Montana, I summarize lessons learned with respect to making safe passage down the Missouri River. My presentation will combine materials from the journals of Lewis and Clark, my own field notes and photographs, and GIS-generated maps that overlay satellite imagery to highlight the challenges that today's paddlers will face. Also, I will propose the establishment of a *Missouri River Paddlers Information Clearinghouse* to better assist paddlers to safely voyage on the river.

Bio: Dr. David Miller is professor and chair of the Department of Geography at the State University of Cortland located in upstate New York. This summer he will complete his three summer long solo Kayak Expedition of the Missouri River. He is currently working on a "paddlers" guidebook that incorporates satellite imagery, fieldwork based GPS course tracks, and GIS generated maps.

River Users continued

Rivers of Change - Variety, Voices and Two Centuries of Altering our Rivers and Lives

Tom Mullen

Author

PO Box 6533, Malibu, CA 90264

310-968-6270; tmullen@riversofchange.com

If he was reincarnated today, Captain Meriwether Lewis could retrace the journey that his Lewis & Clark expedition made two centuries ago. Within hours he would shake his head in confusion and surprise. What became of the Missouri, Yellowstone and Columbia rivers that his group traveled along?

The answers come alive when told by those who live and work along these waterways. Tom Mullen tells this story in *Rivers of Change - Trailing the Waterways of Lewis and Clark*. He travelled for five months interviewing tribal historians, engineers, wildlife biologists, farmers, barge pilots and others to learn how changing the course of a river impacts the lives of those who live along its bank. This travelogue weaves interviews, anecdotes and research that highlight how the three rivers changed since Lewis and Clark explored them between 1804 and 1806.

The theme of variety is essential to the book. Just as variety of life forms and landscape is critical to maintaining the balance of ecosystems, soliciting a variety of viewpoints from those who live along riverbanks is crucial to deciding how we manage rivers. The Lewis and Clark expedition transformed Western geography from a myth into documented reality. The time has come to celebrate these explorers' achievements, and to use the event as a springboard for reconsidering how we manage Western rivers.

Bio: Tom Mullen spent over a decade working as a water resources consultant while living in Africa, Asia, Europe, the Middle East, Latin America and in the U.S. He has an M.S. in Water Resource Systems Engineering. More information about his book can be found at: www.riversofchange.com.

A Strategy to Prevent Zebra Mussels Invasion on Boats during the Lewis and Clark Bicentennial

Bill Zook

Pacific States Marine Fisheries Commission (PSMFC)

320 E. Penzance Rd., Shelton, WA 98584

360-427-7676; bjzook2@msn.com

Co-Authors: Stephen Phillips, PSMFC, Portland, OR and representatives from each of the seven Missouri Basin states, the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, National Park Service and the Pacific States Marine Fisheries Commission

In Spring 2002, the co-author group (above) was charged with developing a zebra mussel exclusion strategy designed to respond to concern that activities celebrating the upcoming Lewis and Clark Bicentennial (2003-2005) would significantly increase boater movement between states known to have zebra mussels and the Missouri River. Within this relatively short timeframe the Work Group identified four public outreach and education actions to reduce the risk of boaters transporting and introducing zebra mussels and other Aquatic Nuisance Species (ANS) into basin waters. The Work Group also identified two additional strategies that would help contain any introduction that might occur.

The four exclusion strategies included:

- 1) a basin-specific information and education campaign targeting Lewis and Clark trip planning resources,
- 2) the establishment of a network of Traveler Information Radio Stations (TIS) on major travel routes used by boaters to access the Missouri Basin from the east,
- 3) the creation of a public outreach and education partnership program with marina, portage and concession operators on the Missouri River called the *River Watch Program*, and
- 4) the development and installation of a common ANS information signs at all Missouri River access sites. In addition two containment strategies were identified. They included: 1) the establishment of a comprehensive zebra mussel monitoring program, and 2) development of a rapid response plan.

Bio: Bill Zook is an aquatic nuisance species consultant with Pacific States Marine Fisheries Commission in Shelton, WA.

Biotic Habitat Interactions - Part 1

Session 2 - Tuesday, May 24, 10:00 a.m.

Evapotranspiration Rates and Water Balance of Platte River Riparian Woodlands

Matthew Landon
U.S. Geological Survey
100 Centennial Mall North, Room 406 Federal
Building, Lincoln, NE 68508
402-437-5835; mlandon@usgs.gov

Co-Authors: David L. Rus, Benjamin J. Dietsch,
and Michaela R. Johnson, U.S. Geological Survey,
Lincoln, NE

Riparian woodland area along the Platte River in Nebraska has expanded substantially in the last century due to changes in hydrologic and land management conditions. Depths to water table in the cottonwood-dominated riparian woodlands are typically less than 2 meters. Evapotranspiration (ET) is potentially an important, but currently poorly understood, component of the regional water balance in the Platte River basin, where competing demands have resulted in water shortages in the coupled ground water/surface water system.

In 2002, the U.S. Geological Survey and Nebraska Platte River Cooperative Hydrology Study Group (COHYST) began a 3-year study of ET and water and energy balances in riparian woodlands at two sites that have characteristics generally representative of many Platte River woodlands. The purpose of the study is to improve understanding of the interactions between riparian woodlands and the hydrologic system.

During the 2002 and 2003 drought years, ET rates at the two sites were most strongly influenced by atmospheric vapor pressure

deficit and the availability of soil water and ground water. At the eastern site, decreases in soil water content and declines in ground water levels of 0.3 to 0.7 meters that occurred during June through August caused ET rates to decrease, with wilting occurring in the shrub-dominated understory but no observed health impacts to the cottonwood dominated overstory. At the western site, with a similar overstory to the eastern site but a red cedar-dominated understory, ET rates were most strongly influenced by atmospheric vapor pressure deficit. At both sites, precipitation was less than ET in 2002, but exceeded ET in 2003. Rates of measured ET were substantially less than potential ET rates, indicating that despite the availability of relatively shallow ground water to the phreatophytic vegetation, ET rates were limited by stomatal regulation and water availability.

Bio: Matt Landon is a hydrologist with the U.S. Geological Survey where he has worked since 1990. He has worked on numerous studies of ground water/surface water interaction and ground water quality in Minnesota and Nebraska. Matt is currently working on studies of evapotranspiration by riparian woodlands along the Platte River and transport of anthropogenic and natural contaminants to public supply wells for the National Water-Quality Assessment (NAWQA) Program's High Plains Regional Ground Water Study. He has a B.S. in Geology from the University of Kansas and an M.S. in Hydrogeology from the University of Minnesota.

Biotic Habitat Interactions - Part 1 *continued*

Analysis of Soils and Chute Reconstruction Success at Tobacco Island Bend

Jolene Hulsing

University of Nebraska at Omaha, U.S. Army Corps of Engineers, Omaha District
106 South 15th Street, Omaha, NE 68102-1618
402-221-4506; jolene.m.hulsing@usace.army.mil

The threefold purpose of this study is to:

1) determine if soils collected at Tobacco Island, Plattsmouth NE differ from the US Army Corps of Engineers (USACE) description used in the detailed project report of 1994, 2) predict if the chute will erode as predicted by USACE based on particle size analysis of collected soil cores, and 3) observe possible trends comparing recently accreted sediments (since the 1940s) with older accreted sediments (pre-1890s) using GIS layering of historical survey data.

The Tobacco Island Bend project is part of the *Missouri River Fish and Wildlife Mitigation Project*. The chute was reopened in December 2001 to return floodplain farmland habitat for fish and wildlife. At Tobacco Island Bend, eight sampling sites were located using GIS (ArcView Ver. 3.2). The sites were chosen using three criteria: the presence of a water surface in both the 1890s and 1947 survey data overlaid on 1994 digital imagery, the presence of land surface in the 1890s and 1947 survey data overlaid on 1994 digital imagery, and the location within the proposed extent of erosion along the chute. At each of the eight locations, undisturbed continuous soil cores were collected using a Giddings truck mounted soil probe. Each core was described, recorded, stratified, and sub sampled for later particle size, sieve, calcium carbonate, and organic carbon analysis. Recommendations will be made to the USACE for more soils analysis in future detailed plans of chute reconstruction.

Bio: Jolene Hulsing works as a hydrologic technician for the U.S. Army Corps of Engineers, Omaha District in the Sedimentation & Channel Stabilization Section. She has spent the last three years studying and working with the *Missouri River Fish and Wildlife Mitigation Project*. She receives her M.S. from the Geography/Geology Department at the University of Nebraska at Omaha in May.

The Environmental Monitoring and Assessment Program for Great River Ecosystem

Ted Angradi

U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-continent Ecology Division
999 18th Street, Suite 500, Denver, CO 80202
303-312-6575; angradi.theodore@epa.gov

Co-Authors: E. William Schweiger, U.S. Environmental Protection Agency, Denver, CO, David W. Bolgrien and Brian H. Hill, U.S. Environmental Protection Agency, Duluth, MN

Monitoring and assessment tools, including sample designs, analytical procedures, field protocols, metrics and reference conditions are not well developed for Great River Ecosystems such as the Missouri, Mississippi, and Ohio Rivers. The Environmental Monitoring and Assessment Program's Great River Ecosystems Initiative (EMAP-GRE) is a partnership among the EPA's Office of Research and Development, States, Tribes and other federal agencies.

The initiative addresses science gaps, and will contribute to improved ecological assessments of these nationally significant resources. Specific objectives of EMAP-GRE include: 1) develop and demonstrate a probability sample design that will yield unbiased, robust, state-scale estimates of Great River condition, 2) develop and test indicators and metrics of Great River condition and stress, and 3) determine reference condition for selected Great River habitats and indicators. Achieving these objectives will permit an assessment, with known statistical confidence, of the condition and extent of the Missouri, upper Mississippi, and Ohio River Ecosystems.

GRE habitats included in the research are the main channel, main channel littoral areas, and riparian areas. Remote sensing data will provide a larger-scale assessment perspective including the floodplain. Multiple biological assemblages will contribute to the assessment, including fish, macroinvertebrates, phytoplankton, periphyton, zooplankton, and aquatic and terrestrial vegetation. Water quality, sediment toxicity, fish tissue contaminants, aquatic and riparian physical habitat, and human disturbance will be

quantified as indicators of stress to provide context for interpreting biological data and for identifying reference condition. In total, about 320 randomly-selected sites will be sampled on the three rivers in July-October of 2004 and 2005. Additional targeted sites will be sampled for developing reference condition. This abstract does not necessarily reflect EPA policy.

Bio: Ted Angradi is a research biologist with the U.S. Environmental Protection Agency. He has been researching lotic ecosystems for 15 years including 4 years studying the Upper Missouri River.

Detailed Surficial Geological Mapping of the Missouri River Valley: River Management Implications

John Holbrook
Department of Geosciences, Southeast Missouri State University
MS6500 One University Plaza, Cape Girardeau, MO 63701
573-651-2338; jholbrook@semo.edu

Co-Authors: Robert B. Jacobson, U.S. Geological Survey, Columbia, MO and Faith Amadi, Larry Macklin, Chima Nzewunwah, Nikki Tanksley, John Dolde, and Steve Pagan, Southeast Missouri State University, Cape Girardeau, MO

Surficial geologic mapping of parts of the Lower Missouri River Valley bottom (Kansas City to St. Louis) reveals that the river was defined by four distinctly different patterns during the past 3000 years. Distinctions between patterns are based on differences in their channel width, channel depth, meander wavelength, meander radius, and grain size.

The first morphology has channels of very narrow width that are unusually deep (around eight meters). The second morphology consists of wide-sweeping meander loops comparable in depth to the modern channel. The third morphology is similar to the second, but with much tighter meander loops. The fourth and most recent pattern is the shallow island-braided river Lewis and Clark traveled. The regional extent of these effects argues against local tectonic

control; hence, the changes in pattern are most likely explained by sensitivity to late-Holocene climate variation. Climatic variation may have affected channel patterns by altering runoff, sediment supply, and vegetation influences.

Recognition of this geologic history has two important implications for long-term management and rehabilitation of the river. First, systematic geologic variations translate to differences in the distribution of sediments and topography that fundamentally determine landscape potential for habitat, agriculture, and development. Surficial geologic maps are thus a rich source for information to assist in flood-plain management decisions. Second, because the river has changed pattern dramatically on the scale of centuries, the river viewed by Lewis and Clark may not have been indicative of its long-term condition.

Bio: John Holbrook is currently finishing his twelfth year as a professor in the Department of Geosciences and Environmental Sciences at Southeast Missouri State University. In the fall, he moves to the University of Texas, Arlington to serve as a professor in the Department of Geology and the Department of Environmental and Earth Sciences. His research emphasis is in controls on sediment distribution in modern and ancient river systems. He received his B.S. from the University of Kentucky in 1985, his M.S. from the University of New Mexico in 1988, and his Ph.D. from Indiana University in 1992.

Habitat Rehabilitation

Session 1 - Wednesday, May 26, 8:00 a.m.

Current Implementation Plan, Corps Fish and Wildlife Mitigation Project

Kelly Ryan

U.S. Army Corps of Engineers
601 East 12th Street, Kansas City, MO 64106
816-983-3324; kelly.ryan@usace.army.mil

Co-Author: Michael Barnes, U.S. Army Corps of Engineers, Kansas City, MO

The purpose of the Annual Implementation Reports for the US Army Corps of Engineers *Missouri River Fish and Wildlife Mitigation Project* is to create an administrative record of mitigation efforts that have already occurred, complete a status of the mitigation efforts that are underway, and outline a plan for continued mitigation in the future. The session provides an introduction to the project and a report on 2003 and 2004 activities.

Bio: Kelly Ryan is a registered civil engineer. He has worked for the Corps and Forest Service for 19 years and currently serves as project manager for the *Missouri River Fish and Wildlife Mitigation Project*. He has a B.S. in Civil Engineering from the University of Arizona and an M.S. in Civil Engineering from Arizona State University.



Lisbon Bottom Side-Channel formed from flooding in the 1990s.

The Big Muddy National Fish and Wildlife Refuge

Tom Bell

U.S. Fish and Wildlife Service
4200 New Haven Road, Columbia, MO 65201
573-876-2786; tom_bell@fws.gov

The Big Muddy National Fish and Wildlife Refuge was established on September 9, 2004 to preserve and restore portions of the Missouri River floodplain and its fish and wildlife habitats, and to provide compatible public uses. The Big Muddy Refuge has a land acquisition target of 60,000 acres of floodplain habitat along 367 miles of the river, from its confluence with the Kansas River near Kansas City to its junction with the Mississippi River near St. Louis, Missouri. The vision for this refuge is not the creation of a single large block of habitat, but the inclusion of numerous separate units all linked by the Missouri River.

To date, the Big Muddy has 12,000 acres at eight different sites, including Overton Bottoms north (2,050 acres), Lisbon Bottom (2,014 acres), and Jameson Island (1,871 acres) that are featured during river trips at the 8th Annual Missouri River Natural Resources Conference.

The habitat rehabilitation occurring at these sites has led to a number of diverse interdisciplinary studies undertaken by federal, state, and university researchers. The information being gathered and the lessons learned should prove enormously helpful in crafting rehabilitation strategies for the big Muddy Refuge, as well as elsewhere on this and other large rivers.

Bio: Tom Bell is the refuge manager for the Big Muddy National Fish and Wildlife Refuge. He has worked at the U.S. Fish and Wildlife Service for 27 years and has an M.S. in Fish and Wildlife Management and an M.S. in Refuge Management from the University of Missouri - Columbia.

Songbird Use of Early Successional Bottomland Habitats along the Lower Missouri River

Brian Root

Missouri Department of Conservation
1110 S. College Ave., Columbia, MO 65201
573-882-9880; Brian.Root@mdc.mo.gov

Co-Authors: Dirk E. Burhans, University of Missouri, Columbia, MO and Daniel C. Dey, U.S. Department of Agriculture Forest Service, University of Missouri, Columbia, MO

As part of a larger bottomland oak reforestation study along the lower Missouri River, we monitored songbird use of six 40-acre blocks of former cropland at two sites managed by the Missouri Department of Conservation from December 1999-February 2004. Breeding bird species richness increased from 17 to 24 from 2000 through 2003 as vegetation structure became more complex. Several shrub-sapling species increased, including Field Sparrows (*Spizella pusilla*), Common Yellowthroats (*Geothlypis trichas*), Indigo Buntings (*Passerina cyanea*), and American Goldfinches (*Carduelis tristis*). Abundance of Orchard Orioles (*Icterus spurius*), an open woodland nesting species, increased substantially during the 4th year after planting. However, grassland species, such as Grasshopper Sparrows (*Ammodramus savannarum*) and Dickcissels (*Spiza americana*) generally decreased, except where a covercrop of redbud grass (*Agrostis alba*) inhibited other herbaceous regrowth. Abundances of open habitat species, including Horned Larks (*Eremophila alpestris*) and Killdeer (*Charadrius vociferus*), declined.

We monitored nests of 23 species during 2001-2003. Of the common nesting species, daily nest mortality of Dickcissels was highest at 7.4%. Predation at Indigo Bunting and Field Sparrow nests was comparable to other studies in Missouri rural old field sites. Orchard Orioles had relatively low daily nest predation rates (1%). Brood parasitism rates by Brown-headed Cowbirds (*Molothrus ater*) were low relative to other central and northern Missouri sites.

Missouri river bottomlands provide habitat for a variety of species of conservation interest, including declining grassland species such as Henslow's Sparrows (*Ammodramus henslowii*)

and Grasshopper Sparrows. Nest predation is comparable to other habitats, and cowbird parasitism levels are substantially lower than other early successional habitats, suggesting that many breeding species may be self-sustaining.

Bio: Brian G. Root is a resource scientist with the Missouri Department of Conservation in Columbia, MO where he researches wildlife interactions in bottomland and riparian forests across Missouri. His M.S. and Ph.D. in Wildlife Sciences are from the University of Missouri-Columbia.

Integrated Investigations of Ecological Responses to Rehabilitation at Overton Bottoms, MO

Carol Finn

U.S. Geological Survey
1400 Independence Road, MS 100, Rolla, MO 65550
573-308-3742; cfinn@usgs.gov

Co-Authors: Dale Blevins and Brian Kelly, U.S. Geological Survey, Lee's Summit, MO, John Holbrook, Southeast Missouri State University, Cape Girardeau, MO, Robert Jacobson, U.S. Geological Survey, Columbia, MO, and Jeff Spooner, U.S. Geological Survey, Rolla, MO

Effective rehabilitation of lands in the Missouri River corridor depends on a strong foundation of scientific understanding. Two prominent scientific questions are: Can the best places to achieve rehabilitation goals be identified before land is acquired, and, will alterations of a site intended to achieve one rehabilitation goal have unintended negative consequences for another part of the ecosystem?

To partially address these questions, the U.S. Geological Survey began a study near Overton, Missouri in 2003 to quantify selected ecological responses to physical and biological manipulations intended to enhance ecological recovery. Understanding ecosystem responses requires integration of biologic, hydrologic, geologic, and cartographic investigations.

Specifically, the investigation is targeted at: 1) determining how a constructed chute will affect ground water levels and, thus, the extent and distribution of wetlands and hydrophytic

continued on next page

Habitat Rehabilitation *continued*

continued from previous page

vegetation, 2) determining relations between vegetative moisture stress, depth to ground water, and the species composition, richness, and diversity of woody vegetation, 3) characterizing the extent and depositional nature of sedimentary layers underlying the flood plain and relating them to ground water fluctuations, soils moisture, and vegetative assemblages; and 4) determining how floodplain vegetative communities have evolved during ten years of succession in an unveeved flood plain. Completed data collection activities include installation of a monitoring well network, acquisition of satellite imagery, and preparation of preliminary surficial geologic maps from core-samples of surficial sediments. The study will be complete in 2005.

Bio: Carol Finn is the science coordinator for the Central Region Geography of the U.S. Geological Survey. Prior to joining the Regional Geographer's staff, she served four years as assistant branch chief for Production Operations at the USGS Mid-Continent Mapping Center, ten years as a geophysicist with the U.S. Air Force at Patrick Air Force Base, FL working on nuclear treaty monitoring research, and two years as a geodesist with Defense Mapping Agency Hydrographic/Topographic Center. Carol holds a B.S. in Geology from Southwest Missouri State University and an M.S. in Geophysics from St. Louis University.

Restoration Modeling for Edward (Ted) and Pat Jones - Confluence Point State Park

Ken McCarty
Missouri Department of Natural Resources
P.O. Box 176, Jefferson City, MO 65102
573-751-8660; ken.mccarty@dnr.mo.gov

Co-Authors: Charles DuCharme, Missouri Department of Natural Resources, Jefferson City, MO and Dennis Meinert, Missouri Department of Natural Resources, St. Louis, MO

The Edward (Ted) and Pat Jones - Confluence Point State Park comprises 1,118 acres at the confluence of the Mississippi and Missouri rivers. In 1804, this property was mostly river channel that Lewis and Clark boated across on

their famous Voyage of Discovery. In 1811, Naturalist Henry Brackenridge described the confluence point as a long prairie with a thin fringe of timber alongside the Missouri. This was called "Mamelle Prairie" and it ended at a confluence almost two miles west of the present location as mapped in 1819. In the 1940's the confluence was where we see it now, covered in a mix of riverfront forest and scour channels. Today the property is entirely crop fields protected by an agricultural levee, which the Missouri Department of Natural Resources will soon begin restoring.

The restoration vision for confluence point state park is a natural landscape reminiscent of what Lewis and Clark saw along the lower Missouri in 1804, that emphasizes native vegetation and wetland communities appropriate for the soils and hydrology of its current setting. This paper assimilates hydrologic, soil and topographic information collected for the site, with vegetation descriptions from *Missouri's Terrestrial Natural Community Classification System*. Together these will form the basis for restoration.

Through GIS analysis, a wetland zones and potential vegetation map has been produced for this low, frequently flooded site with its predominately clay soils. The presentation will illustrate how the different physical and biological elements have been integrated to develop this revegetation model.

Bio: Ken McCarty is the chief of the Natural Resource Management Section of the Missouri Department of Natural Resources Division of State Parks. He has an M.S. in Biology from the University of Missouri.

Biotic Habitat Interactions - Part II

Session 1 - Wednesday, May 26, 8:00 a.m.

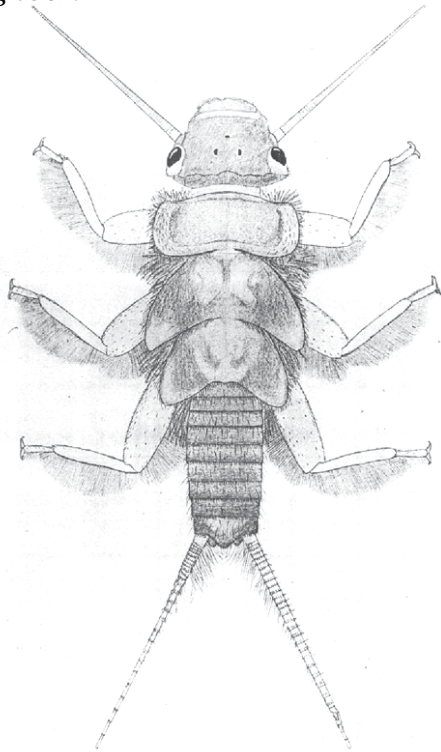
Waterbird and Invertebrate Response During Spring to Previously vs. Newly Flooded Habitats

Amanda McColpin

Missouri Department of Conservation
14939 Hwy F, Rothville, MO 64676
660-256-3353; acmdlh@mcmsys.com

Co-Authors: Leigh H. Fredrickson, Gaylord Memorial Laboratory, University of Missouri, Puxico, MO, Andy Raedeke and Dave Graber, Missouri Department of Conservation, Columbia, MO

Historical river discharge and precipitation patterns in mid-Missouri suggest that spring and early summer flooding of seasonal flood-plain wetlands may have been more common and widespread than fall flooding. However, on many managed wetland complexes most available natural seasonal wetland vegetation (moist-soil) is flooded during fall to provide migration habitat for waterbirds, especially waterfowl, and little previously unflooded moist-soil is available for flooding during spring migration.



The stonefly (Attaneuria ruralis) is restricted to very large rivers and inhabits snags and other types of stable substrates in the Lower Missouri River.

Picture from Frison 1935.

We conducted a two-year study on state and federal wetland complexes along the Missouri River and its tributaries in central and north-west Missouri to examine spring waterbird and invertebrate response on moist-soil units that either had been flooded the previous fall (control) or had not been flooded the previous fall (treatment). All study sites were flooded during spring. Study units were dominated by annual wetland plants. We conducted 1-3 ground-based waterbird surveys per week on each site. We collected benthic and nektonic invertebrates during 2-3 sampling periods each spring.

Overall waterfowl densities were similar during spring between treatment and control wetlands, but densities on treatment sites exhibited large peaks in bird use immediately after flooding. Some benthic and water column invertebrates tended to be more abundant on control sites. However, there was considerable variability in the response of both waterbirds and invertebrates across taxa and sites. On control sites, the proportion of dabblers foraging increased throughout spring, but on treatment sites, the proportion foraging was moderately high throughout spring. Our results highlight benefits of providing newly flooded moist-soil habitat in conjunction with previously flooded habitat during spring.

Bio: Amanda McColpin recently completed her M.S. at the University of Missouri studying waterbird distribution in Missouri River flood-plain wetlands. She is currently continuing her work in Missouri wetlands in collaboration with Missouri Department of Conservation biologists.

Charles Schwartz, Wildlife Drawings, Missouri Conservation Commission

Biotic Habitat Interactions

Part II *continued*

Evaluation of Avian Use in the Missouri River and Floodplain

Andrew Raedeke
Missouri Department of Conservation
1110 S College Ave., Columbia, MO 65201
573-882-9909-3219;
Andrew.Raedeke@mdc.mo.gov

Co-Authors: Dale D. Humburg, Missouri Department of Conservation, Jefferson City, MO and Doug Helmers, Natural Resources Conservation Service, Chillicothe, MO 64601

Much of the wetland habitat and sandbar habitat associated with the Missouri River and its floodplain have been destroyed or highly altered. Restoration efforts have ranged from passive management, where little management activity takes place, to intensive management, where water manipulation and disturbance are done on a frequent basis.

We evaluate the role of intensively managed wetlands, passively managed wetlands, sandbar habitat, and wetland basins in the agricultural landscape for waterbirds. We conducted 45 aerial surveys via helicopter during the fall and spring migration periods in 2000-2002. We observed 2,757,811 individual birds and derived an estimate of 3,417,969 birds in the floodplain representing 79 different species. No single wetland type provided the needed resources during every season or every year. Dynamic environmental conditions coupled with a diversity of habitat needs of a wide spectrum of species requires a broad range of wetland restoration strategies to ensure habitat in both wet and dry periods, during spring and fall, and between the early and late periods of migration.

Bio: Andrew Raedeke is a resource scientist with the Missouri Department of Conservation, Columbia, MO. Previously, Andrew was a survey coordinator with the Missouri Department of Conservation and a research assistant professor in Rural Sociology at the University of Missouri-Columbia. He holds a Ph.D. in Rural Sociology and an M.S. in Fisheries and Wildlife from the University of Missouri-Columbia. He also holds a M.S. in Theology with emphasis on environmental ethics from the Luther Seminary and a B.S. from Concordia College, Moorhead, MN.

Nursery Habitat for Larval Fishes in the Lower Missouri River

Kerry Reeves
Missouri Cooperative Fish and Wildlife Research Unit, University of Missouri
302 ABNR, Columbia, MO 65211
573-884-8534; ksr5g4@mizzou.edu

Co-Author: David L. Galat, USGS Missouri Cooperative Fish and Wildlife Research Unit, University of Missouri-Columbia, Columbia, MO

The larval stage is the most environmentally vulnerable of a fish's life cycle, and frequently is a survival bottleneck. Restoration goals for the Lower Missouri River involve creating additional shallow-water habitat, potentially enhancing the amount and quality of available larval-fish nursery habitat.

Our objectives are to quantify habitat needs for this critical stage as guidance for habitat restoration. To accomplish this we selected ten sandbars; five on inside bends, and five behind wing-dikes between river kilometers 252 and 353 for study. Sandbars and associated primary and secondary channels were sampled biweekly from 15 March, 2002 until 30 September, 2002. Channel samples were collected using bow-mounted ichthyoplankton nets. Two parallel samples were collected in shallow water along six sandbar regions. Two regions each represented primary and secondary sides, and one each represented upstream and downstream ends.

Larval fish relative abundance (R.A.) was not significantly different between primary and secondary channels or between sandbar types. However, shallow water along the sandbar margin had significantly higher R.A. than the primary channel. Further, shoreward samples with mean depth of .23m and mean current velocity of .14m/s had significantly higher R.A. than parallel, riverward samples with mean depth of .37m and mean current velocity of .17m/s. These preliminary results support the hypothesis that more larval fishes in the Lower Missouri River use shallow-littoral zones around sandbars as nursery habitat than the primary channel. Habitat restoration projects and flow management should attempt to maximize availability of this habitat during the seasonal period of larval fish development.

Bio: Kerry Reeves is currently a Ph.D. student in the Missouri Cooperative Fish and Wildlife Research Unit, University of Missouri-Columbia, Columbia, MO.

Spawning Periods and Growth of Larval Gizzard Shad from the Lower Missouri River

Lori Patton

University of Missouri - Columbia
Department of Fisheries and Wildlife, 302 ABNR,
Columbia, MO 65211
573-268-2643; ldp2fc@mizzou.edu

Co-Authors: Kerry S. Reeves, University of Missouri-Columbia, Columbia, MO and David L. Galat, USGS Missouri Cooperative Fish and Wildlife Research Unit, University of Missouri-Columbia, Columbia, MO

Early life history data is a primary need to better understand the recruitment process and manage fish populations. Spawning periods and patterns of gizzard shad (*Dorosoma cepedianum*), an important forage fish in the Missouri River, depend on environmental cues such as discharge and temperature, and population factors such as the size structure of the adult population.

Our objectives were first to relate discharge and temperature profiles to date captured and three more refined dates: 1) date first otolith increment was formed, 2) approximate date of hatch, and 3) approximate date spawned. Our second objective was to determine the length of the spawning period and spawning patterns. Larval fishes were collected in channel and shoreline habitats of the Lower Missouri River 4-5 days per week from 15 March to 30 September 2002. After back-calculating age from larval gizzard shad otoliths, their spawning period was no longer distributed among 9 weeks, 20 May to 22 July, based on collection date. They actually had a 12 week spawning period from 25 April to 10 July.

By determining an approximate date when larvae were spawned rather than using collection date, they were associated with a discharge and temperature pattern much closer to the actual pattern experienced. Discharge and temperature patterns based on date caught and approximate date spawned differed substantially. Length-frequency graphs showed two distinguishable spawning peaks of gizzard shad along with a constant influx of larvae.

Bio: Lori Patton is a Masters student in Fisheries at University of Missouri-Columbia under Dr. David L. Galat. She has a B.S. in Fisheries and Wildlife from University of Missouri-Columbia.

200 Year Missouri River History [1803-2003] of the Least Tern and Piping Plover

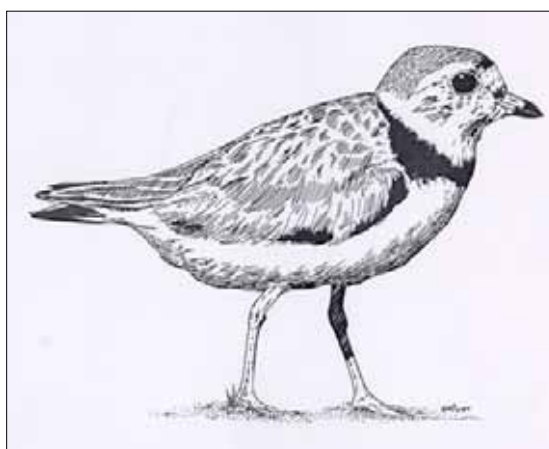
Bill Beacom

2423 Jackson, Sioux City, IA 51104
712-255-3412; bbeacom@pionet.net

A survey of scientific papers relating to the presence and other characteristics, including nesting, of the interior least tern and the piping plover demonstrates that these migratory birds were uncommon on the Missouri River and were only present on the river in small numbers during droughts. The interior least tern and piping plover typically nest in May and June. Since sandbars on the pre-impoundment Missouri River were typically submerged until late July or August, these migratory shorebirds nested at other locations off of the Missouri River.

During the rare years when exposed sandbars may have been available to the tern and plover in May and June, it is not likely that nesting resulted in any significant fledging. This lack of fledging was due to the pre-impoundment hydrograph of the Missouri River, which included many rises of short duration, especially in the spring and early summer that would have flooded most nests. Since impoundment, the hydrograph of the Missouri River has largely been characterized by significantly reduced fluctuations, which has benefited nesting and fledging of the terns and plovers. Flows that seek to simulate the pre-impoundment hydrograph would reduce the population of these birds on the Missouri River.

Bio: Captain Bill Beacom has been a Missouri River Captain 46 years and is self-educated.



Piping Plover

Public/Private Partnerships

Session 1 - Wednesday, May 26, 10:10 a.m.

The Wetland Reserve Program Along the Missouri River and Major Tributaries

Doug Helmers

USDA-Natural Resources Conservation Service
1100 Morton Parkway, Chillicothe, MO 64601
660-646-6220; doug.helmerts@mo.usda.gov

Co-Authors: Kevin Dacey, Missouri Department of Conservation, Columbia, MO, Chris Hamilton, USDA-Natural Resources Conservation Service, Columbia, MO, and Mike McClure, Missouri Department of Conservation, Chillicothe, MO

The Wetland Reserve Program (WRP) was established under the 1990 Farm Bill and is administered by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). WRP has placed 1.3 million acres under permanent and 30-year easements nationwide. Missouri alone has placed nearly 100,000 acres under easement. NRCS along with its partner agencies are responsible for the restoration of each site. During the early 1990s very little restoration occurred on most sites; “walk aways” or tree plantings were common techniques.

During the middle 1990s it was determined that additional hydrology restoration was required to meet the objectives of the program. During this period a priority was placed on expanding floodplains, restoring hydrology, and providing additional technical assistance to landowners on managing wetlands. The late 1990s and early 2000s involved not only hydrology restoration but also included restoring microtopographic features that had been removed from the landscape during extended periods of row crop agriculture. These geomorphic features include oxbows, swales, and seasonal and vernal pools. Engineering techniques have also evolved during the past decade by designing structures in floodplains to withstand flood events without having to make multiple repairs.

Currently new approaches are being used in areas where hydrogeomorphic models have been developed to identify and restore those features that are appropriate to the particular geomorphic setting of the site. The lessons learned from these restoration techniques will provide value to governmental and non-governmental agencies in developing wetland restoration plans in the future.

Bio: For the past ten years, Doug Helmers has worked for the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) with the Wetlands Reserve Program and Swampbuster provisions of the Farm Bill. Currently, he serves as the Wetland Emphasis Team Leader for NRCS in Northwest Missouri and is a member of the National Wetland Restoration Cadre for NRCS. Doug holds an M.S. from the University of Missouri-Columbia.

The Two Rivers Project of Fremont County, Iowa

David Carter

Fremont Soil and Water Conservation District
PO Box 490, 301 South Main, Tabor, IA 51652
712-374-2014; carter@fremontswcd.org

In the 1980s and 90s, Fremont County, Iowa, had been plagued with frequent and extensive flooding. The East and West Nishnabotna Rivers have destroyed crops, levees, and homes throughout much of the county. Also, the town of Hamburg, near the confluence of the Nishnabotna and Missouri Rivers, has a history of damaging floods, especially in the last 20 years.

In the summer of 1999, the Fremont County Soil and Water Conservation District began the *Two Rivers Project* to help farmers enroll in the Wetlands Reserve Program (WRP) and the Emergency Watershed Program (EWP). The project is an Environmental Protection Agency funded Wetland Development Grant. Fremont County now has over 7,684 acres of cropland and timber enrolled in the two programs, and 4,100 acres of land are on the easement ranking list of the Iowa NRCS.

In addition, the *Two Rivers Project* is involved in shallow water areas, farmable wetlands, and filterstrips in the Conservation Reserve Program; cooperative planning with the county's economic development corporation; and an outdoor learning center for local schools. This is an example of what can be done with the cooperation of many different agencies and organizations. The presentation will also highlight some of the restorations within Fremont Soil and Water Conservation District and discuss some of the differences between true wetland and floodplain easement restorations.

Bio: David Carter is the project coordinator for the *Two Rivers Project* funded by the U.S. Environmental Protection Agency (EPA). He was raised in Fremont County and returned to help the Fremont Soil and Water Conservation District with the project after receiving a B.S. in Forestry Management from Iowa State University. David received the EPA 2003 National Wetland Award for Stewardship and Land Development sponsored by Senators John McCain and Russell Feingold.

Democratizing Science, Management, and Public Policy in the Missouri River Ecosystem

Meghan Sittler
Environmental Resource Center
University of Nebraska-Lincoln
345 Nebraska Union, Lincoln, NE 68588
402-472-8823; msittler2@unlnotes.unl.edu

Co-Author: Robert D. Kuzelka, AICP, University of Nebraska-Lincoln School of Natural Resources and Environmental Studies Program

Agricultural stakeholder involvement is central to the National Research Council 2002 Missouri River report recommendation for development and implementation of adaptive, ecosystem management principles, as well as the definition of a new management regime for the Missouri River. This presentation details the results of a pilot study of fifteen agricultural producers in three counties, Atchison County, Missouri, Fremont County, Iowa, and Otoe County, Nebraska, who completed structured interviews.

The interview questions centered upon the producers' relationship to the river, perceptions of the current management of the river, and willingness to support and participate in a proposed collaborative management organization for the Missouri River Ecosystem (MRE) as part of ecosystem and adaptive management policies. The results of the interviews indicate that there is a basis for increased citizen involvement, the development of a collaborative stakeholder organization, and the implementation of adaptive ecosystem management principles.

Recommendations for the structure of a collaborative organization are made as well as recom-

mendations for future study of agricultural stakeholder amenability to the implementation of the NRC's (2002) recommendation for the restoration of the MRE through adaptive collaborative ecosystem management policies.

Bio: Meghan Sittler received her M.S. in Natural Resource Sciences from the University of Nebraska-Lincoln (UNL) School of Natural Resource Sciences with minors in Political Science and Planning in August 2003. Additionally, she holds a graduate certification in Public Policy Analysis from UNL. Meghan currently serves as the program adviser for the Environmental Studies Program at UNL and is an instructor within the School of Natural Resources.

Important Bird Areas and the Missouri River: A Project Vision

Roger Still
Audubon Missouri
State Office of the National Audubon Society
2620 Forum Blvd., Suite C-1, Columbia, MO 65203
573-447-0528; rstill@audubon.org

The National Audubon Society is in the process of identifying and taking action at *Important Bird Areas* (IBA) throughout North America. As part of a global program through *BirdLife International*, this effort is aimed at conserving habitat critical to birds. Audubon Missouri, the state office of the National Audubon Society, believes that an untapped conservation and recreational opportunities exist along the Missouri River, particularly in the bi-state corridor between Kansas City and St. Joseph. We seek to initiate a broadly collaborative project in this corridor that stimulates restoration of bottomland forests and wetlands, contributes to the conservation of imperiled bird species, and connects people to the river again in a positive way. This project is projected to be a marquee project of Audubon's IBA program in Missouri.

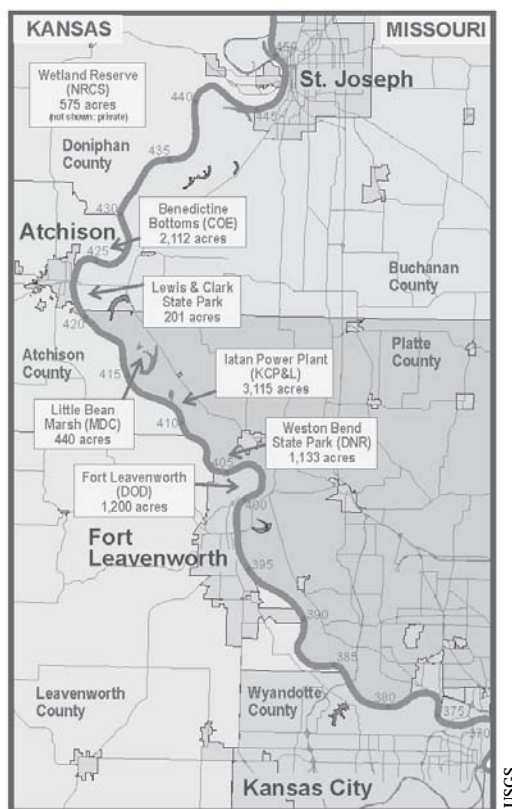
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Public/Private Partnerships *continued*

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This presentation will outline Audubon's emerging vision for this stretch of the river and the positive 'connections' we have made around that vision to date in both the public and private sectors. The underlying aim is to enter into a dialogue and to receive feedback about this potential project with conference participants.

Bio: Roger Still is the executive director of Audubon Missouri, the state office of the National Audubon Society. Prior to coming to Audubon, Roger was executive director of The Nature Conservancy of Missouri for five years.



Proposed corridor for Audubon Missouri's collaborative project to stimulate river restoration.

Potential for Reducing Nutrient Loading to Rivers with Nutrient Farming/Trading

Tony Prato
Center for Agricultural, Resource and Environmental Systems
University of Missouri-Columbia
212 Mumford Hall, Columbia, MO 65211
573-882-0147; pratoa@missouri.edu

The U.S. has experienced dramatic losses in wetlands due in part to drainage of wetlands for agricultural production. The Mississippi River Basin has lost more than 26 million hectares of wetlands since the 1780s. A negative consequence of wetland drainage is increased nutrient loading to the Mississippi River and associated hypoxic (low oxygen) conditions in the Gulf of Mexico. Hypoxia causes suffocation of fish, shrimp, crabs and other marine mammals, and negatively impacts commercial fishing communities and industries, consumers of commercial fishery resources and recreational users of fish.

Two principal ways to decrease agricultural nutrient loading to the Gulf are to: a) reduce nutrient runoff by modifying cropping systems, fertilizer application rates and drainage patterns, and b) create and restore in excess of 9.45 million hectares of ecosystems, principally wetlands, riparian buffers and riparian forests between farms and adjacent streams and rivers. The acreage target is part of EPA's Hypoxia Action Plan. Preliminary results are reported for a study of the technical, economic and institutional feasibility of reducing nutrient loading in the Mississippi River Basin by market-based nutrient farming/nutrient trading. Nutrient farming involves converting cropland to wetland for the purpose of producing nutrient credits. Credits would be sold to point sources, such as wastewater treatment plants, that would use them to achieve nutrient emission standards. If feasible, nutrient farming/nutrient trading would afford an alternative enterprise for crop farmers, provide a more cost effective way for point sources to achieve nutrient emission standards and reduce nutrient loading to the Gulf of Mexico.

Bio: Tony Prato is professor of Ecological Economics and co-director of the Center for Agricultural, Resource and Environmental Systems and director of the Missouri River Institute at the University of Missouri-Columbia. He conducts research on management systems for alleviating negative impacts of agriculture on water quality and adaptive management of the Missouri River, and teaches courses in natural resource and environmental economics, and conservation and management of protected areas.

Fisheries Resources

Session 2 - Wednesday, May 26, 10:10 a.m.

Analysis of the Missouri River Natural Hydrograph as Sioux City, Iowa

Donald Jorgensen
Missouri River Technical Committee of the
Siouxland Chamber of Commerce
33599 479 Ave., Jefferson, SD 57038
605-966-5645; donjorg@pionet.net

The natural hydrograph is believed to favor restoration of native wildlife. In reference to the unchanneled reach from Gavins Point Dam to Ponca, Nebraska, it is stated that a spring rise or rises and a summer low flow, if implemented, would restore spawning cues for fish (e.g. pallid sturgeon), and form sandbar habitat for birds (e.g. least tern and piping plover). It would be useful to analyze the natural hydrographs for this reach. Data of 1929-1955 conditions were obtained from the U.S. Geological Survey and the U.S. Army Corps of Engineers and were used to create hydrographs of natural flow, temperature, and stage at Sioux City, Iowa.

Analysis of the 'natural' hydrographs indicated that the initiation of the June rise and the occurrence of a 18 degree C water temperature needed for pallid sturgeon spawning were both highly variable and typically not coincidental, ranging as much as 63 days. The temperature data does not support the usual assumption that flow and water temperature were closely coupled in the 'natural' hydrograph and cued the pallid sturgeon to spawn. These results and the historical observations of pallid sturgeons spawning in the tributaries as compared to the main stem are very significant.

The inspection of stage data of the 'natural' hydrographs for the years 1929-1955 indicates the natural hydrograph was very unfavorable to the successful reproduction of the least terns and piping plover on the island sandbars of the Missouri River because the sandbars would have been completely submerged in 26 of the 29 years investigated. These results are consistent with historical observations of sandbar submergence during the June rise.

Bio: Donald Jorgensen, P.E., is a civil engineer, geologist, and retired USGS hydrologist. He has more than 60 publications on multiple topics including the Missouri River. He is self employed including direction of Lakota Consulting.

Identification of Hard Spawning Substrates on the Lower Missouri River

Mark Lastrup
U.S. Geological Survey
4200 New Haven Road, Columbia, MO 65203
573-876-1831; mlastrup@usgs.gov
Co-Authors: Robert Jacobson, U.S. Geological Survey, Columbia, MO

Cobble and gravel deposits have been identified as important spawning substrates for sturgeon. To date, 220 kilometers of the lower Missouri River (river miles 263-126) have been surveyed for locations of potential spawning substrate. A total of 51 deposits and 27 bedrock outcrops in contact with the river have been mapped. The location, size and composition have been recorded for each of the deposits. Digital photographs have been taken at each site. We are investigating the origins of these deposits with the intent of providing a predictive model for where spawning substrates occur within the Missouri River valley. At present, four origins are apparent: re-deposited glacial till, local stream gravel (Ozark plateau), local limestone/dolomite and re-deposited railroad ballast.

The remaining 201 kilometers of the lower river (Osage River to St. Louis) will be mapped in 2004. The information will be available to interested researchers as an interactive map using Internet Map Service technology. If interested in receiving the ArcView shapefile and photos prior to the availability of the map service, contact Mark Lastrup (mlastrup@usgs.gov).

Bio: Mark Lastrup is a geographer with the River Studies Branch, USGS Columbia Environmental Research Center. In addition to work on hard substrates, he has also used GIS to characterize historical channels and public lands on the Missouri River valley bottom..

This paper will be presented by Robert Jacobson, U.S. Geological Survey (see page 28).

Fisheries Resources *continued*

Annual Reproductive Hormone Levels in Shovelnose Sturgeon from the Missouri River

Diana Papoulias
U.S. Geological Survey
4200 New Haven Road, Columbia, MO 65201
573-876-1902; dpapoulias@usgs.gov

Co-Authors: Mark L. Wildhaber,¹ Aaron J. DeLonay,¹ Mandy L. Annis,² and Don E. Tillitt,¹
(1) U.S. Geological Survey, Columbia, MO
(2) JCI, Inc., Fort Collins, CO

The physiology of fish changes during the course of the reproductive cycle (the period from spawn to spawn) and according to environmental conditions (principally temperature and photoperiod). Specific environmental cues trigger hormonal cascades which in turn cycle the gonad through gametogenesis and ultimately spawning. To date little is known about the specific reproductive physiology of Missouri River sturgeons. Therefore, we have collected adult shovelnose sturgeon monthly over the course of a year and measured plasma hormones (17 β -estradiol, 11 keto-testosterone) and vitellogenin. These measurements have been associated with the stage of gonad development and concomitant seasonal environmental conditions. Our results provide a seasonal profile of the development of shovelnose sturgeon eggs and sperm under contemporary conditions existing in the Lower Missouri River. We discuss the significance of our data relative to understanding the spawning success of Missouri River sturgeons in a river that is significantly different from that in which it evolved.

Bio: Diana Papoulias is a research fisheries biologist at the U.S. Geological Survey, Columbia Environmental Research Center in Columbia MO. She has spent the last several years studying the effects of contaminants on fish reproduction. Diana received a Ph.D. from the University of Missouri-Columbia.

Effectiveness of Ultrasound for Estimating Fecundity of Missouri River Shovelnose Sturgeon.

Janice Bryan
Independent Contractor
4200 New Haven Road, Columbia, MO 65201
573-876-2953; jrbryan@usgs.gov

Co-Authors: Mark L. Wildhaber,¹ Diana M. Papoulias,¹ Aaron J. DeLonay,¹ Donald E. Tillitt,¹ Mandy L. Annis,² and J. Alan Allert¹
(1) U.S. Geological Survey, Columbia, MO
(2) JCI, Inc., Fort Collins, CO

Understanding the reproductive cycle of shovelnose sturgeon in the Missouri River is important in evaluating the status and viability of the population. Using a noninvasive method for examining fish permits a nonconsumptive means by which to collect reproductive data. In order to evaluate the reproductive status of shovelnose sturgeon, we used ultrasound to estimate fecundity, egg size and gonad size. To estimate gonad volume we took three equidistant transverse ultrasound images and one longitudinal external length measurement. Gonad area in each cross section and egg diameters were measured using image analysis software. Fecundity was then estimated by dividing the calculated gonad volume by mean calculated egg volume. Ultrasound-measured fecundity and egg diameters were compared to actual egg measurements, weight-based fecundity estimates and egg stage. Overall, ultrasound technology is an effective tool for estimating fecundity.

Bio: Janice L. Bryan has an M.S. in Fisheries and Wildlife from the University of Missouri-Columbia. She is currently serving as a contract fisheries research technician at the USGS Columbia Environmental Research Center in Columbia, MO.

Movements and Habitat Selection of Bighead and Silver Carp in the Lower Missouri River

Duane Chapman

U.S. Geological Survey

4200 New Haven Road, Columbia, MO 65201

573-876-1866; dchapman@usgs.gov

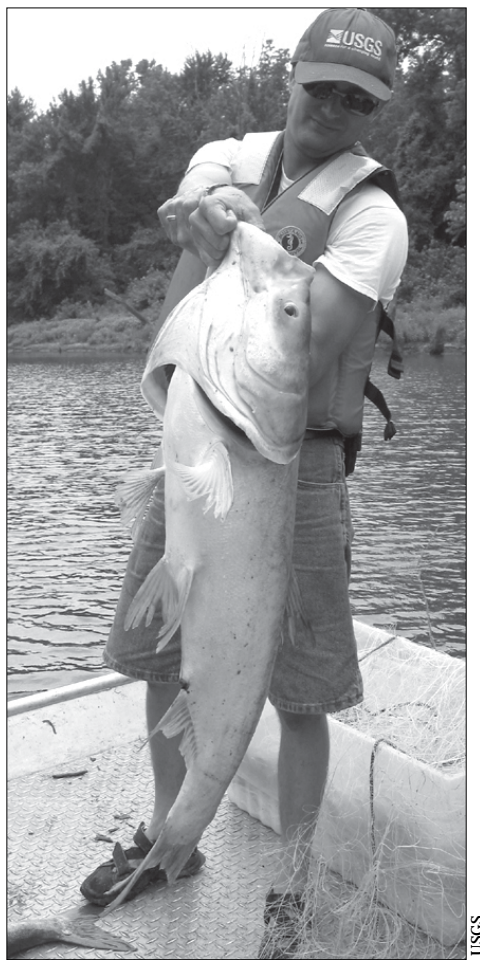
Co-Authors: Brian Carollo, Joseph Deters, and Christopher Witte, JCI, Inc., Fort Collins, CO

Bighead and silver carp are Asian species that are currently expanding in range and numbers in the Mississippi and Missouri River drainages. These highly invasive species are now probably the most abundant large fish in many parts of those drainages. Impacts to native species are unknown.

Since October 2002, USGS scientists have been using telemetry and fishing with nets to determine habitat selection and behavior of bighead and silver carp in the Missouri River. A variety of habitat characterization techniques are used to characterize the habitats selected by the fish, including water quality measurements, bathymetry, substrate classification, acoustic imaging, and acoustic Doppler current mapping. USGS is conducting detailed mapping of riverbed elevations, bedforms, substrate, and velocity fields for discrete, representative sections of the river.

Preliminary results identify that both of these fishes, but especially silver carp, are active during cold-water periods. Many fish moved upstream during high water events during the warm months with movements of over 150 miles within a season, both upstream and downstream. Silver carp tend to move longer distances than bighead carp. Water temperature and quality in habitats selected by the fish during the coldwater period did not differ from the main channel. This information on the behavior and habitat selection of these fish is needed to predict impacts on native fishes and to formulate control methodologies.

Bio: Duane Chapman is a fisheries biologist with the U.S. Geological Survey in Columbia, MO. He first worked with an Asian carp (grass carp) in aquaculture while an undergraduate summer helper for the Iowa Conservation Commission in 1978. His first scientific journal publication was on grass carp while working on his Masters at the University of Wyoming in 1988. Duane then took a 14-year detour into the realms of limnology and aquatic and marine toxicology before beginning this project with invasive Asian carp in 2002.



Joe Deters holding a bighead carp, the invasive species sometimes called the "flying fish."

Notes

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Acknowledgements

Thanks to all the helpful folks on the Organizing Committee who worked for the past year to make the conference possible.

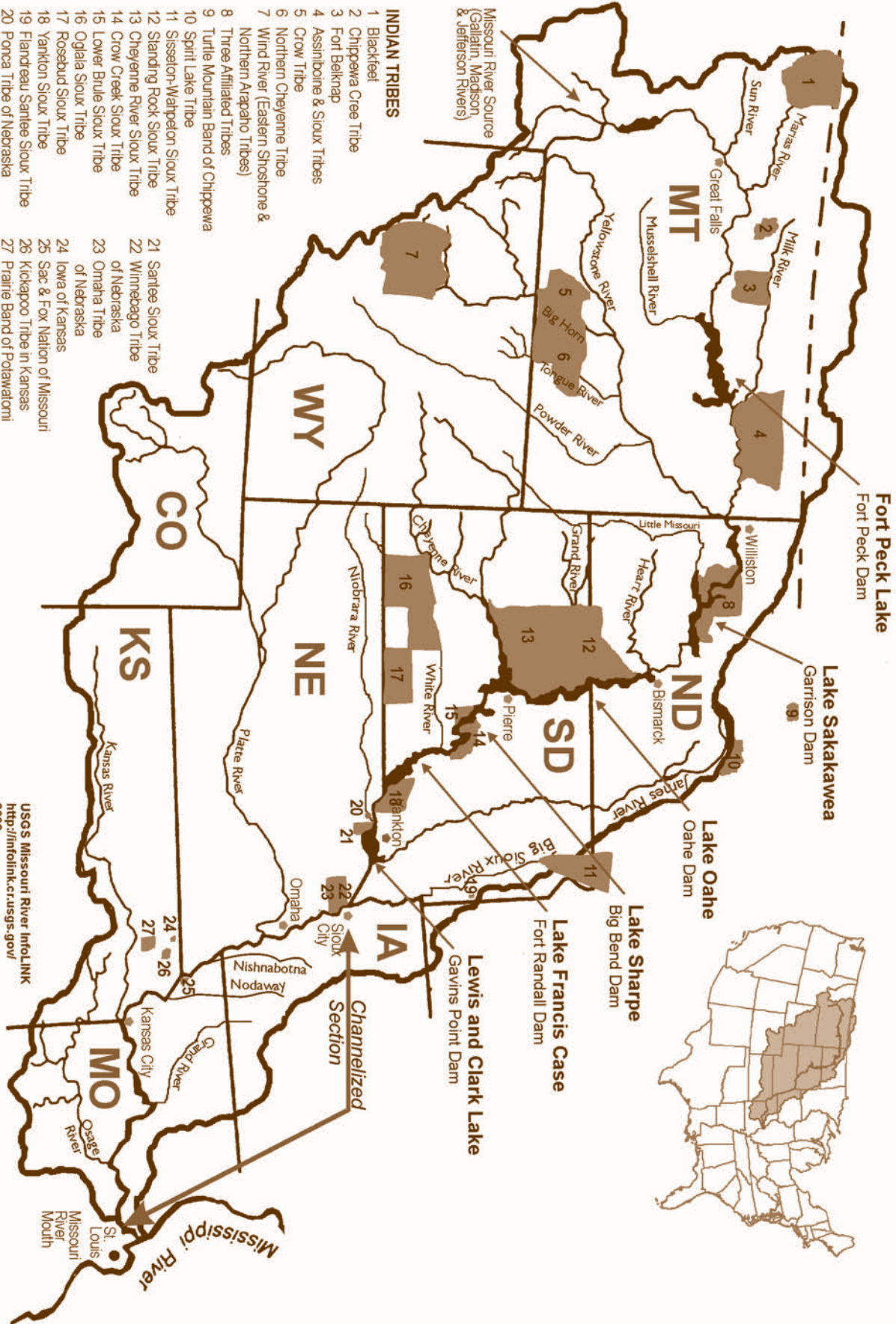
The river trips are the most extensive ever undertaken for a Missouri River Natural Resources Conference. Special thanks to the U.S. Army Corps of Engineers for providing the barge and the Missouri Department of Conservation, U.S. Fish and Wildlife Service, and U.S. Geological Survey for providing boats.

In addition, thanks to the many researchers who are sharing their knowledge with the river trip participants.

The Conference Program was produced by the U.S. Geological Survey, Columbia Environmental Research Center and printed by the Missouri Department of Conservation on recycled paper.



MISSOURI RIVER BASIN



- INDIAN TRIBES**
- 1 Blackfeet
 - 2 Chippewa Cree Tribe
 - 3 Fort Belknap
 - 4 Assiniboine & Sioux Tribes
 - 5 Crow Tribe
 - 6 Northern Cheyenne Tribe
 - 7 Wind River (Eastern Shoshone & Northern Arapaho Tribes)
 - 8 Three Affiliated Tribes
 - 9 Turtle Mountain Band of Chippewa
 - 10 Spirit Lake Tribe
 - 11 Sisseton-Wahpeton Sioux Tribe
 - 12 Standing Rock Sioux Tribe
 - 13 Cheyenne River Sioux Tribe
 - 14 Crow Creek Sioux Tribe
 - 15 Lower Brule Sioux Tribe
 - 16 Oglala Sioux Tribe
 - 17 Rosebud Sioux Tribe
 - 18 Yankton Sioux Tribe
 - 19 Flandreau Santee Sioux Tribe
 - 20 Ponca Tribe of Nebraska

- 21 Santee Sioux Tribe
- 22 Winnebago Tribe of Nebraska
- 23 Omaha Tribe of Nebraska
- 24 Iowa of Kansas
- 25 Sac & Fox Nation of Missouri
- 26 Kickapoo Tribe in Kansas
- 27 Prairie Band of Potawatomi

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