Master Manual Update

Monday, March 22
1:15 p.m.

Richard Opper, Missouri River Basin Association,
P. O. Box 301, Lewistown, MT 59457

Since the drought of the late 1980s, the Corps of Engineers has been investigating ways to revise and update the Missouri River Master Manual, the operating plan for the river. A couple of years ago, the Corps encouraged the Missouri River Basin Association (MRBA), a coalition of the basin's states and Indian tribes, to play a lead role in the basin's planning activities. Since then, MRBA has already agreed upon recommendations to enhance the basin's overall economic and environmental health. Those recommendations have been endorsed by federal agencies and in many cases, the U.S. Congress. Now the association is trying to resolve the remaining questions of how to recover the basin's endangered species, and how to manage the basin's complex reservoir system when there is not enough water to fully satisfy all the uses of the river system.

An Overview of the Missouri River Land Transfer Bill and South Dakota's Strategy for Implementation

Monday, March 22
1:35 p.m.

Rick Collignon, South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, SD 57325

In the fall of 1998, the U.S. Congress passed the Cheyenne River Sioux Tribe, Lower Brule Sioux Tribe, and State of South Dakota Terrestrial Wildlife Habitat Restoration Act. This legislation is designed to:

- address mitigation required by the 1958 Fish and Wildlife Coordination Act on lands flooded by Lakes Oahe and Sharpe that was never implemented,
- resolve long standing jurisdictional disputed over land and water fronting Indian reservations along the Missouri River,
- provide a stable funding for the operation and maintenance of Missouri River recreational areas which continue to suffer from Federal Budget cuts,
- address public demand for access to the Missouri River Corridor, while federal budgetary support for new improvements is restricted by Public Law-89-72. (continued)

This legislation would transfer Corps lands, including recre-

ation areas to either the Cheyenne River Sioux Tribe, Lower Brule Sioux Tribe, or the State of South Dakota and would provide a stable funding mechanism. Money available from trust fund interest would be available for operation, maintenance and enhancement of existing recreation areas and for wildlife enhancement, both on and off existing Corps project lands. This paper will briefly discuss the details of this legislation and outline South Dakota's strategy for its implementation.

Monday, March 22
1:55 pm.

Enhancing Natural Resources for the Native Americans in the Missouri River Basin

Richard Bad Moccasin, Mni Sose Intertribal Water Rights Coalition, 514 Mt. Rushmore Road, Rapid City, SD 57709

The Mni Sose Intertribal Water Rights Coalition was organized in 1993 as a vehicle by which the 28 Indian Nations in the Missouri River Basin could seek legal, administrative, economic, and physical control over their water resources. Since its inception, the Coalition has been engaged in a constant effort to educate U.S. agencies and Congressional committees of the treaty and trust responsibilities of the Federal government.

Under the Flood Control Act of 1944, which authorized the Pick-Sloan project, a total of 350,000 acres, or 23 percent of the total land appropriated, was taken from 8 Indian reservations for the construction of five earthen dams to control flooding along the Missouri River. Although a $1.3 billion annual economic benefit is derived from these projects, the Tribes have shared little or none of the revenues. However, based upon the efforts of the Coalition, the Tribes are now in the process of approving contracts for allocations of hydropower from the Pick-Sloan dams, which will ultimately result in lower electrical rates on the reservations.

The Coalition is working with Federal and other agencies to develop partnerships with Tribes to support tribal water uses, conduct research, and encourage technology transfer to improve water resource development and cultural protection of the environment. With the assistance of the Mni Sose Intertribal Water Rights Coalition, Tribes are moving from a passive role to an active role in protecting their tribal homelands. Tribes are acquiring the legislative, administrative, and operational capabilities to govern, manage, and protect their tribal water resources.

Missouri River Restoration

Monday, March 22
2:15 pm.

Ron Kucera, Missouri Department of Natural Resources, P. O. Box 176, Jefferson City, MO 65102

This paper will discuss the very significant opportunity for big river restoration that may be considered by the 106th Congress. The opportunity exists in the next two years to put us on a course that will reverse 100 years of severe environmental degradation in the Missouri River basin. Details on individual legislative initiatives and their current status will be presented.

The Geospatial Component of the Missouri River InfoLINK

Monday, March 22
2:35 pm.

Mark Laustrup, USGS-BRD Columbia Environmental Research Center, 4200 New Haven Road, Columbia, MO 65201

Following the Midwest Flood of 1993, the Lower Missouri River Ecosystem Initiative was funded by the National Biological Service to facilitate the transfer of scientific data and other information needed by river management agencies and local, state and federal decision-makers. The U.S. Environmental Protection Agency (Region 7) and the National Biological Information Infrastructure (NBII), have recently provided funding to expand this work.

InfoLink tasks include: 1) expanding and linking the network of people who will provide and use Missouri River information; 2) developing an information clearinghouse by acquiring data (with metadata) and linking to relevant web pages; and 3) upgrading the web page to include map server functionality.

The map server allows an individual to explore at several different scales via a series of nested pull-down menus. The basin perspective currently includes maps describing economy, physical features/processes and ongoing monitoring activities. Biological data will be served as they become available. The regional scale is organized by 1:100,000 quadrangle tiles. A sample of the information provided at the regional scale includes historical land cover (1879), county summaries of agricultural, demographic and financial characteristics, county disaster payments associated with the 1993 flood, public lands, levees, and pre-flood wetlands. Access is also provided to the 1:24,000 quadrangles defining the valley bottom. Eventually, 1:12,000 digital orthophotos will be served as they become available.

Monday, March 22
3:20 p.m.

Aquatic Assessment of the North Great Plains

Thomas R. Johnson, U.S. EPA, Region VIII, 999 18th Street, Suite 500, Denver, CO 80202-2466

CO-AUTHORS
Robert Sprentall, U.S. Forest Service, Nebraska National Forest, 125 North Main, Chadron, NE 69337
Joyce Williamson, U. S. Geological Survey-Water Resources Division, Rapid City, SD 57702
Allen Heakin, U.S. Geological Survey-Water Resources Division, Rapid City, SD 57702
Walt Duffy, U.S. Geological Survey-Biological Resources Division, Brookings, SD (present address is Arcata, CA)

An assessment of the aquatic environment of the Northern Great Plains from a broadscale perspective was undertaken. Its purpose was to determine with available information the status of and impacts to surface and ground water, aquatic species at risk and aquatic habitats (including wetlands and riparian areas). The area included within this assessment extended from the Red River Valley in North Dakota to the Rocky Mountain foothills in Montana, and from the Canadian border to the Nebraska Sandhills.

The sources of information for this assessment included state water quality reports, state and EPA water quality databases, USGS water resources databases, literature searches for aquatic species occurrences, NRCS National Resource Inventory databases, the National Wetlands Inventory and literature searches on aquatic habitats and other topics. This information was mapped using GIS and presented by hydrologic unit or by county.

The status of aquatic resources was presented with emphasis on such subjects as important water quality parameters, locations of species of concern, extent and changes in wetland acreage and condition of riparian areas. Predominant threats and impacts to the aquatic resources of the Northern Great Plains were identified and discussed, including nonpoint and point source pollution, hydromodification and population and land use. Water use, both surface and ground, was also analyzed. Findings presented included locations of watersheds rated by the states as most and least impacted, watersheds with the greatest number of aquatic species at risk, changes in wetland acreage, amounts of water use and locations with the greatest amounts of impacts such as agriculture, point sources or dams. Gaps in information and areas of future investigation within the Northern Great Plains were identified.

Environmental Monitoring and Assessment Program: An Assessment Frameword for the Upper Missouri River

Monday, March 22
3:40 p.m.

Eric Hyatt, U.S. EPA Region 8, 999 18th Street, Suite 500 (8 EPR-EP), Denver, CO 80202-2466

EPA's Office of Research and Development and Region 8 office are developing an integrated assessment of the Upper Missouri River Basin, incorporating monitoring and assessment of surface water and analysis of landscape and land cover. Resource types to be monitored will include the Missouri River mainstem, mainstem reservoirs, tributaries, and riparian areas. The Environmental Monitoring and Assessment (EMAP) approach uses a probabilistic sample survey design to characterize status and condition across a given resource type. Parameters to be monitored include water chemistry, fish, macroinvertebrates, physical habitat and others. This presentation will discuss the EMAP approach and outline the proposed assessment question and specific resources to be monitored. Input will be sought from conference participants on the proposal.

Multiple Attribute Decision-making Approach to Sustainable Management of the Missouri River.

Monday, March 22
4:00 p.m.

Tony Prato, Center for Agricultural, Resource and Environmental Systems, University of Missouri-Columbia, 130 Mumford Hall, Columbia, MO 65211

The upcoming bicentennial of Lewis and Clark's Voyage of Discovery has piqued interest in managing the Missouri River in a manner that restores cultural and environmental values without jeopardizing the socioeconomic benefits of recreation, navigation, water supply and flood control. This paper describes a multiple attribute decision-making (MADM) approach that stakeholders can use to identify and evaluate alternative schemes for enhancing sustainable management of the Missouri River. The approach characterizes a river management scheme in terms of multiple cultural, economic and environmental attributes that have value to stakeholders. Stakeholder preferences for attributes are expressed by assigning weights to the attributes. (continued)

The most preferred management scheme for a stakeholder is identified based on attribute values for alternative schemes and attribute weights assigned by the stakeholder. Since different stakeholders are likely to assign different weights to attributes, the most preferred river management scheme will vary across stakeholders. When this occurs, stakeholders disagree about river management. A compromise river management scheme can be identified using collaborative decision-making techniques. Incorporating the MADM and collaborative decision-making approaches in a decision support system (DSS) makes it accessible to stakeholders. The DSS determines the attributes for each scheme by applying various attribute evaluation methods to spatial data compiled using a geographic information system. In addition, the DSS prompts a stakeholder for attribute weights and other information needed to determine the most preferred and compromise river management schemes.

Monday, March 22
4:20 p.m.

A Decision Support system for Information Management and Water Quality Assessment in Dardenne Creek

Dave Connett, 200 Mumford Hall University of Missouri Columbia, MO 65211

Dardenne Creek is located in central St. Charles County, Missouri. Its watershed covers about 160 square miles and contains a variety of land uses and land types. It is typical of watersheds that support a large number of activities including industrial, open space, urban and rural activities. The watershed has experienced environmental problems including increased flash flood hazard, increased degrading of the stream and streambank, degraded water quality from non-point source pollution, and destruction of natural resources.

A decision support system (DDS) is developed for information management and water quality assessment in Dardenne Creek watershed. The DSS is composed of three components: a graphical user interface (GUI), a geographic information system, and an environmental modeling system. ArcView GIS is used to develop the interactive GUI and integrate hydrologic simulation models for use on personal computers. An Internet-based version is provided for interactive data query and map generating. The modeling system consists of simulation models for evaluating agricultural non-point source pollution, storm water runoff and flood impact in the watershed. (continued)

Comprehensive databases are developed for the Dardenne Creek watershed in spatial and tabular formats, including socio-economic information from U.S. census and environmental databases such as flood extents, land uses, soils, etc. The user can easily access the databases, perform queries, conduct modeling analyses, and view model inputs and outputs through the DDS. The watershed decision support system will be used by state and local planners in assessing and implementing watershed management plans. Its framework will be readily transportable to other watersheds.

The GEWEX continental-scale International Project (GCIP) and its Plans for the Missouri River Basin

Monday, March 22
4:40 p.m.

Rick G. Lawford, GCIP Program Manager, NOAA Office of Global Programs, Suite 1210, 1100 Wayne Ave., Silver Spring, MD 20910

The GEWEX Continental-scale International Project (GCIP) is currently shifting its focus from the eastern part of the Mississippi River Basin (Tennessee and Ohio River Basins) to the Missouri River Basin. The shift brings GCIP to the last of four large-scale areas within the Mississippi River Basin where it will conduct intensive regional hydrometeorological studies and enhanced data collection periods. The focus on the Missouri Research Basin will continue until the fall of 2000. This talk provides an overview of GCIP and its current plans for studies in the Missouri River Basin.

The strategic mission for GCIP is "to demonstrate skill in predicting water resources on time scales up to seasonal and interannual as an integral part of a climate prediction system." GCIP research is carried out by academic and government scientists who measure and model regional water and energy budgets, and determine how climate information and predictions can be used to improve water management decisions. Although considerable progress has been made in achieving these goals for shorter time scales through research in other parts of the Mississippi River Basin, the work in the Missouri Basin is expected to contribute to longer term prediction. The GCIP focus in the Missouri River Basin will also provide unique insights to some science questions that have not been addressed previously within GCIP. The talk will conclude with a description of current GCIP research needs and opportunities.

Tuesday, March 23
1:00 p.m.

Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project.

Bob Dimmit, 700 Federal Bldg (Room 847), 601 E. 12th, Kansas City, MO 64106

COAUTHOR
Glenn Covington, 700 Federal Bldg (Room 847), 601 E. 12th, Kansas City, MO 64106

This project was authorized by the Water Resources Development Act of 1986 and restores, preserves or develops 48,100 acres in the Missouri River Valley between Sioux City and St. Louis. Acquisition of 29,900 acres from willing sellers and development of 18,200 acres of publically owned lands are included in the project. This paper discusses the status of the project.

Tuesday, March 23
1:20 p.m.

Characteristics and Evolution of a Side-channel Chute on the Lower Missouri River

Robb Jacobson, USGS-BRD, Columbia Environmental Research Center, 4200 New Haven Road, Columbia, MO 65201

The Great Flood of July 1993 broke through levees on the Missouri River at Lisbon Bottom near Glasgow, Missouri. Subsequent large floods in 1995 and 1996 eroded more of the Bottom and connected levee-break scours to form a 3-kilometer chute across the Bottom. The chute has attracted considerable interest because of the hazard it poses to barge navigation and because of its potential value as fish and wildlife habitat. The chute also has many similarities to highly engineered side-channel rehabilitation projects on the lower Missouri River. However, unlike engineered rehabilitation projects, the Lisbon Bottom chute has been allowed to evolve freely and create natural side-channel habitats. As such, the Lisbon Bottom chute provides a field experiment in passive, minimum-cost flood-plain rehabilitation. Repeated mapping of the chute, its bathymetry, and velocity distributions indicate that it is evolving from a narrow, fast channel toward a wide, shallow channel similar to chutes that existed before extensive channelization of the Missouri River.
(continued)

Concurrently, sinuosity has increased, although not enough to decrease the channel slope to that of the main channel. Bathymetric and acoustic Doppler velocity data indicate that the naturally evolving chute provides habitats that are not well represented in the main channel. Biological function of the chute, however, is thought to be constrained by instability of the sand bed, and lack of large woody debris or other stable substrates to support benthic invertebrate populations.

State of the Floodplain: Dynamics of Selected Areas after 1993 Flooding along the Missouri River

Tuesday, March 23
1:40 p.m.

Curt Niebur, Campus Box 1169 One Brookings Drive St. Louis, MO 63130

COAUTHORS
Raymond E. Arvidson and Edward A. Guinness, Washington University Earth & Planetary Sciences, Campus Box 1169, One Brookings Drive St. Louis, MO 63130

During the 1993 Flood, many areas along the Missouri River were severely damaged by floodwaters. Some of these areas were completely abandoned and are being incorporated into the U.S. Fish and Wildlife Big Muddy National Fish and Wildlife Refuge. The levees protecting the refuge units were not repaired after 1993 and have not been actively maintained since then. As a result, these “beads” have been left to evolve with minimum anthropogenic interference since 1993 with the exception of embankment and wing dike repair and emplacement. Other areas damaged in 1993 were repaired, put back into use and are actively maintained by levees and other control structures. Recurrent flooding since 1993 has further modified the beads. We have been monitoring several of these areas since 1993 using a combination of remote sensing (SPOT, Landsat TM, aerial photography, AIRSAR, and TOPSAR), field work, and computer flow models (RMA2). Biogeomorphic and landform dynamics across the large areas can be tracked with time-series remote sensing observations and spot-checked using fieldwork. Computer flow models help determine factors contributing to levee breaks, scour zones, and channel formation in the floodplain. The models have focused on our core study site at the Jameson Island/Lisbon Bottoms Refuge near Columbia, MO. The models show that landform dynamics for this natural bead have been strongly controlled by the remnant anthropogenic structure (levees, tight river bends, levee breaks, etc.) and biogeomorphic feedback loops.

Tuesday, March 23
2:00 p.m.

Decommissioning of the Privately Ownded Dams: the Effects of Electric Deregulation in Montana

Dr. Aart Dolman, 3016 Central Ave., Great Falls, MT 59401

The 1997 State Legislature in Montana deregulated the electrical industry, and in the same year Montana Power offered its generating facilities for sale. This includes the five dams the corporation owned in the Great Falls area. For a time, the City of Great Falls considered purchasing one or more of the dams but then it discovered that the maintenance and finance costs for the next fifty years would be prohibitive. The result is that the issue of decommissioning of the dams has become a reality, particularly in the face of the renewal of the fifty year FERC license.

Tuesday, March 23
2:20 p.m.

Fish and Wildlife Resources and Bank Stabilization on the Upper Missouri River

William B. Bicknell, U.S. Fish and Wildlife Service,
1500 East Capitol Avenue, Bismarck, North Dakota 58501

)The Upper Missouri River is a national treasure from a historic, recreational, and fish and wildlife habitat perspective. The habitat values provided by the remaining free flowing reaches of the river and the associated woodland community have been affected by many influences. This paper focuses on bank stabilization activities on the Upper Missouri River, with emphasis on North Dakota's Garrison reach, and discusses potential issues with fish and wildlife resources. State and Federal natural resource agencies have raised concerns about the cumulative effects that hundreds of stabilization projects have on the sustainability of the Missouri River ecosystem. The Omaha District of the U.S. Army Corps of Engineers has recently agreed to conduct a cumulative impact study to help answer questions concerning the long term effects of existing and proposed bank stabilization projects. The scoping process for this study will be initiated during the first quarter of 1999. This study provides an opportunity to evaluate habitat impacts and develop a sound basis for making decisions concerning future bank stabilization proposals. Sustaining the unique habitat values of the Missouri River will require a coordinated effort and innovative approaches.

Reservoir Deltas: Processes and Impacts

Tuesday, March 23
3:00 p.m.

John Remus, U.S. Army Corps of Engineers, 215 North 17th St., Omaha, NE 68102-4978

A direct result of the impoundment of water behind a dam is deposition of sediments (deltas). The precise distribution and final configuration of these deposits is dependent on reservoir size and shape, reservoir operations, sediment inflow, sediment characteristics, and the inflow hydrograph. The impacts of delta growth may include increased water surface elevations, increased ground water levels, increased frequency of ice jamming, changes in aquatic related habitats, and disruption of recreational opportunities. The presentation will outline the delta formation process, and provide discussion concerning long-term impacts.

Use of Continuous Seismic Reflection to Assess the Composition of the Missouri River Bed

Tuesday, March 23
3:20 p.m.

Steven K. Sando, U.S. Geological Survey, 111 Kansas Ave. SE, Huron, SD 57350

Gavins Point Dam has altered the sediment-transport regime of the Missouri River, changing channel morphology downstream. In managing dam operations, the U.S. Army Corps of Engineers (COE) must monitor rate and extent of channel morphology changes below Gavins Point Dam to anticipate impacts on future uses of the river and adjacent lands.

As part of channel monitoring efforts, the COE requested that the U.S. Geological Survey (USGS) use a continuous seismic-reflection system to study bed-material composition and occurrence of subsurface horizons in the Missouri River bed downstream from Gavins Point Dam. Seismic-reflection systems transmit and receive acoustic signals through the water column and river bed. As the signal encounters horizons of different acoustical impedance, part is reflected back to the receiver and part penetrates further into the sediment and again is reflected upon encountering subsequent horizons. Reflection strength is dependent on contrast between adjoining horizons and the signal is recorded on a thermal chart recorder. The seismic record can be interpreted to identify occurrence and elevation of subsurface horizons. Qualitative assessment (continued)

of surficial bed composition is possible because changes in intensity and pattern of the record occur when surface bed material changes. When operated in conjunction with GPS, the seismic system can be used to map surficial bed composition and occurrence of subsurface horizons.

The USGS used the seismic system to conduct two studies, in 1996 and 1998, below Gavins Point Dam. Notable results include: 1) the seismic system was effective in distinguishing subsurface horizons and determining qualitative composition of surficial bed materials; 2) bed composition and elevation and dominant subsurface horizons along cross-sectional and longitudinal profile lines were determined. Specific results, with emphasis on mapping surficial bed composition, will be presented.

Tuesday, March 23
3:40 p.m.

Pipeline Transport of Large Volumes of Solids

C.A.Shook, #1103, 12303 Jasper Ave., Edmonton, AB, Canada T5N 3K7

The Canadian bituminous oil sand deposits represent one of the world's largest reservoirs of extractable hydrocarbons and synthetic crude oil has been produced commercially from these deposits for more than 25 years. Two plants are currently in operation, producing approximately 20% of the total Canadian crude oil output, and it is planned to increase production considerable in the next few years.

Slurry pipeline transport is employed throughout the extraction processes, and especially in tailings transport. Large volumes of solid tailings are produced in the extraction process, in the form of a slurry of clean sand, with median diameter greater than 150 microns, together with clay and silt. To illustrate the quantities of solids, the new mine to be opened in 2001 will produce 23 million cubic metres of solids per year.

Progress in handling these slurries reliably has been achieved through a series of systematic research investigations using laboratory pipelines up to 20 inches in diameter. This research has been generalized in the form of mechanistic models which can be used to predict friction losses. Deposition velocities have been generalized with correlations which have been improved as the data base has expanded. This presentation will summarize the current state of knowledge in this field.

Conversion of the Pick-Sloan System to a Sustainable System: The Pipeline Transport of Silt

Tuesday, March 23
4:00 p.m.

Howard Coker, Department of Chemistry, University of South Dakota, Vermillion, SD 57069

A preliminary report on the feasibility of converting the Pick-Sloan system to a sustainable system was presented at the First Annual Conference. Each year, 100,000 acre-ft of sediment enters the six main-stem reservoirs. The permanent pool (25% of capacity) of Lewis and Clark Lake will be sedimented in a decade, that of Lake Francis Case in two decades. Quantitative computation of the energy required to the transport the sediments of each reservoir to the Missouri River channel at Gavins Point is not yet possible. No careful study of pipeline transport has been made for particles below 165 micron in diameter. However, a plausible extension to 62.5 micron particles gives an upper bound for the transport of the silt and clay of 4% of the electrical energy generated at the system generators. The actual energy requirements should be substantially less than 4%. The sand and gravel may constitute as much as 5% of the sediment. As determined by software obtained from the GM Locomotive Group, transport of this amount by rail would also require 4% of the energy generated by the system. Definition of the full cost of transport of both components will provide a benchmark for evaluating alternate strategies for achieving sustainability. These would include alternate uses of the sediments such as enrichment of agricultural land and investments in mitigation efforts.

Tuesday, March 23
4:20 p.m.

The Missouri River Corridor Program of South Dakota: A Grassroots-driven, Long-term Strategic Plan for Regional Revitalization

Christine Yackley, PO Box 42, Onida, SD 57564-0042

The Missouri River Corridor Program (MRCP) is designed to be a catalyst for facilitating holistic river resource and watershed-based rehabilitation, preservation, and stewardship. The MRCP seeks sustainable development of the Missouri River with a mission statement that is: To develop and implement a comprehensive strategic plan for maximizing the potential of the environmental, cultural, historical, recreational, and economic resources within the Missouri River Corridor. Through this plan, it is hoped that a balance can be established between the preservation and enhancement of natural biodiversity and natural processes, human heritage features, and ongoing human development so that the corridor will function productively and, ultimately, to flourish for generations to come. Once accomplished, these achievements should then stimulate program spin-offs to include increased tourism, expansion of specific resource-related goods and services, and new avenues for extended economic development and rural revitalization for the communities and inhabitants residing within, or adjacent to, the corridor boundary. Using the South Dakota reach of the Missouri River as the common physical "thread" that binds this region together, the MRCP is intent upon acting as the catalyst and pointing the direction to guide the inhabitants of the Missouri River Corridor and its tributaries towards achieving these ends. These actions, currently being accomplished through the localized efforts of the volunteers and agencies involved, are truly bringing new life to, and renewed human identification with, the Missouri River and its basin.

Water Demands from Five Semi-arid Missouri River System Tributaries in Kansas

Tuesday, March 23
4:40 p.m.

Thomas A. Eddy, Division of Biological Sciences, Emporia State University, Emporia, KS

Water supplies in the major tributaries of the semi-arid western region of the Missouri System are failing to meet the needs of the primary users in agriculture, industry and municipalities. This project used estimates of water demands from five Kansas rivers to gain information critical to making intelligent decisions concerning allocation of water resources in the region. Estimates of demands from the rivers for commercial and domestic uses were acquired from governmental studies. Natural demands from evaporation and evapotranspiration were estimated from field studies in the tributary basins. The evaporation and evapotranspiration demands from the surface waters in the 5 systems totaled 300,000 acre-feet / yr. This demand equaled all estimated annual uses of domestic water for the entire state of Kansas and is approximately three times the amount of industrial water use in Kansas. Irrigation (65,3675,000 acre-feet/ yr.) is the only use exceeding the natural losses. Evaporation and evapotranspiration have not previously been included in water use estimates. This study indicates the significance of including natural water demands in formulating river water management strategies.

South Dakota Department of Tourism

Sailing on Lake Oahe

Wednesday, March 24
Concurrent Session I
8:00 a.m.

Water Quality of a Remnant Riparian Wetland along the Missouri River

Dale Blevins, Room 221 301 W. Lexington Independence, MO 64050

COAUTHORS
David C. Heimann, U.S. Geological Survey, Independence, MO
Peter B. McMahon, U.S. Geological Survey, Lakewood, CO

Recent acquisitions of Missouri-River flood plain for wetland restoration need data on remnant wetlands to quantify water-quality functions and provide strategies for wetland water-quality management. The U.S. Geologicial Survey and the State of Missouri are investigating nutrient cycling at Little Bean Marsh adjacent to the Missouri River. The marsh is a naturally-occurring riparian wetland, covers approximately 300 acres, and is surrounded by row-crop agriculture.

Inflows, outflows, and ground-water levels were measured to quantify hydrologic functions and samples were collected twice per month over 12 months at 5 locations to quantify nitrogen (N) and phosphorus (P) removal rates. Many water samples with concentrations of nitrate less than 0.005 mg.L and persistent concentrations of total N greater than 0.5 mg/L indicate denitrification is rapid when water temperatures are greater than 5 deg. C and may be limited by rates of nitrification or vegetative decay. Acetylene-block experiments, conducted in small enclosures on the marsh bottom, have measured summer denitrification rates averaging 0.21 g/d/m2 when nitrate was artificially added. Measurements of Eh and pH and moisture in bottom-sediment cores have identified hydrochemical conditions favoring denitrification.

Two years of continuous dissolved-oxygen, temperature, specific-conductance, Ph, and water-level data have also been collected. Despite shallow depths, thermal stratification is common and greatly affects dissolved-oxygen concentrations as does photosynthesis. Dissolved- oxygen frequently is less than the 5 mg/L standard set for the protection of aquatic life. Specific conductance is closely related to rainfall events and ice formation. Sediment and P accumulations will be measured on plates set on the marsh bottom for a year.

Pollution in Big Spring Creek: A Success Story

Wednesday, March 24
Concurrent Session I
8:20 a.m.

Isaac Opper, 5th Grade Student at Lewis and Clark Elementary, Lewistown, MT

Isaac Opper learned from a news article in the local paper that fish in Big Spring Creek, the river that runs through his town and is the source of the community's drinking water, were contaminated with Polychlorinated Byphenyls (PCBs). Upon learning that no one knew where the PCBs came from, he decided to find out. His independent efforts to track the source of contamination, researching PCBs and sampling the creek sediments, indicated where the PCBs were entering the river. Because of his work, state and federal agencies are following up with major efforts to find and eventually clean up the source of PCBs in his community.

Corps Planted and Natural Plant Recolonization on the Benedictine Bottoms

Wednesday, March 24
Concurrent Session I
8:40 a.m.

Joseph Curry, Benedictine College, 1020 N. 2nd Street Atchison, KS 66002

COAUTHORS
Allison M. Lidolph, Sarah E. Zielinski, John W. Davis, Martin Simon, Benedictine College, 1020 N. 2nd Street Atchison, KS 66002

The transition of the Benedictine Bottoms from agricultural land back to its native floodplain habitat was begun by the Army Corps of Engineers at the end of the 1993 growing season. Since 1994, the Corps has planted 176,100 tree and shrub seedlings on 550 acres, and 750 acres with native grass species and legumes. Plant diversity is being monitored through a floristics study conducted by the Benedictine College Biology Department. This study is done by pressing and mounting the collected blooming plants. These mountings are then identified by using *Grays Manual of Botany* and placed in the Benedictine Bottoms Herbarium. The progress of the CORPS tree planting is monitored by using maps, and planting data. Beginning the fall of 1997 various plots were surveyed for the abundance of (continued)

surviving Corps planted trees. The Benedictine Bottoms Herbarium has grown to include over 47 families, 103 genera, and 127 species. The results of this study are being compared to a relatively undisturbed wetland complex located 20 miles south of the Bottoms in Fort Leavenworth. It was found in the Corps planting three species accounted for 27.6% of the plantings made up the greatest part of the surviving trees in the 1994 plantings. The 1995 plantings had a much higher degree of survivorship. An examination of the planting techniques, microhabitats, weather and flooding conditions of the past four years provides for why certain species were successful and why others were not. This study has been supported in part by the Kansas Department of Wildlife and Parks, and the Discovery College Committee.

Wednesday, March 24
Concurrent Session I
9:00 a.m.

Historical Description of Benedictine Bottoms Missouri River Flood Plain Plant Biodiversity

Sarah Kafka, Benedictine College, 1020 N. 2nd Street Atchison, KS 66002

COAUTHORS
Martin Simon, Allison M. Lidolph, Jack Davis, and Daniel Bowen, Benedictine College, 1020 N. 2nd Street Atchison, KS 66002

The Water Resources and Development Acts of 1986-1990, mandated that the Army Corps of Engineers mitigate the wetland habitats along the Missouri River that had been converted to agricultural use. An important function of this mitigation is to restore the disturbed habitat to some previous ‘natural’ conditions. Historical records of vegetation types previously occurring in the mitigation site, referred to as the Benedictine Bottoms, are useful in establishing the appropriate benchmark of the pre-disturbance habitat. These benchmarks are necessary to determine the progress of the mitigation efforts. Six different data sets are being evaluated to establish a basic vegetation growth and development pattern of a floodplain over a period of almost 200 years beginning with the data from the Lewis and Clark expedition of 1803. This historical evaluation includes the Public Land Survey maps from the early 1850’s, species collected by the sisters from Mount St. Scholastica in Atchison, Kansas in the early 1900’s, Jean Linsdale’s data from the 1920’s in Doniphan County, Malcolm Brumwell’s data from 1939 and 1940 of the Ft. Leavenworth

Military Reservation and Hubert W. Blocker's collection from the 1950's and 60's. This historical evaluation ends with the 1997 Kansas Biological Society survey of the Ft. Leavenworth area.The total composite benchmark list of species contained 359 different species. Each of the six data sets depict slightly different floristic characteristics which could serve as the benchmark habitat. Our analysis of the historical botanical record suggests that various habitat types existed in the Benedictine Bottoms which reflect differences in land use practices over the last 200 years.

Avian Use of Missouri River Flood Plain Wetlands

Wednesday, March 24
Concurrent Session I
9:20 a.m.

***Dale Humburg*,** Missouri Department of Conservation, Columbia Research Center, 1110 S. College Avenue, Columbia, Missouri, 65210

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Studies were conducted following the Great Flood of 1993 to determine differences in avian use of Missouri River floodplain wetlands and aquatic habitats. Four habitat types studied included temporary wetlands, remnant oxbows and sloughs, and two types of blue holes or scours created when flood waters breached levees and scoured deep basins. Two types of scours were created when levees parallel and proximate to the river ("connected scours") and when levees perpendicular to the river (nonconnected scours) were breached. All four habitat types were included in biweekly, helicopter surveys (March to September) of 80 sites (20 of each type) between Hartsburg and Kansas City, Missouri and 60 sites surveyed between St Joseph, Missouri and Sioux City, Iowa (no connected scours existed above St Joseph). More than 700,000 birds of 80 species were tallied, and use was determined by specific habitat conditions that generally were exclusive among (continued) habitat types during single

survey periods. The same conditions, however, were present in different habitat types at different times of the spring - fall survey period. Changes in habitat condition were due to precipitation, flooding, degree of disturbance (e.g. farming or levee construction), and drainage projects. Results reflect the need for integrated habitat management strategies that include intensively managed wetlands, passively managed floodplain tracts, and agricultural lands.

Wednesday, March 24
Concurrent Session I
9:40 a.m.

Waterbird Use of a Chute and Flood Plain Wetland Complext during Spring Migration

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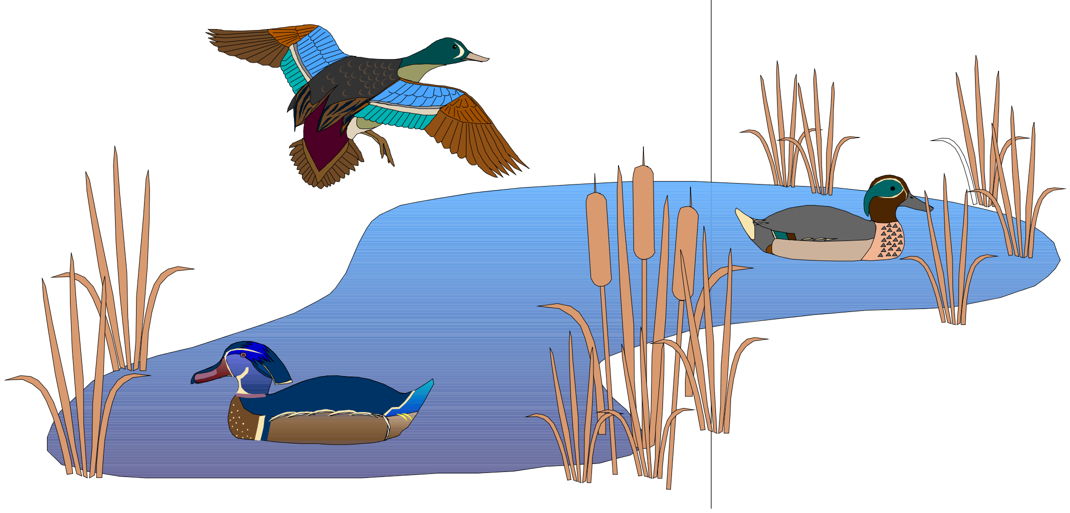
Waterbird use of a newly formed chute and a wetland complex on the adjacent floodplain was studied on the Lisbon Bottoms Unit of the Big Muddy NFWR to assess the benefits of spring flood pulses and new floodplain habitats to wildlife. The wetlands complex contained 6 semi-permanent wetlands, 2 seasonal wetlands, 3 temporary wetlands and was connected to the river at high flows by a notch in the bank of the river. The complex was observed for waterbirds from mid-March through mid-May 1997 and 1998, which encompassed spring waterbird migration and spring high flow events. Relative use of the three wetland types and the chute were assessed before, during, and after the spring flood using abundance and species richness of 7 waterbird groups (ducks, geese, herons, rails/coots, pelicans/mergansers/cormorants, shorebirds, and terns/gulls) as an index. The chute, the seasonal wetlands, and the temporary wetlands were used primarily by migrating waterbirds, whereas, semi-permanent wetlands were used by wood ducks. Ducks, coots, herons, and shorebirds occurred on all the wetland types, but geese, terns, and pelicans, were only found on the chute. Thus, the chute supported more groups of waterbirds than the wetland complex. Before the flood, the chute and the seasonal wetlands supported nearly all of the waterbirds. During the flood, the flooded willows, seasonal wetlands, and temporary wetlands were used by ducks, coots, and rails. After the river levels fell, the chute was used by spring migrating shorebirds.

Waterbird Use of Lower Missouri River Flood Plain Wetlands

Wednesday, March 24
Concurrent Session I
10:20 a.m.

Amanda McColpin, University of Missouri Fisheries and Wildlife Program, 302 ABNR Columbia, MO 65211-7240

During the past century, the lower Missouri River floodplain was converted from forested floodplain interspersed with wetlands to a primarily agricultural landscape. Catastrophic flooding in 1993 set the stage for large-scale restoration and enhancement of floodplain fish and wildlife habitat. By evaluating waterbird use on a variety of wetland types, this study provides insights into management opportunities on newly acquired floodplain wetlands. This study examines time budgets of several waterbird species in randomly selected sites of five wetland types on the Missouri River floodplain from Hartsburg to Kansas City, Missouri. Sites were visited approximately twice a week, March-October, 1996-1997. Behavior of randomly selected individual waterbirds was continuously recorded for 10 minutes using a hand-held data recorder. Blue-winged teal *(Anas discors)* showed dynamic behavioral patterns which varied with wetland type and season; in general, the proportion of time spent feeding was higher during spring than fall migration, especially in the newly scoured sites. Feeding behavior dominated least sandpiper *(Calidris minutilla)* time budgets at all sites and during both migratory periods. Surprisingly, adult great blue herons *(Ardea herodias)* spent the least time feeding in remnant emergent wetlands and the most time feeding in scours connected to the river and in unfarmed temporary wetlands. Waterbirds used all wetland types studied (including flood-scoured sites, temporary wetlands and remnant emergent wetlands), indicating that a variety of wetland habitat types with varying water regime, vegetation structure and food base should be included in restoration and enhancement efforts.



Wednesday, March 24
Concurrent Session I
10:40 a.m.

Birds Respond to Habitat, 1998, Piping Plover and least Tern Survey Results

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Habitat for the least tern (*Sterna antillarum*) and piping plover (*Charadrius melodus*) was greatly reduced during three consecutive years of record runoff (1995-1997) into the Missouri River System (System). With the loss of habitat availability during this period, breeding adult numbers and productivity declined for both species. With a return to normal runoff and subsequently excellent habitat conditions, 1998 saw a dramatic reversal to declining recruitment rates for both least terns and piping plovers. Piping plover adult surveys observed a 297% increase in breeding adults (465/117) in 1998 compared to 1997, while least tern adult numbers were up 31% (631/481). While adult censuses were not record levels, observed nest success and fledge rates during 1998 were the highest on the System since surveys began in 1986. Least tern observed nest success was 82.5% (282/342). Piping plover observed nest success was 77.2% (179/232). This compares to a System average (1986-1997) observed nest success of 41.7% for least terns and 40.9% for piping plovers. The nesting success was followed by unprecedented fledging success. Least tern fledge success in 1998 was 1.73 fledglings/adult pair. Piping plover fledge success was 1.61 fledglings/adult pair. This compares to a System average fledge ratio of 0.48 for least terns and 0.69 for piping plovers. Quantitative changes in habitat availability and other impacts resulting in the increased least tern and piping plover recruitment will be presented.

Can the Missouri River Play a role in Piping Plover Recovery in the Northern Great Plains?

Wednesday, March 24
Concurrent Session I
11:00 a.m.

Nell McPhillips, U.S. Fish and Wildlife Service, South Dakota Field Office, 420 South Garfield Avenue, Pierre, SD 57501.

The Northern Great Plains population of the piping plover *(Charadrius melodus)* continues to decline. The 1988 Recovery Plan for this species identifies portions of the Missouri River as essential to piping plover recovery. As Missouri River management issues remain contentious and the larger portion of the Northern Great Plains piping plover population nests in the Coteau regions of Montana and North Dakota, some are questioning the validity of managing the Missouri River for piping plover recovery. I evaluate the importance of the Missouri River piping plover population to the overall recovery of the Northern Great Plains population by reviewing current literature, population recovery status and management information, population census data, population modeling data and the history of managing piping plover populations on the Missouri River. I suggest that we cannot meet current and proposed piping plover recovery goals for the Northern Great Plains population without maintaining and managing Missouri River sandbar/shoreline habitats. Furthermore, we would also threaten International recovery of the Canadian Prairie population of the piping plover without appropriate Missouri River management.

Wednesday, March 24
Concurrent Session I
11:20 a.m.

Amphibian Use of Flood-created Wetlands on the Missouri River Flood Plain

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The Missouri Department of Conservation, along with cooperating federal agencies and universities, has been examining the contribution and value of wetlands created by the Missouri River flood of 1993 in enhancing the biodiversity of the lower Missouri River ecosystem. In one portion of this research, which is called the Missouri River Post-flood Evaluation project (MRPE), I examined amphibian use of not only the new flood-created wetlands, but also amphibian use of existing wetlands. I examined amphibian use at 6 different types of wetlands: remnant emergent, wooded slough, farmed temporary, unfarmed temporary, flood-created non-connected, and flood-created river-connected wetlands. During 1996 through 1998, sampling was conducted at 24 wetlands during late-February through May to note which amphibian species and how many amphibians were coming to the wetlands. In addition, sampling for larval amphibians at each wetland was performed in late-May and June to determine wetland contribution to amphibian breeding efforts. It appeared flood-created wetlands attracted some amphibians, but were of little value as breeding ponds. Temporary wetlands, especially farmed temporary wetlands, and wooded sloughs and remnant emergent wetlands attracted amphibians and served as breeding ponds for amphibians. Factors influencing the value of flood plain wetlands for amphibians will be discussed.

Wednesday, March 24
Concurrent Session II
8:20 a.m.

Benthic Macroinvertebrates Associated with Specific Habitats and Substrates in the lower Missouri River

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Benthic macroinvertebrates serve as the primary food source for many fish and wildlife species, and are important indicators of habitat quality and floodplain biodiversity in large rivers. The benthic community of the channelized lower Missouri River is poorly known; no comprehensive species list is available, and community-based habitat affinities which are necessary for guiding future restoration efforts have not been previously established. Specifically, ecological features such as invertebrate abundance, species richness, and number of species unique to individual habitats can be used as indicators of the relative value of existing habitats and those presently being restored within the floodplain.

We have examined invertebrate diversity and abundance in the Lisbon Bottoms reach near Glasgow, Missouri (RM 213-218) by sampling of main channel (sand, snags, rock), backwater (silt, muck), and chute (sand, snags) habitat with artificial substrates, ponar grab, hand netting, and benthic trawls to determine the contribution of these habitats. A total of 128 species of macroinvertebrates are now known from this reach, including taxa considered rare or restricted to large rivers (= 9), and taxa not previously reported from the lower Missouri (= 4). Main channel rock substrate had the highest total species richness (= 78), biomass (83,869/m^3 interstitial volume), and the most number of unique taxa within the EPOT (Ephemeroptera, Plecoptera, Odonata, and Trichoptera) insect orders (= 49). Other habitats contributed fewer unique taxa, including depositional silt/muck (= 22), sand (= 4), and detritus snags (= 3). Sand habitats in the chute and main channel had the lowest biomass (87.4/m^2) and taxa richness (= 6), however benthic trawls from sand yielded higher taxa richness and biomass than Ponar grabs due to the size of the area sampled and the patchiness of organic detritus deposition.

Artificial substrate data suggests that heterogeneity, stability, and composition of substrates in the river are major factors directly controlling invertebrate colonization success. Even though snags and habitats with finer substrate materials had fewer taxa and invertebrate abundance, they harbor ecologically important species and contribute to overall ecological function and biodiversity in the floodplain. These results highlight the importance of improving and maintaining habitat diversity, and have significant implications for future hydrologic management and rehabilitation efforts within the Missouri River corridor.

Wednesday, March 24
Concurrent Session II
8:40 a.m.

Biodiversity Patterns of Terrestrial Macroinvertebrates on the Benedictine Bottoms in Northeast Kansas

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The U.S. Army Corps of Engineers initiated a mitigation project to restore 930 hectares of farm land back to Missouri River floodplain. Benedictine College is monitoring the biodiversity changes of the Benedictine Bottoms located in northeastern Kansas. As a part of this study, arthropod sampling was initiated in May 1995, along randomly chosen transects. Sticky traps, set 1-1.3m off the ground, consisted of clear transparencies covered with 96cm2 of Tanglefoot adhesive. The use of pitfall traps was later introduced in May 1997. Circular pitfall traps with a diameter of 15.5 cm were placed in the ground and filled with one 2.5 cm of preservative. Over 43,000 individuals were collected and identified to order. Data from the 1995-1998 sampling period indicate that seasonality, microhabitat, and land use play a significant role in explaining the variance in invertebrate biodiversity. Non-flying insects were collected on the sticky traps lending credibility to their use beyond aerial invertebrates. The pitfall traps revealed additional taxonomic diversity with the collection of primarily terrestrial insects. The results from this study will be compared to data collected from another intact floodplain site with comparisons determining the effect that mitigation efforts have had on restoring the biodiversity to the Benedictine Bottoms. Funding came from the Kansas Department of Wildlife and Parks, the Evah C.Cray Residuary Charitable Trust, and Discovery College Committee.

Habitat Use and Catch Rates of Benthic Fishes in the Missouri River

Wednesday, March 24
Concurrent Session II
9:00 a.m.

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Alterations to the channel morphology, flow velocity, historic seasonal flow patterns, and the construction of large impoundments on the Missouri River may have caused changes in the population structure and habitat use of benthic fishes. Through the identification of habitat preferenda and population structure of twenty-six selected benthic fish species, we hope to provide criteria useful for the management and sustainability of these native species' populations. Fish were collected from Montana to Missouri and pooled into one of three river categories for analyses: *Least Impacted* (upper Missouri and Yellowstone Rivers), *Inter-reservoir* (Fort Peck to Gavins Point), and *Channelized* zones (Iowa/Nebraska to mouth).

Depth and velocity gradually increased from Montana to Missouri in flowing habitats. Water temperature and turbidity both gradually increased from Montana to Missouri, but showed sharp declines in the inter-reservoir zone. Substrate changed from a gravel-sand dominated bottom in the least impacted zone to a sand-silt dominated bottom in the inter-reservoir and channelized zones. Differences in these variables among the three river zones affect habitat suitability and use by specialized species.

From our twenty-six target benthic species, we selected four to represent our river wide results: shovelnose sturgeon (*Scaphirhynchus platorynchus*), blue sucker (*Cycleptus elongatus*), channel catfish (*Ictalurus punctatus*), and sicklefin chub (*Macrhybopsis meeki*). These species occurred in all three zones, but with differing frequencies associated with habitat differences. Individual species showed similar physical habitat preferences across all three river zones, but their abundance varied among these zones according to available habitat conforming to their preferences.

Wednesday, March 24
Concurrent Session II
9:20 a.m.

Electrofishing in the Missouri River in the Vicity of the Ameren UE Labadie Power Plant

Kenneth W. Lynn, Ameren Corporation, 1901 Chouteau Mail Code 602, St. Louis, MO 63103

Ameren Corporation (formerly known as Union Electric Company) conducted biomonitoring in the Missouri River in the vicinity of the AmerenUE-Labadie Power Plant from 1980 to 1985, and then again from 1996 through 1997. The study was done in order to characterize the aquatic community in the vicinity of the Labadie Plant, and to provide a database against which natural variations in the populations could be discerned. The plant's water intake is located on the lower Missouri River in Franklin County, Missouri, at river mile 57.5. Electrofishing was conducted at a quarterly (seasonal) frequency at five sites, one upstream from the plants water intake structure, one in the plant's cooling water discharge canal, and three sites immediately downstream.

Results indicate that a well-balanced, indigenous aquatic community exists in the vicinity of the Labadie Plant. No unusual results were obtained in either the fish sampling. No population dynamic trends were observed that would indicate that the plant's operation is having a deleterious effect on the fish or benthos populations. In fact, the results indicate that the populations are sustainable and relatively stable. Trend analyses of the calculated indices indicates that measurable improvement has occurred from 1974 to the present. The study results document the continued existence of a normal and expected distribution, composition, and diversity of the fish community, and serve to support the contention that a balanced, indigenous, healthy fishery continues to exist in the vicinity of the Labadie Plant.

Use of Backwater Habitats by native Fishes in the Missouri River, North Dakota

Wednesday, March 24
Concurrent Session II
9:40 a.m.

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Many ecologists are confident that backwater habitats are critically important during one or more life stages of most native riverine fishes. Documentation, however, has been sparse or completed in lotic ecosystems that have been highly regulated or substantially modified. In 1997, we initiated a study on a portion of the Missouri River above Lake Sakakawea in North Dakota that has a relatively natural hydrograph as a result of inflow from the unregulated Yellowstone River. Also in this river segment, there are several backwaters that appear to be functioning in their historical manner. During several hypothesized key hydrograph periods in 1997 and 1998, we sampled fishes with a variety of gears in two backwater habitats to help determine seasonal use. We wanted to identify which hydrograph periods may potentially be critical for native fish species during different life stages. For example, adult northern pike *(Esox lucius)*, bigmouth buffalo *(Ictiobus cyprinellus)*, and smallmouth buffalo *(I. Bubalus)* exhibited a strong affinity to backwater habitats as spawning areas during peak flows, while larvae and juveniles of these same species utilized backwaters as nursery and rearing habitats later in the year. Other species, such as white crappie *(Pomoxis annularis)*, black bullhead *(Ameiurus melas)*, and western silvery minnow *(Hybognathus argyritis)* appeared to be more residential, with all life stages present during most sample periods. Our observations of age-0 blue suckers Cycleptus elongatus, burbot Lota lota, and walleye Stizostedion vitreum indicated that backwater habitats may provide critical refuge and food resources during high water periods that coincide with early life history stages of some channel-hatched species. The monitoring of native species in backwater habitats will provide much needed empirical data that will help direct and support the reclamation and management of floodplain habitats and aid researchers in not only understanding how, but to what extent and when these backwaters provide critical habitat for native fishes.

Wednesday, March 24
Concurrent Session II
10:20 a.m.

Changes in Walleye Population Status and Angler Use and Harvest Pattersn in Lake Oahe, South Dakota

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Since 1982, when fish population surveys were initiated,, the walleye population status and angler use and harvest patterns for Lake Oahe have undergone drastic changes. Changes in angler use and harvest patterns, in association with the development of the walleye fishery, were also documented by creel surveys in 1982, 1983 and 1991-1998. These changes have been caused by a number of factors that have altered the system. As Lake Oahe has aged, habitat has become more suitable for walleye spawning and recruitment. Better available spawning habitat, higher condition values in response to the establishment of rainbow smelt, and the selective harvest of large fish from the walleye population have all favored an increase in levels of walleye recruitment and a shift in walleye population size structure. Reduction in walleye growth rates since 1996 has reduced the rate of replacement of large walleye harvested by anglers and has helped shift the Lake Oahe walleye population from a relatively low density population with high size structure to a higher density population with smaller size structure. Possible alternatives for reversing this process and restoring the reputation of Lake Oahe as a "big fish" fishery will also be discussed.

Understanding Changes in Rainbow Smelt Distribution and Abundance and their Effects on Condition and Angler Catchability of Walleyes in Lake Oahe, South Dakota

Wednesday, March 24
Concurrent Session II
10:40 a.m.

Wayne Nelson-Stastny, South Dakota Department of Game Fish & Parks, Missouri River Fisheries Center, 523 East Capitol, Pierre, SD 57501

Rainbow smelt are the primary prey for walleyes in Lake Oahe. Because of their role as a primary prey species, smelt influence the condition and catchability of walleyes by anglers. Nocturnal larval trawling was implemented in 1995 to provide an index of reproductive success by rainbow smelt. In 1993 coldwater gill netting was initiated to provide an index of abundance of age-2 and older rainbow smelt in the lower third of Lake Oahe. Hydroacoustic surveys were employed in 1996 to obtain estimates of age-0 smelt abundance and age-1 and older smelt abundance. Rainbow smelt were abundant in Lake Oahe from 1993 through 1995. The catch of age-2 and older smelt in the coldwater survey gill nets ranged from 316.4 to 154.6 per net night from 1993 to 1995. Reproduction by rainbow smelt in 1995 was strong as indicated by the 107.1 larval smelt/100 m^3 of water filtered in Lake Oahe. In 1996 and subsequent years the smelt population has declined substantially. In 1996 the catch per net night of age-2 and older smelt in the coldwater survey dropped to 56.8. In 1998 the catch of larval smelt was below 4 smelt/100 m^3 of water filtered. Hydroacoustic estimates of smelt abundance dropped from 1,120,289,830 smelt in 1996 to 618,232,185 smelt in 1997. As rainbow smelt populations declined relative weight of walleyes in Lake Oahe declined from values near 100 in 1993 to value to values from 81 to 87 in 1997 for preferred walleyes. The declining smelt population also led to increased catchability of walleyes by anglers.

Nebraska Game and Parks Commission

Wednesday, March 24
Concurrent Session II
11:00 a.m.

Trends in Selected Cyprinid Populations in the Lower Missouri River

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The pre-settlement Missouri River was highly turbid with wide seasonal flow variations and a shifting braided channel. Some fish species which evolved in this environment are not well adapted for today's Missouri River which has been channelized and impounded resulting in the loss of many acres of shallow water, braided channel-sandbar habitat. Sicklefin chub *(Macrybopsis meeki),* sturgeon chub *(M. gelida)* and flathead chub *(Platygobio gracilis)* have been petitioned for Federal Endangered Species Act listing. Plains minnow *(Hybognathus placitus)* and Western silvery minnow *(H. argyritis)* are species of special concern in the Missouri River. The objectives of this study were to compare the abundance of these Missouri River chubs and minnows to historical seining data and to compare seining and benthic trawling efforts in the Lower Missouri River. Logistic regression analysis of binary presence vs. absence data from 1994 through 1997 indicated a decline in the probability of collecting flathead chubs and Western silvery minnows. Neither of these species were collected in 1997. The probability of collecting sicklefin chubs increased over time while the probability of collecting sturgeon chubs remained stable.

Morphometric and Meristic Differences among Missouri River Sicklefin Chubs

Wednesday, March 24
Concurrent Session II
11:20 a.m.

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The sicklefin chub (*Macrhybopsis meeki*) is a small minnow inhabiting the Missouri and Lower Mississippi Rivers. Although historically collected throughout the mainstem Missouri River, recent collections (post 1990-) suggest declining and fragmented populations. In recent surveys, most sicklefin chubs have been collected in two spatially separate areas: the Missouri River in Missouri and in Montana/North Dakota. Concern for genetic conservation of these fragmented populations was expressed in the U.S. Fish and Wildlife Service's 1993 status report. Standardized collections of sicklefin chubs from throughout the Missouri River permitted us to examine phenotypic differences among spatially separate populations. Our objectives were to compare selected morphometric and meristic characters of sicklefin chubs among spatially separate populations and relate differences to abiotic characteristics. Sicklefin chubs were sampled at randomly selected locations with bottom trawls and bag seines in 18 lotic segments from river kilometer 3,255 to the Mississippi River confluence. About 30 morphometric and meristic characters, such as eye diameter, body depth, anal fin rays, and number of compound taste buds, were measured. These data will identify phenotypic variability in this species and will help contribute to our understanding of the influence of genetic and/or environmental variability on phenotypic variability.