

2010
MRNRC Conference and BiOP Forum
A Climate for Change
Presentation Abstracts

Title: Do Water-Level Fluctuations Drive Piping Plover Productivity and Available Habitat at Lake Sakakawea?

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Abstract: Nesting habitat at Lake Sakakawea has become increasingly important to the Northern Great Plains population of piping plovers (*Charadrius melodus*; hereafter plovers). However, inter- and intra- annual fluctuations of water level at Lake Sakakawea may influence plover productivity and abundance of quality habitat. Declining water levels expose unvegetated nesting habitat for plovers, but stable or increasing water level can reduce abundance of habitat through encroachment of vegetation or inundation. Water levels generally peak in mid-summer, potentially impacting plover productivity. We intensively searched and monitored segments of shoreline at Lake Sakakawea during 2006–2009; we found 351 plover nests. Our research focuses on how water level fluctuations or habitat management may influence the amount and quality of plover habitat. First, we quantified characteristics of plover habitat by examining nest-site selection. Second, we examined the importance of several variables that may influence nest survival. Last, we are developing models to estimate and predict abundance of plover habitat at Lake Sakakawea using water levels. These research efforts should help the Corps and USFWS to make informed decisions about: 1) whether reservoir habitats should be included among the habitats managed under the BiOp; 2) if habitat on Lake Sakakawea should be managed through a program similar to that of the Emergent Sandbar Habitat Program; 3) locating habitat restoration actions; and 4) deciding what type of habitats should be the goal of restoration actions.

Title: Applications of a GIS Floodplain Mapping Model – Valley Identification, Connectivity Indexing, and Emergency Management.

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Abstract: Researchers at the Kansas Biological Survey (KBS) developed a topographic floodplain model (FLDPLN) that has been used to identify and map river valley floodplains for many rivers and stream networks, including the lower half of the Missouri River. FLDPLN uses simple hydrologic principles to estimate floodplain extent as a function of floodwater depth: backfill flooding to approximate backwater effects, and spillover flooding to approximate floodwater rerouting. Consequently, FLDPLN can be used for river valley identification, flood extent estimation, hydrologic connectivity indexing, and also for scenario modeling (e.g., a particular flood event, or connectivity impacts of adding or removing a levee). Model outputs have applications for river valley morphology assessment, ecological modeling, and flood disaster response mitigation and damage assessment. We will highlight KBS research on Missouri River floodplain wetlands, and will also discuss the Segmented Library of Inundation Extents (SLIE) spanning 40 counties in eastern Kansas that is used in emergency management.

Title: Effective Approach to Missouri River Ecosystem Restoration and Protection with Wetlands Reserve Enhancement Program Partnerships

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Abstract: In 2004, the first ever approved Wetlands Reserve Enhancement Program (WREP) was initiated in Nebraska. It has been successful in providing restoration and protection of important habitats found adjacent to the Missouri River and connection with the historic wetland habitats found across the floodplain. WREP is being used effectively to connect lands that are already protected providing a contiguous corridor benefit. Through a comprehensive partnership approach, WREP is providing many public benefits including wildlife habitat, flood prevention and water quality. WREP enrollment through easements and restorations provides habitat for sensitive species like the Interior Least Tern, Piping Plover and Pallid Sturgeon. Early partnership commitment is the key to the success of WREP in Nebraska. The Nature Conservancy (TNC) contributed \$1 million for necessary restoration work. Four of Nebraska's Natural Resources Districts added \$900,000 to fund wetland and Missouri River ecosystem restorations. These partners are leveraging their own funds with Nebraska Environmental Trust monies. The U.S. Army Corps of Engineers has also provided funding for projects to aid their Missouri River Recovery efforts. NRCS and the USACE have worked with landowners to restore key chute and backwater projects on WRP easement lands through the compatible use process. WREP partnerships are more than financial assistance. There has been a great collaboration of effort by many agencies and organizations in providing technical assistance to landowners. NRCS and partners established a Wetlands Assistance Team to focus on technical delivery. Other technical assistance stakeholders include the Nebraska Game and Parks Commission, The Nature Conservancy, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers and Ducks Unlimited. To date, 120 landowners have enrolled nearly 16,000 acres in WREP. The goal NRCS and partners set for the program is 18,800 acres. In FY2009, the upper reach of the Missouri River was added to the project. Landowners in this area alone enrolled over 4,000 acres last year. This addition also yielded a new partner – the National Park Service.

Title: Effects of Forest Type and Age Class on Songbird Populations across a Cottonwood Successional Gradient within the Missouri National Recreational River

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Abstract: Trajectories of change in the extent, age distribution, and species composition of riparian forests are likely to influence future patterns of biodiversity within the historic floodplain of the Missouri River. Forest songbirds as a group are likely to be sensitive indicators of such changes. We conducted censuses of breeding songbirds across a successional age gradient in 79 cottonwood and non-cottonwood riparian forest stands within the Missouri National Recreational River in the summer of 2009. Data from these censuses are being used to characterize songbird species richness and population densities across different age classes (<25, 25-50, 50-114, >114 years) and types (cottonwood, non-cottonwood) of riparian forest within the MNRR. Stands were sampled twice each using point count methodology, with density estimates computed for each species by each forest type and age class using program DISTANCE. The five most commonly encountered species in order of abundance were House Wren, Yellow Warbler, Mourning Dove, Baltimore Oriole and Rose-breasted Grosbeak. Preliminary analyses suggest strong relationships between various species and particular forest age classes. Eastern Wood-Pewee, Ovenbird, and cavity-nesting species were most abundant in stands >50 years old. Bell's Vireo, Field Sparrow, Common Yellowthroat, Orchard Oriole, and Yellow Warbler were most abundant in stands <50 years old. Bell's vireos were nearly exclusively located in younger stands, with 117 of 121 detections in stands <50 years old. These patterns suggest that long-term declines in cottonwood recruitment due to flow regulation could lead to declines in species reliant on young age classes of forest.

Title: Argument for a Systems Approach to Monitoring Missouri River Restoration Progress

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Abstract: A systems approach which includes a Missouri River community component is needed to fully measure progress for the Missouri River adaptive management program. This component is needed so that the relationship between restoration and river communities can be understood and evaluated in progress assessments. The typical approach includes an implied partial system assessment addressing interactions among the natural, the human built/action and social (economical and governmental) systems. Although there are 1.95 million people in 86 cities and towns and additional interest communities on the River, currently we do not have a model for the Missouri River which explicitly includes and addresses the communities' component of the system. This presentation introduces and argues for a general restoration systems model which includes communities. The importance of including and understanding the mutual nature of the relationships among the restoration natural, human built/action, social subsystems and the community subsystem is discussed. A description and examples of how one might approach such an effort is presented.

Title: The Cottonwood Management Plan: Tools for Other Restoration Efforts

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Abstract: In developing the Cottonwood Management Plan, our team collected data and developed tools which could benefit many other programs, especially other restoration and compliance efforts. Data collected for the CMP include vegetation, hydrology, and spatially explicit landscape data. Tools developed include a community cottonwood habitat model and a toolbox of techniques for habitat restoration. Our goal is to make these data and tools available to further restoration efforts on the Missouri River. Below we describe objectives for data collected and information on tools developed. Vegetation data objectives: 1. Historic and present-day land use/land cover. 2. Present-day successional stage and age distribution of riparian woody vegetation patches. 3. Plant species composition, structure and characteristics within existing cottonwood stands. Hydrologic data objectives: 1. Mean elevation of ground water level. 2. Land-Capability Potential Index (LCPI) map. Spatially-explicit data objectives: 1. Total acres of habitat types. 2. Predominant land use surrounding cottonwood forest. 3. Mean distance between habitat patches. 4. Relative interspersions of supporting habitats. 5. Proportion of the forest dominated by cottonwood and by CTW poles and saplings. The Cottonwood Community Model is a predictive model providing future condition assessments. Other teams can use the model to predict future conditions under proposed alternatives. The model characterizes the baseline conditions and the HEP method guides the forecasting of future conditions. Our toolbox of techniques includes more than 31 techniques for four broad strategies: protection of cottonwood stands; restoration of hydrologic and geomorphic processes; artificial propagation; and modification to management policies.

Title: Recaptures and Growth of Pallid Sturgeon Early Life History Stages in the Upper Missouri River, Montana and North Dakota

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Abstract: Minimal information on the early life history dynamics of pallid sturgeon *Scaphirhynchus albus* is available throughout the range of the species due to rarity of reproduction and infrequent collections of wild-produced larvae, young-of-year, and juveniles. Beginning in 2004, hatchery-produced pallid sturgeon have been released as larvae (1-17 days post-hatch) in the Upper Missouri River in association with research and propagation activities. Parental broodstock used to produce the larvae have been genetically characterized, and recaptures of survivors from the larval releases can be traced to hatchery cross and year of release using genetic analysis. Exposed to hatchery conditions during only the very early larval life stage, growth and early life history dynamics exhibited by these individuals should be representative of naturally produced pallid sturgeon under operations and habitat conditions of the contemporary Missouri River. Using data on recaptures of more than 40 young-of-year and juvenile pallid sturgeon originally released as larvae, the objectives of this study are to: 1) summarize collections to date of young-of-year individuals and juveniles sampled in the Missouri River and Yellowstone River, and 2) quantify the growth dynamics of young-of-year and juvenile pallid sturgeon through the initial years of life. Results will provide biologists and resource managers not only with information on natural early life stage growth patterns in the contemporary Missouri River and Yellowstone River, but also provide insight into survival of larval pallid sturgeon released at different ages.

Title: Predictive Models for Adaptive Management of Emergent Sandbar Habitat to Support Recovery of Least Terns and Piping Plovers on the Missouri River

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Abstract: Adaptive management of Emergent Sandbar Habitat (ESH) on the Missouri River requires the development of predictive models for forecasting effects of habitat creation on recovery of piping plovers (*Charadrius melodus*) and the interior population of least terns (*Sternula antillarum*). The ESH model that we have developed includes mechanical creation of sandbar habitat, loss of habitat due to erosion and vegetation growth, and effects of river stage and reservoir storage on the amount of suitable habitat available for nesting each year. Tern and plover population models incorporate fledgling production, survival of juvenile and adult stages, and dispersal of new breeders between reaches. The models are linked through the acreage of nesting habitat predicted by the ESH model, which influences the processes of reproduction and dispersal in the population models. We use Monte Carlo simulations to assess the effect of parameter estimation error on habitat creation scenarios. The model produces expected distributions of ESH acreage, population sizes, and productivity (fledge ratios) for terns and plovers in future years. By analyzing the sensitivity of population metrics to model parameters and assumptions, we determine what information is most critical for improving the predictive capability of the model. In addition, we assess the scales at which populations respond to increases in habitat and how the resulting considerations may affect decisions about management actions during the recovery process.

Title: Effect of Owl Trapping and Removal on Piping Plover Hatchling Survival

Author(s): Daniel H. Catlin, Joy H. Felio, and James D. Fraser

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Abstract: Predation of nests and chicks can reduce the reproductive output of shorebirds. We studied the effect of great horned owl (*Bubo virginianus*) removal on piping plover (*Charadrius melodus*) hatchling survival on Missouri River sandbars (2008 – 2009). The U.S. Department of Agriculture – Wildlife Services (USDA – WS) removed great horned owls from sandbars using modified pole traps. We used marked piping plovers and Cormack-Jolly-Seber models to estimate chick survival on sandbars before and after owl removal. USDA – WS captured and removed five owls in 2008 and 6 owls in 2009. Owl removal increased daily survival of piping plover chicks ($\beta = 1.61$, 95% CI: 0.69 – 2.54), but this effect decreased with increasing age of the chick ($\beta = -0.09$, 95% CI: $-0.15 - -0.02$). Survival was higher in 2008 than in 2009, regardless of owl capture, indicating that even though owl capture was effective at increasing survival, the results of trapping may vary from year to year.

Title: The Effect of Flow on Fledging Time, Survival, and Growth of Piping Plover Chicks on the Missouri River

Author(s): Daniel H. Catlin, Joy H. Felio, James D. Fraser

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Abstract: The reproductive success of piping plovers (*Charadrius melodus*) nesting on the Missouri River live in a system where the primary process driver, flow, is largely controlled by mainstem dams. A previous study of piping plover chicks suggested that their growth and survival were affected by the nature of the dam that controlled the flow in their environment (i.e. hydropeaking and hypolimnetic vs. static and epilimnetic). We investigated the effect of changing flows on the time to fledging, survival, and growth of piping plover chicks below the Gavins Point Dam (static and epilimnetic; 2006 – 2009). We banded chicks as near to hatch as possible and attempted to recapture them by hand approximately every other day until they had fledged, measuring wing-chord and mass at each capture. Because we attempted to recapture these birds, we used our recapture probabilities from a capture-recapture model as a proxy for fledging time. Our results suggest that piping plovers that were reared with higher water releases from the dam fledged later than those that were reared with lower releases. Increased water levels could lead to lowered fledging success. We also present some preliminary results from an analysis of growth that suggests that the mechanism for the extension of fledging times is food limitation. Our results will help water managers make decisions about the effects of water releases on piping plover reproductive output.

Title: Cross-Section Comparisons on the Lower Missouri River – A Technique for Sediment Management

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Abstract: Sediment inputs and extractions on the lower Missouri River can have a profound effect on the morphology of the river. Inputs can come from tributaries, erosion of the bankline, or aquatic habitat projects. Extractions are primarily sand dredging and the bed material load exiting the mouth of the river. When the inputs and extractions do not balance each other, changes to the morphology of the river take place. These changes are generally adverse to aquatic habitat and stakeholder interests. This paper presents a methodology to monitor bed material changes over time by comparing temporally distinct cross sections in reaches as short as one half mile up to the entire 500 miles within the Kansas City District. This methodology could serve as the basic tool for sediment management of the bed material in the lower river with implications to sand dredging location and quantities and allowable quantities of sediment reintroduction from aquatic habitat projects. The paper will examine the GIS techniques, costs, limits, uses, and future improvements to this methodology.

Title: Generating Information from Large Volumes of Data: Development of a Sturgeon Information Management System (SIMS)

Author(s): Kimberly A. Chojnacki, Chad J. Vishy, Emily K. Pherigo, and Aaron J. DeLonay

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Abstract: The U.S. Geological Survey, Columbia Environmental Research Center is engaged in a multidisciplinary study to investigate pallid sturgeon (*Scaphirhynchus albus*) behavior and movement in the Lower Missouri River. This research generates volumes of data on sturgeon sampling, morphology and meristics, surgical implantations, reproductive assessments, telemetry search effort, telemetry locations, surveys of habitat use, and environmental variables. As a result, the Sturgeon Information Management System (SIMS) was developed as a central platform for the organization and exploration of the rich and diverse data stream collected by multiple partners and disciplines. Data types including text, numerical values, spatial coordinates, photographs and videos are created and maintained using a range of software and hardware products. The purpose of SIMS is to compile raw data into meaningful information to support near real-time interactive science. The SIMS platform provides the ability to rapidly create data linkages and queries to quickly provide highly customized reports to researchers. Reports can detail a wide variety of information, from project level summary statistics to complete histories of individual fish. SIMS enables researchers to interactively chart the movements of one or more pallid sturgeon. Rapid querying, charting, and mapping of data by SIMS is key to visualizing sturgeon movement and habitat use through time. SIMS provides a platform to efficiently explore relationships among the volumes of data available and can aid in the development of approaches to analyze complex datasets. SIMS effectively helps to bridge the gap between data organization and information delivery.

Title: Missouri River Watershed Coalition - A Multi-state Model for Coordination of Invasive Species Management

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Abstract: Many western states rely heavily upon the Missouri River system for economic and ecological stability. The rivers, streams, reservoirs, and lakes of the watershed support and provide for agriculture, recreation, tourism, wildlife habitat, irrigation, drinking water, industry, power generation, and livestock. Invasive plants, saltcedar (*Tamarix* spp.), Russian olive (*Elaeagnus angustifolia*) and phragmites (*Phragmites australis*) in particular, threaten these many uses. Dense non-native plant infestations can restrict access and degrade habitat for threatened and endangered species; and may reduce the amount and quality of essential water. Recognizing the critical need for protecting the natural resources of the Missouri River headwaters, state weed coordinators from CO, MT, NE, ND, SD, and WY formed the Missouri River Watershed Coalition (MRWC) in 2005. In partnership with the Center for Invasive Plant Management, the MRWC coordinates its efforts with federal, state, and local agencies, universities, NGOs, and private landowners. The mission of the MRWC is to maintain productive, biodiverse riparian ecosystems that provide quality water resources, habitat, recreation, and power to meet the economic and ecological needs of the Missouri River Watershed. Coalition goals are to reduce the introduction and spread of invasive plants in the region; to increase regional coordination, and to develop regional management strategies for invasive plant species and water resources; and to maximize funding efficiency for education, prevention and management on riparian corridors. Increased funding and improved organization are critical to implementing viable invasive species management programs in the watershed. With shrinking state budgets, the national economic downturn, predicted geographic expansion of many invasive species, and the potential for many new invasions on the horizon, the need to cooperate and pool limited resources on the watershed level has never been more crucial. The MRWC provides an ideal model for regional coordination of invasive species management.

Title: Missouri River Spring Pulse: 2009 Drainage Impact Evaluation

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Abstract: In March 2006, the U.S. Army Corps of Engineers (USACE) revised its Missouri River Mainstem Reservoir System Master Water Control Manual to include criteria for the release of a bimodal spring pulse from Gavins Point Dam to benefit the endangered pallid sturgeon. This presentation focuses on the evaluation of the Missouri River Recovery Program's spring pulse monitoring data collected in 2009 on the Lower Missouri River from Gavins Point Dam to the confluence with the Mississippi River. The evaluation results of the monitoring data obtained on the spring pulse's created spring rise and the subsequent natural rises on interior drainage adjacent to the Missouri River will be presented. Unlike the 2008 monitoring period where large precipitation and runoff events in May and June created a large natural spring rise of long duration from the Platte River to the mouth, the 2009 monitoring period shows impacts from short-duration events in a river with higher channel flows. Stage graphs at impacted sites will be presented as they show evidence of gate closures, pumping, and accumulation of interior runoff behind levees. This allowed the estimation of preliminary impact thresholds and the categorization of resulting socioeconomic impacts, including potential crop damages.

Title: Missouri River Spring Pulse: 2008 and 2009 Observed Attenuation

Author(s): Jennifer P. Davis

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Abstract: In March 2006, the U.S. Army Corps of Engineers (USACE) revised its Missouri River Mainstem Reservoir System Master Water Control Manual to include criteria for the release of a bimodal spring pulse from Gavins Point Dam to benefit the endangered pallid sturgeon. This presentation compares the estimated attenuation rates of the March 2008 and May 2009 created spring pulses. March 2008 and May 2009 flow conditions in the Missouri River were very different; however, similar attenuation rates were observed for both created pulses. March 2008 initial flows in the Missouri River were low proceeding the release of the navigation and spring pulse flows at Gavins Point Dam. May 2009 flows in the Missouri River were at full-service or greater prior to the release of the spring pulse. The 2008 and 2009 created-spring pulses did not produce impacts to landowners, and their peaks attenuated greatly by Kansas City, MO at river mile 366.1. Flows at permanent data-collection-platform gage sites along the Missouri River will be shown, and the attenuation of the spring pulse for both years presented.

Title: Ecological Requirements for Pallid Sturgeon (*Scaphirhynchus albus*) Reproduction and Recruitment in the Lower Missouri River

Author(s): Aaron J. DeLonay, Robert B. Jacobson, Diana M. Papoulias, Mark L. Wildhaber, Kimberly A. Chojnacki, Casey L. Bergthold, and Gerald E. Mestl

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Abstract: Over the past five years, the U.S. Geological Survey Columbia Environmental Research Center in collaboration with the Nebraska Game and Parks Commission, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers' Missouri River Recovery – Integrated Science Program have engaged in a comprehensive program of research to improve the fundamental understanding of the reproductive ecology of the pallid sturgeon (*Scaphirhynchus albus*) in the Lower Missouri River. Results of this study have significantly increased our knowledge of the species and its reproductive ecology, including new insights into the extent of sturgeon movement and how sturgeon use habitat. Migratory patterns of reproductive adults have been documented and the spawning behaviors of pallid sturgeon have been initially described. Our understanding of the reproductive physiology of the species has expanded and is being used to place behavior within the context of environmental cues and spawning success. Habitats selected by adult pallid sturgeon for spawning have been intensively characterized. Information on spawning locations, patterns of larval sturgeon collection, and simple models of larval transport indicate the potential extent of larval dispersal. Conceptual and quantitative models describing life history requirements, reproductive physiology, migration, habitat use, and spawning success have been developed based on this research. Knowledge gained through this comprehensive program, combined with comparable studies conducted in other geographic portions of the species' range, have resulted in improved understanding of pallid sturgeon and have produced new hypotheses and potential metrics to gauge habitat improvement and species recovery.

Title: Status and Trend of Cottonwood Forests along the Missouri River from Kansas City to Montana

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Abstract: We used field sampling and GIS-based mapping to assess the species composition, age distribution, and historic (1892, 1950s) and current (2006) extent of cottonwood and non-cottonwood floodplain forests along eight Missouri River segments between Kansas City and Fort Benton, Montana. Forest and shrubland area declined 47% from 1892 to 2006, with losses primarily from agricultural clearing or inundation by reservoirs. These totals, however, do not include the extensive forest loss that occurred from filling of the larger reservoirs (Oahe, Sakakawea, Fort Peck) on the system. We estimate that 186,900 acres of floodplain forest and shrubland occur within the eight study segments, of which 165,000 acres (88%) are cottonwood patch types. Most (62%) of the cottonwood area is composed of stands >50 years old. A significant proportion (24%) of forest in the 25-50 year age class suggests that a temporary pulse of cottonwood recruitment accompanied channel adjustments to dam closure on some segments. Recruitment has declined more recently, however, with stands < 25 years old making up only 14% of the total cottonwood area. These patterns, along with significant historic declines in sandbar area, indicate that the fluvial geomorphic dynamics that drive cottonwood recruitment have been reduced, and cottonwood regeneration compromised, under the river management practices of at least the last 25-30 years. Hence, maintenance of the current extent of cottonwood forest is likely not sustainable over the long-term without proactive restoration of river processes.

Title: USACE Missouri River Mitigation: Wetland Restoration Functional Assessment

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Abstract: As a result of the Bank Stabilization and Navigation Project (BSNP) there has been a loss of 522,000 acres of wetland habitat along the Missouri River. In 1986 and 1999 over 148,000 acres along the Missouri River were designated to mitigation efforts in order to restore wetland habitats. The United States Army Corps of Engineers acquired the Benedictine Bottoms (2,112 acres) in 1994, Elwood Wildlife Refuge (1,116 acres) in 2006 and Dalbey Bottoms (1,600 acres) in 2009, as part of the Missouri River Wetlands Mitigation Program. Wetland habitat types among the three properties sampled in North Eastern Kansas include: ephemeral pools, scour holes, tributaries, backwater and sloughs. A five-year USACE project (Missouri River Mitigation Wetland Restoration Functional Assessment: Implementation of Amphibian Monitoring and Adaptive Management for Wetland Restoration Evaluation Project) involves four states: Nebraska, Kansas, Missouri, and Iowa, was developed to assess wetland functionality. The first year of the project involved amphibian chorus sampling following the North Atlantic Amphibian Monitoring Program (NAAMP) protocol to determine presence or absence of species as well as habitat utilization of various species. Chorus sampling occurred from early May-late July and was alternated weekly with a hydrological study of each site. This involved using a GPS to track the inundation patterns to determine where propagation efforts should be directed. We recorded 14 species present in North Eastern Kansas utilizing various wetland habitat types. We found large (~100m circumference) ephemeral pools to support the most diverse breeding frequently identifying over 4 species per pool as well as scour holes. While small, (~25m circumference) ephemeral pools and tributaries were usually vacant during peak breeding periods.

Title: Factors Affecting Piping Plover Nest Success on Missouri River Sandbars

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Abstract: Since 2004, engineered sandbars have been created on the Missouri River to increase the amount of nesting habitat available for piping plovers and least terns. We studied nesting piping plovers on 33 sandbars (10 engineered and 23 natural) in the Gavins Point Reach and the Lewis and Clark Lake in 2008 and 2009. We examined the effects of year, sandbar, sandbar type (engineered or natural), sandbar age, date, nest age, caging, egg number, nesting density, and the interactions of these factors on daily nest survival rates. We found and followed 594 nests in the study area during the 2008 and 2009 breeding seasons. We used a point density estimate in ArcGIS (ESRI, Inc., Redlands, Calif.) to estimate the number of active nests that fell within a 1 hectare circle, centered on an active nest. As date increased, so did survival ($b=0.08$, $p=0.046$). Birds on engineered sandbars had higher nest survival rates than birds on natural sandbars ($b=2.85$, $p<0.0001$) but survival rates on engineered sandbars declined with age ($b=-0.76$, $p<0.0001$). The nesting densities observed in 2008 and 2009 did appear to affect nest survival rates. Nests on engineered sandbars had higher survival than those on natural sandbars. However as engineered sandbars aged, nest survival declined. These findings suggest that newly engineered habitats are important sites for piping plover breeding.

Title: Colonization of Engineered Sandbar Habitat by Piping Plovers on the Missouri River

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Abstract: To increase the piping plover population on the Missouri River, the U.S. Army Corps of Engineers has built several sandbars in the Gavins Point Reach and Lewis and Clark Lake since 2004. Sandbars were surveyed for nesting activity and use by individually marked piping plovers during the 2008 and 2009 breeding seasons. Nesting was initiated earlier on older engineered sandbars than on age zero engineered sandbars in 2008 ($\chi^2=48.5$, $p<0.001$) and 2009 ($\chi^2=40.3$, $p<0.001$). Yearling birds that recruited to the study area were more likely to nest on age zero sandbar than on older sandbars in both 2008 ($\chi^2=11.3$, $p<0.001$) and 2009 ($\chi^2=27.0$, $p<0.0001$). On newly engineered sandbars, yearlings experienced 95% nest success compared with 54% nest success of yearlings nesting on other sandbar types. Older birds also had higher nest success on newly engineered sandbars (88%) compared with older sandbar types (54%). It is clear from this study, that newly engineered sandbars provide important habitat for yearling recruits. In addition, for all piping plovers, colonization of newly engineered habitat may result in increased annual productivity.

Title: An Adaptive Management Strategy for Endangered Species Habitat Restoration

Author(s): Timothy M Fleeger

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Abstract: The Biological Opinion (BiOp) on the Operation of the Missouri River Mainstem System calls for an Adaptive Management (AM) framework to implement actions to restore habitat for federally-listed species. Pursuant to compliance with this BiOp, the US Army Corps of Engineers (Corps) constructs nesting habitat for two bird species - least terns and piping plovers – under its Emergent Sandbar Habitat (ESH) program. As part of a Programmatic Environmental Impact Statement (PEIS) on the ESH program, the Corps recently completed an AM strategy for the implementation of this program utilizing the recent guidance issued for Section 2039 of the Water Resources Development Act of 2007. This AM strategy addresses adaptation at both programmatic, regional and site-specific levels and features a suite of (1) measurable objectives, (2) uncertainties to be addressed, (3) potential management actions with cost estimates and anticipated benefits, (4) monitoring and research needs (including cost estimates and priorities), and (5) success criteria for each objective (including interim metrics). The strategy uses a stochastic predictive model to forecast biological responses to alternative management strategies and a series of decision criteria are used to recommend adaptations to the program and specific sites based on both monitoring data and model outputs. The strategy is both specific and management-relevant and will serve as a template for upcoming AM efforts.

Title: Using GIS Spatial Decision Support Systems in Ecosystem Restoration Projects: A Case Study on the Missouri River

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Abstract: The Emergent Sandbar Habitat Evaluation and Ranking (ESHER) tool is a Spatial Decision Support System (SDSS) that aids in the evaluation and selection of restoration sites for two federally-listed shorebird species, the least tern and the piping plover, as part of the Missouri River Recovery Program. The tool utilizes a custom Geographic Information System (GIS) toolbox to calculate spatial measurements of geomorphologic, biologic, socio-economic, and plan formulation variables, coupled with user input on the relative importance of these variables, to evaluate the suitability of potential sites for restoration. The result is a well-documented and consistent approach to annual site-selection that incorporates stakeholder concerns, engineering challenges, and biological criteria very early in the plan formulation process. Incorporation of GIS technology also streamlines the discussion of environmental impacts and assists in avoidance and minimization of conflicts such as infrastructure, wetlands, and cultural resources.

Title: Using Human Threat Indices to Prioritize Conservation Areas for Lotic Fishes

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Abstract: Conservation areas for lotic fishes can be prioritized by evaluating indices of biotic integrity, assessing relative degree of system impairment, and determining areas amenable to conservation practice implementation. Because fish sampling data are usually incomplete, assessing stream segments by relative degree of impairment and available conservation practices provides a means to uniformly assess ecological condition. Potential conservation areas can be delineated using threat indices in an effort to improve large-scale lotic fish management. Our objectives were to 1) develop a series of human threat indices that identify relative, potential impacts of similar threats to stream segments within Missouri River basin and 2) determine if threat indices can be used to predict indicator fish guild species abundance. We developed a series of nested threat indices that identify agricultural, urban, water pollution, and stream modification threats. An omnivore fish guild was hypothesized to increase in species abundance in response to increasing threat index scores. Regression tree modeling indicated omnivore species abundance increases with increasing agriculture and urban threat indices. A piscivore/invertivore guild decreased as hypothesized in species abundance with increasing agricultural threats. Our threat indices are indicators of the relative degree of perturbation to individual stream segments because they cumulatively represent similar suites of threats that may not be accounted for in traditional analyses. Managers can use threat indices to identify thresholds of indicator fish guild species abundance to infer aquatic community health and identify areas of greatest conservation need.

Title: A Summary of On-going Water-Quality and Ecological Investigations within the Missouri River Basin for the U.S. Geological Survey's National Water Quality Assessment Program

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Abstract: Since 1991, the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program has been collecting and analyzing physical, chemical, and biological data from watersheds and aquifers across the United States. In the second decade of the Program (2001–2012), one focus has been on assessments of water-quality and ecological conditions within major-river basins. The Missouri River Basin is one of eight designated major-river basins within the NAWQA program, and currently, there are four on-going investigations within the Basin. Two of these investigations are focused on sites and datasets within the Missouri River Basin. The first uses the SPAtially Referenced Regression on Watersheds (SPARROW) model to provide local and regional estimates of sources, transport, and loads of total nitrogen and phosphorus in rivers and lakes in the Missouri River Basin. The second investigation uses Hydroecological Integrity assessment Process (HIP) software to identify the most relevant hydrologic indices, developed to characterize the five major components of the flow regime at the reach or watershed level, and then uses these indices to explain ecological variability in the study area. The final two investigations expand data analysis beyond the boundaries of the Missouri River Basin. The first is a study investigating how invertebrate functional traits, or traits characterizing the functional composition of benthic invertebrate communities, vary within, and between, ecoregions across the United States. Finally, efforts are underway to compile suspended-sediment data and compute suspended-sediment loads and concentration trends at selected mainstem and tributary sites within the Mississippi River Basin.

Title: Vulnerability to Predation in Juvenile Pallid Sturgeon Scaphirhynchus albus

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Abstract: Predation can play an important role in the recruitment dynamics of fishes with intensity regulated by behavioral (i.e., prey selectivity) and/or environmental conditions. Recruitment of pallid sturgeon *Scaphirhynchus albus*, a federally endangered species, in the Missouri River has been absent or at levels too low to sustain the population. We conducted laboratory experiments to quantify predation vulnerability in juvenile pallid sturgeon, and examine the efficiency of walleye *Sander vitreus*, flathead catfish *Pylodictis olivaris* and smallmouth bass *Micropterus dolomieu* feeding on large (40-50 mm FL) and small (80-100 mm FL) juvenile pallid sturgeon. Experiments for each predator were conducted at high and low densities of pallid sturgeon with contrasting densities of an alternative prey fathead minnows *Pimephales promelas*. Prey density treatments were replicated 4- 5 times under high (>70 NTU) and low (<5 NTU) turbidity conditions. During additional experiments predator behaviors (strikes, captures, and consumed prey) were quantified for each prey type. Walleye and smallmouth bass negatively selected pallid sturgeon across all treatments, indicating low vulnerability to predation. Vulnerability to predation by flathead catfish was moderate for small pallid sturgeon (neutral selection), but low for large pallid sturgeon (negative selection). Turbidity (up to 100 NTU) did not affect pallid sturgeon vulnerability, even at low density of alternative prey. Pallid sturgeon were easily captured by all predators, but were rarely consumed, suggesting mechanisms other than predator foraging behavior govern sturgeon predation vulnerability. In the presence of alternative prey, our results suggest vulnerability of juvenile pallid sturgeon > 40 mm to predation was low for the predators and conditions tested in this study.

Title: Telemetry Inferred Survival Rates of Juvenile Pallid Sturgeon in RPMA2

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Abstract: Recovery of pallid sturgeon (*Scaphirhynchus albus*) includes artificial propagation and supplementation using juvenile pallid sturgeon. Each year, thousands of juveniles are released at various locations throughout the Upper Basin. Three stocking locations have primarily been used in recovery priority management area 2 (RPMA2) in the Missouri River: School Trust (rkm 2840), Wolf Point (rkm 2737), and Culbertson (rkm 2608). There have been very few recaptures of juveniles stocked at the School Trust site by the Pallid Sturgeon Population Assessment and Fort Peck Flow Modification crews. This observation led to the hypothesis of differential survival of juvenile pallid sturgeon stocked at different locations. During the spring and summer of 2008, fifty hatchery-reared yearling pallid sturgeon were telemetered and released at these three stocking sites in RPMA2. The objectives of this study were: 1) to estimate survival from initial stocking through fall, and 2) to estimate annual survival. Survival rates were lower for individuals stocked at upstream locations than in downstream stocking locations. For example, the upstream School Trust site had annual survival rates of 4% and 40% during the spring and summer release, respectively; whereas, the most downstream Culbertson site had survival rates of 66% and 80%. Survival rates were higher for summer stocked fish than spring stocked fish for all stocking locations. Initial results from this study provide biologists and managers with a better stocking recommendation for RPMA2 in the Missouri River.

Title: SWH Construction Activities and Design Update – Kansas City District

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Abstract: An update of the Kansas City District shallow water habitat construction, design, and monitoring activities that were undertaken during 2009 will be presented. A discussion of lessons learned and performance of past projects will also be included. The presentation will also address future SWH project design activities and modifications.

Title: Pilot Study and Plans for Herpetofauna Monitoring in Iowa

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Abstract: The functionality of mitigation wetlands along the Missouri River will be assessed using reptiles and amphibians. This assessment is part of a four-state effort. In Iowa, a pilot study was conducted in 2009. Permanent wetlands were mapped and call surveys conducted at each wetland. Drift fences and pitfall traps were installed and operated at 6 wetlands. Seven species were detected during call surveys. Eight species and 415 individuals were captured in pitfall traps. In 2010, pitfall traps will be added to more wetlands. Pitfall traps will be enhanced with rims to prevent small frogs from escaping, covers to prevent predation by raccoons, and terrestrial funnel traps will also be employed to enhance capture rates. After 3 years, the pitfall trapping data will be analyzed using the Robust Design Pradel mark-recapture model, which will estimate population growth rate, survival, recruitment, and population size, if sample sizes are adequate. Call surveys and associated environmental covariates of wetlands will be analyzed using occupancy estimation to construct models predicting occurrence of calling frogs. Turtles will be marked and recaptured and if movement between ponds is minimal, analyzed using closed population mark-recapture models. The status of the frogs and turtles in these wetlands will aid in determining the functionality of these rare wetlands. The information learned from these studies will inform future design of restored wetlands.

Title: Habitat Use and Movement Patterns of Smooth Softshells, *Apalone mutica*, and False Map Turtles, *Graptemys pseudogeographica*, within the 59-Mile Segment of the Missouri National Recreational River

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Abstract: Turtles are seasonally and ontogenetically dependent on a wide variety of habitats represented in the flood plain river ecosystem. Ecological requirements include suitable nesting sites, foraging areas, basking sites, hibernacula, nocturnal resting areas such as those provided by undercut banks or submerged logs, and areas that afford protection from predators. Habitats and locations utilized by turtles within a river system vary in relation to the age, sex, adaptations, and various ecological requirements of the species in question. Telemetry data can provide valuable insight into both the spatial location and temporal use of critical habitats, which can then be used when making management decisions. To date, comprehensive studies of seasonal movements and habitat use of turtles within southeastern South Dakota have been lacking. In the summer of 2008 we initiated a telemetry study within the 59-mile segment of the Missouri National Recreational River focusing on two species of concern, the smooth softshell (*Apalone mutica*) and the false map turtle (*Graptemys pseudogeographica*). We present our preliminary findings on the habitat associations and movement patterns of both species.

Title: Spatial Patterns of Macroinvertebrate Abundance and Composition in the Missouri River Downstream of Fort Randall and Gavins Point Dams, South Dakota and Nebraska.

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Abstract: We quantified spatial patterns in macroinvertebrate abundance and composition in the Fort Randall and Gavins Point reaches of the Missouri River from June through October 2005 and 2006. Macroinvertebrates were collected in shallow waters using Surber samplers and Hester-Dendy plate samplers. In the main channel, drifting macroinvertebrates were collected with a 0.5-m conical zooplankton net and benthos with a ponar dredge. Over 60 macroinvertebrate taxa were collected in 2005 and 2006 downstream of Fort Randall and Gavins Point dams, the most abundant families collected were Chironomidae, Ceratopogonidae, Isonychiidae, Baetidae, Caenidae, Heptageniidae, Hydropsychidae, and Polycentropodidae. Mean richness (range: 1.7 - 5.6), diversity (range: 0.4 - 1.0), and evenness (range: 0.4 - 0.7) of macroinvertebrates were generally higher in the Gavins Point reach for each gear, except the Surber sampler. Compared to the Fort Randall reach, mean densities of macroinvertebrates, especially Hydropsychidae, were generally higher (2-6 times) in the Gavins Point reach, except for Chironomidae. In both reaches, mean richness, diversity, evenness, and mean densities were generally highest at the downstream sites and sites influenced by a major tributary. The downstream site in the Fort Randall reach is influenced by the Niobrara River, forming a large braided delta as a result of sedimentation. In the Gavins Point reach, the James River influenced the upper and middle sites and the Vermillion River influenced the downstream site. Water levels fluctuate > 0.75 m daily downstream of Fort Randall Dam due to hydropeaking while daily outflows downstream of Gavins Point Dam are relatively constant. Daily dewatering in the Fort Randall Reach may be one factor for decreased macroinvertebrate diversity and densities, especially trichopterans compared to the Gavins Point Reach.

Title: Resource Selection by Adult Pallid Sturgeon, *Scaphirhynchus albus*, in the Channelized Missouri River, USA with Implications for Current and Planned Habitat Creation Projects

Author(s): Justin D. Haas, Gerald E. Mestl, Casey L. Bergthold, Kimberly A. Chojnacki, Aaron J. Delonay, Janice L. Bryan, Mark L. Wildhaber, Thomas W. Bonnot and Joshua J. Millsbaugh

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Abstract: The U.S. Geological Survey, Nebraska Game and Parks Commission and the U.S. Army Corps of Engineers are conducting a research project investigating pallid sturgeon movement, habitat use and behavior. Data for this study are collected through a large scale telemetry effort, which currently includes 113 pallid sturgeon of known gender. These fish were tracked with varying intensity over the lower 1,305 km of the Missouri River from Gavins Point Dam, Nebraska to its confluence with the Mississippi River. Implanted sturgeon were captured using focused sampling within select study segments. During the spawning season, fish in reproductive condition were intensively tracked to characterize reproductive behavior and to locate potential spawning areas. After the spawning season, extensive searches for all implanted sturgeon were conducted to evaluate habitat use. As a result, numbers of fish, release locations and telemetry relocations of implanted sturgeon are not randomly or evenly distributed among designated study segments. Analyses of habitat use presented here were limited to data collected from the upstream portion of the study area during the non-spawning period. Ninety-percent-use distributions varied greatly within and across individuals and within years. All six available habitat types were used and fish appeared to be selecting habitat types that have a high degree of variation in morphology and velocity. These results are supported by concurrent research indicating that sturgeon in this section of the Missouri River are selecting areas with high velocity gradients and depth slopes. This research describes the range of habitats used by pallid sturgeon in a highly altered system. Habitat use and selection can be used by managers to effectively create habitat or increase habitat diversity to benefit the species.

Title: Habitat Use and Population Demographics of Blue Sucker in the Middle Missouri River

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Abstract: Blue sucker (*Cycleptus elongatus*) are a large bodied benthic fish, endemic to the Mississippi, Missouri, and Ohio River drainages. Although widely distributed, the blue sucker is considered vulnerable or imperiled throughout its range, making the blue sucker a potential candidate for federal listing. Anthropogenic modifications to the Missouri River have greatly affected the natural riverine processes and have resulted in the decline of many native fishes. Alteration of the natural flow regime of the Missouri River is believed to have had negative impacts on native fauna. Current works characterizing blue sucker habitat use, migration, population genetics, and population demographics is limited. Therefore, evaluation of hydrological events on the population dynamics and habitat use of the blue sucker would provide useful information for adaptive management of current Missouri River flow regimes. Understanding the effects of these changes on the blue sucker, would be beneficial not only for improving habitat for a single species, but also have implications for other large benthic fish species.

Title: Population Characteristics of Pallid Sturgeon in the Lower Platte River, Nebraska

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Abstract: We examined catch statistics of pallid sturgeon *Scaphirhynchus albus* (PDSG) throughout the lower Platte River, Nebraska (159 km). The lower Platte River was divided up into two sampling segments so that sampling effort could be distributed to areas known to have higher abundances. We captured 66 PDSG throughout the entire reach of the lower sampling segment (i.e., 52 km). Historically, PDSG were not present in the upper sampling segment; however, we captured three PDSG at rkm 67, 76, and 85, respectively. Trotlines (30.5-m main line with 20 baited hooks) captured 52 of 69 total PDSG during the spring (n=9), summer (n=10), and fall (n=33). Trammel nets (38 m long, 1.8-m depth) captured 17 PDSG during the summer (n=7) and fall (n=10). Forty-eight PDSG were identified as hatchery origin and were representatives from the 1997, 2001-2003, and 2005-2008 year classes that were stocked at various locations along the Missouri River. We captured two, genetically confirmed, wild origin PDSG that were previously captured in the Missouri River. The remaining 19 individuals are of unknown origin and are pending genetic confirmation. This year marks the beginning of a five-year study designed to understand the importance of sturgeon species in the Platte River. Information gained on the factors driving population dynamics of sturgeon will be important for increased effectiveness of management activities for these species in riverine systems throughout their native range.

Title: New Genetic Markers Provide an Efficient Tool for Identifying Missouri River Pallid Sturgeon Larvae

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Abstract: Identifying and quantifying age-0 pallid sturgeon in the Missouri River is necessary for identifying critical habitat and monitoring the effects of natural and anthropogenic phenomena on pallid sturgeon reproduction. Several high priority research needs recognized in the revised pallid sturgeon recovery plan and related documents require identification of age-0 pallid sturgeon. Young pallid sturgeon are very similar to the much more abundant shovelnose sturgeon and previously developed morphological and genetic techniques lack resolution and/or are cost prohibitive for screening the large number of sturgeon necessary to identify and quantify rare pallid sturgeon. We are in the process of developing a new generation of DNA markers called Single Nucleotide Polymorphisms (SNPs) that can provide rapid and efficient discrimination between pallid and shovelnose sturgeon throughout most of the Missouri River. Developing these markers is challenging because of tetraploidy (ancient genome duplication) in all sturgeon. Upstream of Missouri River mile 250 we can eliminate more than 98% of all shovelnose sturgeon from a sample rapidly and inexpensively using only two SNP markers and can identify the pallid sturgeon among the remaining specimens using additional genetic markers (microsatellites). Below Missouri River mile 250 the species are more difficult to discriminate, likely due to hybridization, but we believe that the development of additional SNP markers will eventually make identification of age-0 sturgeon larvae cost effective here as well.

Title: The Emergent Sandbar Habitat Program for the Recovery of Terns and Plovers: Model Results and Validation

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Abstract: In 2009, the first Annual Adaptive Management Report was developed for the Emergent Sandbar Habitat (ESH) Program as a tool for communicating analyses of population recovery of piping plovers (*Charadrius melodus*) and interior least terns (*Sternula antillarum*) in the Missouri River Mainstem System. In this Report, we provide details on model predictions, analyses of monitoring data, and a comparison between model predictions and monitoring data (observed population sizes and fledgling ratios) for terns and plovers. We compared predicted and observed values for 2008 and 2009 using the currently implemented scenario: a) 100% ESH construction effort on Gavins Point reach, b) power-peaking on Fort Randall and Garrison reaches, and c) floating discharge levels. Predicted adult population sizes for terns were statistically higher than observed values, whereas predicted population sizes for plovers were higher but statistically similar to observed values. Predicted fledgling ratios were higher than observed ratios for both species, but statistically similar. Making reliable comparisons between predicted and observed ESH requires a standard and consistent method to quantify area of ESH for varying levels of discharge. Quantifying this relationship for the Missouri River Mainstem System will not only allow for model adjustments, but will also allow for an increase in informed decision-making. As future comparisons between model predictions and monitoring data are made, and new research data are collected and incorporated, we expect model predictions to become more accurate.

Title: Trotline Use to Improve Confidence in Survival Rates in the Upper Missouri River, MT

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Abstract: In 2009 the Pallid Sturgeon Upper Basin Workgroup contracted a survival estimate study, which used both Pallid Sturgeon Population Assessment Program (PSPAP) and Yellowstone River pallid sturgeon data. To meet Cormack-Jolly-Seber model assumptions, only a portion of the PSPAP data was incorporated into the analysis. Survival estimates were calculated for fish stocked into the Missouri and Yellowstone Rivers in Montana. All cohorts of pallid sturgeon stocked into the Missouri River had higher survival estimates than the same cohorts stocked into the Yellowstone River, however the confidence of the Missouri estimates were lower than those of the Yellowstone River estimates. To evaluate methods for increasing the confidence of the Missouri River estimates, an intense non-standardized sampling event that used timed trotline sets in areas known to have relatively high concentrations of juvenile pallid sturgeon was conducted. During this sampling event several age classes of hatchery-reared pallid sturgeon from various stocking locations were collected. In addition, catch-per-unit-effort of these trotline sets was higher than that of the more standardized trotline sets. These data will be used in future survival estimates to determine if focused sampling can increase the confidence of survival rates .

Title: MRRP Website – Walkthrough

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Abstract: The Missouri River Recovery Program (MRRP) website (www.moriverrecovery.org) is one of the means the program uses to communicate with the public. The website has been developed using Oracle's Application Express (APEX). Every element displayed on the website is stored within an Oracle database. The website has recently undergone some restructuring which to make browsing more intuitive and easier to navigate. The main tabs cover the major efforts and authorities related to the MRRP. As you drill down inside, the information gets broken down further. We have recently added some interactive data; such as, a mapping tool, mitigation information, spring pulse data, a search tool, and much more.

Title: Linking River Morphology to Larval Drift of an Endangered Sturgeon

Author(s): Laura K. Bazzetta, Robert B. Jacobson, Patrick J. Braaten, and Caroline M. Elliott

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Abstract: Computational models of longitudinal advection and dispersion of contaminants in rivers have potential in predicting larval drift. A critical component of these models is the longitudinal dispersion coefficient which parameterizes the processes that retain and distribute a contaminant. Here we evaluate the potential for longitudinal dispersion coefficients to characterize larval drift of the endangered pallid sturgeon (*Scaphirhynchus albus*) in various segments of the free-flowing Missouri River ranging from Missouri to Montana. We randomly selected transects of acoustic Doppler current profiler (ADCP) flow velocity data from reach-scale datasets that were collected in the Missouri River from 2002-2008 under comparable discharge conditions. We used previously developed equations (Kim and others, 2007) to calculate a one-dimensional longitudinal dispersion coefficient for each ADCP transect. We compared the statistical distributions of these coefficients for 2 to 6 reaches chosen from each of six geomorphic segments of the Missouri River. Distributional patterns indicate that dispersion coefficients relate to observed variation in river morphology at the segment scale. Although one-dimensional dispersion analysis demonstrates potential for estimating larval drift and habitat suitability in unchannelized portions of the Missouri River, the large spatial variation in dispersion coefficients resulting from wing dikes in the Lower Missouri complicates selection of appropriate values. Recent data indicating that pallid sturgeon larvae occur in greater concentration in the thalweg indicate that the majority of larvae may bypass these structures and their retentive eddies. Simulations of passive drift indicate that mean flow velocity is the dominant factor in drift distance, but dispersion characteristics can significantly modify the distribution of distances.

Title: Hydrologic and Geomorphic Considerations in Restoration of River-Floodplain Connectivity, Lower Missouri River

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Abstract: Systematic planning for restoration of river-floodplain connectivity requires understanding how often and how much of a floodplain may be inundated, and how likely the floodplain is to retain the water once flooded. These factors depend fundamentally on hydrology and geomorphology of the channel and floodplain. We discuss application of an index of river-floodplain connectivity, the Land Capability Potential Index (LCPI), to regional-scale restoration planning along the Lower Missouri River, downstream of Gavins Point Dam, South Dakota. The LCPI integrates modeled water-surface elevations, floodplain topography, and soils to index relative wetness of floodplain patches. Geomorphic adjustment of the Lower Missouri River to impoundment and channel engineering has altered the natural relations among hydrology, geomorphology, and floodplain soils, and has resulted in an upstream to downstream gradient in connectivity potential. As a result, restoration cannot rely on flow-regime management alone. The LCPI provides a tool for identifying and mapping floodplain restoration potential, accounting for the geomorphic adjustment. Using simple criteria, we illustrate the utility of LCPI-like approaches in regional planning for restoration of plains cottonwood (*Populus deltoides*) communities, hydrologically connected floodplain wetlands, and seasonal floodplain wetlands.

Title: Simple and Practical Applications of Planning Tools along the Missouri River in NE

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Abstract: According to its authors, the Landscape Capability Potential Index (LCPI) integrates fundamental factors that determine the suitability of land for various uses, and may be useful in guiding land-management decisions. In order to assess the utility of any tool at guiding land management decisions, it must be tested against real world situations likely faced by land managers and restoration practitioners. In 2009 a simple test of the LCPI was conducted to assess its ability to identify hydrologic and edaphic patterns related to cottonwood regeneration success and created grassland failure resulting from the 2007 and 2008 floods along the lower Missouri River.

Title: Seasonal Use of Tributaries by Missouri River Fishes in the Garrison Reach, ND

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Abstract: Conservation and management of regulated rivers requires a riverscape approach (e.g. linking reservoirs, mainstem rivers, backwaters, and tributaries) because many native riverine species require access to diverse habitats on broad spatial scales. Several tributaries flow into the highly regulated Garrison Reach of the Missouri River near Bismarck, ND. Seasonal use of three tributaries by Missouri River larval, juvenile, and adult fishes was examined. All three tributaries exhibited high catches of adult, juvenile, and larval walleye, suggesting that tributaries are important spawning and rearing areas for this species. Adult yellow perch and white bass were abundant in two of the three tributaries, but larvae of these species were not collected. Northern pike and channel catfish occasionally used tributaries, but were in low abundance. Additionally, tributaries provided spawning habitat for Catostomidae and Cyprinidae. Catches of larval Catostomidae were high in one of the study tributaries. Larval Cyprinidae were captured in all three study tributaries, but abundance of this family was always low. Our results suggest that tributaries provide important spawning and rearing habitat for many Missouri River fishes (e.g. walleye), whereas other species occasionally use the tributaries, but likely spawn elsewhere (e.g. main channel).

Title: Project Work Request Manager, How It Functions, Assists in Creating the Annual Work Plan, and Gets YOUR Project Funded

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Abstract: Project Work Request (PWR) Manager centralizes the record keeping and reporting of MRRP projects. It supports the MRRP Annual Work Plan by establishing the authoritative list of proposed work, models different budget funding levels and provides a historical funding reporting tool. Using PWR solves the problems of lost requests, insufficient attribution, time-intensive upward reporting, and lack of transparency while decreasing data entry requirements on the PM. This presentation will outline the tools available to managing your funding requests, an overview of the process used to establish funding thresholds, review, rank, and group PWRs for funding, and notification of PWR status to PMs and other stakeholders.

Title: Missouri River Basin Water Management

Author(s): Joel Knofczynski

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Abstract: The Missouri River Basin Water Management Division (MRBWMD), located in Omaha, Nebraska, directs the regulation of the Missouri River Mainstem Reservoir System (System) to serve the Congressionally authorized project purposes of flood control, navigation, hydropower generation, irrigation, water supply, water quality control, recreation, and fish and wildlife. The combined storage capacity of the six mainstem dams, 73.1 million acre-feet (MAF), makes it the largest reservoir system in North America. The System is regulated using guidelines published in the Missouri River Mainstem Reservoir System Master Water Control Manual (Master Manual). The presentation will generally cover the regulation of the projects for the authorized purposes with some focus on fish and wildlife, including threatened and endangered species.

Title: Comparison of Spring Rise Impacts on Interior Drainage in 2008 and 2009

Author(s): Roy F. McAllister

Mailing Address of Presenter: Corps of Engineers 1616 Capitol Avenue, Suite 9000 Omaha, NE 68102

Email Address and Phone of Presenter: roy.f.mcallister@usace.army.mil 402-995-2507

Abstract: In March 2006, the U.S. Army Corps of Engineers (USACE) revised its Missouri River Mainstem Reservoir System Master Water Control Manual to include criteria for the release of a bimodal spring pulse from Gavins Point Dam to benefit the endangered pallid sturgeon. This presentation compares the drainage data collected in 2009 with the data collected in 2008 and provides evidence on how the duration of natural spring rises affect socioeconomic impacts to landowners. While the created spring rises, resulting from single spring pulses in each year, produced no impacts in 2008 and 2009, the extended period of data collection allowed for the identification of natural spring rise impacts, their durations, and the Missouri River flows required to produce these socioeconomic impacts. The 2008 monitoring period captured large precipitation and runoff events in May and June, which created a large natural spring rise of long duration. In comparison, the 2009 monitoring period captured higher flow spring rises of shorter duration. Natural spring rises in both 2008 and 2009 produced socioeconomic impacts in the form of drainage ditch gate closures, pumping, and overland flooding and on groundwater levels. Stage graphs at impacted drainage sites will be presented for both years and compared to illustrate the effects of two different flow regimes on landowner socioeconomic impacts.

Title: Comparison of Spring Rise Impacts on Groundwater in 2008 and 2009

Author(s): Roy F. McAllister

Mailing Address of Presenter: Corps of Engineers 1616 Capitol Avenue, Suite 9000 Omaha, NE 68102

Email Address and Phone of Presenter: roy.f.mcallister@usace.army.mil 402-995-2507

Abstract: In March 2006, the U.S. Army Corps of Engineers (USACE) revised its Missouri River Mainstem Reservoir System Master Water Control Manual to include criteria for the release of a bimodal spring pulse from Gavins Point Dam to benefit the endangered pallid sturgeon. This presentation compares the drainage data collected in 2009 with the data collected in 2008 and provides evidence on how the duration of natural spring rises affect socioeconomic impacts to landowners. While the created spring rises, resulting from single spring pulses in each year, produced no impacts in 2008 and 2009, the extended period of data collection allowed for the identification of natural spring rise impacts, their durations, and the Missouri River flows required to produce these socioeconomic impacts. The 2008 monitoring period captured large precipitation and runoff events in May and June, which created a large natural spring rise of long duration. In comparison, the 2009 monitoring period captured higher flow spring rises of shorter duration. Natural spring rises in both 2008 and 2009 produced differing socioeconomic impacts in terms of groundwater depths in response to the spring rises. Groundwater depth plots and nearby river stages at five Missouri River sites will be presented for both years and compared to illustrate the effects of two different flow regimes on landowner socioeconomic impacts.

Title: Yellowstone River-Intake Dam Modifications: Engineering Design

Author(s): Curtis J. Miller Chris J. Svendsen

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Abstract: Modifications to the Intake Dam and diversion headworks are proposed to allow fish passage and to prevent entrainment into the irrigation canal. Design of project features includes the use of both numerical and physical modeling. For fish passage, the approach to and preliminary results from numerical modeling used to evaluate key parameters relative to success criteria are presented. Ongoing analyses to overcome challenges encountered with entrainment prevention are discussed.

Title: Wind Energy Development and Challenges in the Upper Missouri River Basin

Author(s): Timothy C. Modde

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Abstract: Renewable energy is rapidly developing in the United States in response to concern for dependency on foreign oil, carbon emissions, and these impacts on our economy. Tax incentives, state energy portfolios requirements, and the planning for enhancement of the national electric grid have all given momentum toward rapid planning for renewable energy projects. Solar, wind and geothermal sources are the primary types of renewable energy being developed; in addition large rivers and coastal areas have generated substantial interest in hydrokinetic power. Much of the Missouri River Drainage is found within the high wind resource landscape. The current distribution of wind energy development is more an expression of access to transmission than access to the resource. However, as transmission access is provided, wind energy developments will expand to those areas being serviced by power delivery. U.S. Department of Energy estimates that by 2030, wind power will support 20% of the nations power needs, compared to the 1% currently provided. To accomplish this goal the numbers of wind turbines will have to be increased from the approximately 38,000 MW available today to 300,000 MW by 2030. Although wind energy is largely carbon neutral, there remain environmental issues associated with wind energy development. Of interest to the Fish and Wildlife Service are federal trust resources including migratory birds (especially raptors) and endangered species. The issues associated with these resources include both direct mortality and habitat fragmentation. It is no coincidence that the primary flight paths for migratory birds coincide with areas of high wind generation. Thus, it is important that wind development proceed with close coordination with federal and state environmental staff to avoid or minimize potential damage. This presentation will provide a few examples and updates on efforts where wind development and environmental interests can coordinate their efforts to reduce impacts on natural resources.

Title: Successful Floating Emergent Sandbar Applications for Shore Bird Habitat

Author(s): Timothy P. Mulholland

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Abstract: Recent advances in artificial floating island technology have resulted in the deployment of two emergent sand bar habitat floating islands for Caspian tern in lake settings. These islands include a 22,000 square foot island for Summer Lake Wildlife Refuge in Oregon launched in February 2009 and a 44,000 square foot island launched in Sheepy Lake, California in January 2010. The technology has several benefits over traditional earthen islands in that they can be assembled from the shore and towed out to the desired position; thus, no aquatic life was disrupted and water levels remained normal. The floating sand bars can fluctuate with water levels providing more operational control of main stem reservoirs. The projects were funded by the Army Corps of Engineers and are being monitored by Oregon State University. The spring count of Caspian terns on the Summer Lake floating island ranged from 8 – 33 individuals and some of the terns were copulating and digging nest scrapes in the pumice substrate in preparation for egg-laying. The colony monitors were surprised that despite eight pairs of Caspian terns nesting on the floating island, all the ring-billed and California gulls choose to nest on an earthen adjacent island. The floating island was free of nesting gulls and the nest predation pressure that gulls frequently represent at tern colonies. The colony monitors have also observed that tern chicks tended to move freely on the floating island, whereas tern chicks on earthen islands with nesting gulls tend to stay close to their nest scrape and the protection of their parents due to intense predation pressure from gulls.

Title: Missouri River Ecosystem Restoration Plan: Innovative Methods of Integrating Conservation Planning Methods, Conceptual Ecological Models, USACE Planning Requirements, and NEPA to Develop a Comprehensive Plan

Author(s): Wayne Nelson-Stastny, USFWS, MRNRC Coordinator & MRERP Co-Lead; Randy Sellers, USACE, Project Manager; Paula Gagnon, The Louis Berger Group, Inc., Aquatic Ecologist/Conservation Planner; Karla Sparks, USACE, Environmental Resource Specialist

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Abstract: The Missouri River Ecosystem Restoration Plan/EIS (MRERP/EIS) is among the largest basin-wide restoration planning efforts in the US, and represents an unparalleled opportunity and challenge. The aim of the effort is to identify restoration, mitigation and recovery goals for the Missouri River and its tributaries, ecological systems and native species for the coming 30-50 years. The complexity of the project and its geographic scale present numerous challenges, among which is the need to provide real engagement opportunities for the interested public and stakeholders, including members of 29 basin tribes, 8 states and dozens of federal, state and local agencies. To address this challenge, a team of planners representing multiple backgrounds and approaches has developed the MRERP roadmap, which incorporates tested and innovative techniques to ensure procedural and legal requirements are met through a transparent, objective, and scientifically based planning approach.

Title: Geographic Differences in Reproductive Synchrony of Scaphirhynchus: An Interpretation of the Data Relative to Genetics, Cues, and Reproductive Behavior

Author(s): Diana M. Papoulias, Aaron J. DeLonay, Mandy L. Annis, Nathan J. Nye, Wyatt Doyle, Tracy Hill, Steve LaBay

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Abstract: Current understanding of Scaphirhynchus biology indicates these fish can migrate up to hundreds of miles to spawn in both the mainstem and tributaries of large rivers; that peak spawning is in the spring when photoperiod, flows, and temperatures are increasing; and that inter-population genetic differences exist range-wide within their distribution. Scaphirhynchus reproductive behavior is hypothesized as a cause of the genetic differences among populations that are not geographically isolated. Such an hypothesis suggests the existence and importance of multiple patterns of migratory behavior; relatively discrete spawning aggregations, fidelity to a spawning location, or variability in reproductive timing. In this presentation, we review several years of physiological data that may support the existence of one or more of these reproductive strategies. We assessed reproductive readiness by measuring egg polarization and sex hormones, from reproductive females captured through the pre-spawning and spawning periods at two distinct locations in the Missouri River and one in the Wabash River. Site-specific differences in the temporal patterns of reproductive condition is compared and related to behavior and environmental conditions. Measures of spawning readiness integrate both inherent genetic adaptation and responses to environmental factors that cue migration and spawning, and further refine our interpretation of observed behaviors by diagnosing the motivation and appropriateness of the behavior. Monitoring reproductive sturgeon provides important insights for establishing testable hypotheses of Scaphirhynchus reproductive strategies. Existence of evolved and adapted reproductive traits has important management implications for restoring imperiled and fragmented populations through hatchery augmentation, habitat creation, barrier removal and flow management.

Title: 24 Years of Monitoring – What have we Learned?

Author(s): Gregory A. Pavelka

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Abstract: The U.S. Army Corps of Engineers has funded an adult census and productivity monitoring of least terns and piping plovers on the Missouri River beginning in 1986 when both species were listed under the Endangered Species Act to the present. In the 24 years of monitoring an immense dataset has been collected. The dataset will be analyzed to determine general population and productivity trends of the two species, to determine population and productivity trends due to geography, to determine population and productivity trends due to water management and to determine population and productivity trends due to management actions performed by the Corps of Engineers.

Title: Evaluating Paddlefish Sport Fishery Potential in Lake Francis Case, South Dakota

Author(s): Landon L. Pierce, Brian D.S. Graeb, Jason S. Sorensen

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Abstract: South Dakota's Lake Francis Case, a mainstem Missouri River reservoir, historically supported a paddlefish (*Polyodon spathula*) sport fishery until a lack of natural recruitment forced its closure in 1986. Paddlefish have been stocked in Lake Francis Case intermittently since 1974 and annually since 1990 to maintain a broodstock population and potentially reinstate a sport fishery. Although advanced fingerling stockings have maintained a broodstock population, the effects of reinstating a sport fishery are unknown. The objective of this study was to determine the sport fishery potential of paddlefish in Lake Francis Case, SD. We simulated the effects of two potential fishery regulations (i.e. limited-entry system without length limits ["yield"], and a limited-entry system with a high-minimum length limit ["trophy fishery"]) on the yield, size distribution, number of fish harvested, and proportion of paddlefish at maturity. Size distributions decreased slightly as exploitation increased. Yield and the number of fish harvested were greater at all levels of fishing mortality evaluated for the yield fishery; whereas, the proportion of mature fish (i.e. broodstock) was higher under the trophy regulation. Harvest would not greatly affect size structure under either management strategy. Our modeling provides the foundation for the decision-making process regarding the ability of this population to sustain sport harvest.

Title: Age and Growth Analyses of Flathead Catfish (*Pylodictic olivaris*) in the Missouri River from 2002-2008

Author(s): Timothy K. Porter Gerald E. Mestl

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Abstract: The objective of this study was to monitor the flathead catfish (*Pylodictic olivaris*) population in the Missouri River and document any changes in the population characteristics. The four segments of the Missouri River (the upper unchannelized, lower unchannelized, upper channelized, and lower channelized) were sampled in July by boat electrofishing. Two segments were sampled each year and each segment was visited on alternate years (i.e. the upper unchannelized and lower channelized were sampled in 2002 and the lower unchannelized and upper channelized were sampled in 2003). We present the results of the age and growth analyses from the sub-samples of spines that were collected from 2002 through 2008.

Title: Range-wide Contribution of Paddlefish Nursery Areas in the Mississippi River Basin

Author(s): Brenda M. Pracheil, Daniel D. Snow, Mark A. Pegg

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Abstract: Protection of declining paddlefish populations is dependent on conservation of paddlefish nursery areas that ultimately contribute to adult recruitment. However, paddlefish are highly migratory and can move thousands of kilometers over the course of a year and location of paddlefish capture may not be indicative of nearby nursery area success. Stable oxygen ($\delta^{18}\text{O}$) and hydrogen ($\delta^3\text{H}$) isotopes have been used extensively to determine origins and movement histories of animals. These isotopes can be especially useful for determining areas of natal origin because $\delta^{18}\text{O}$ and $\delta^3\text{H}$ signatures found in water and transferred to hard-parts of fish. These ratios become incorporated into fish hard-parts developed while inhabiting a particular geographic area. Stable isotope ratios contained in the portion of the paddlefish jaw bone formed in the first year, for example, can give geographic identity to paddlefish production areas potentially leading to a greater ability to protect critical paddlefish habitat. Our objective of this study was to provide coarse-scale geographic resolution of paddlefish nursery areas from across the species range in the Mississippi River basin through $\delta^{18}\text{O}$ and $\delta^3\text{H}$ analysis of the first year of paddlefish jawbone growth. Paddlefish jawbones were collected from Montana, South Dakota, Nebraska, Missouri, Illinois, Tennessee, and Louisiana. We removed the jawbone tissue formed during the first year of growth and then analyzed the $\delta^{18}\text{O}$ and $\delta^3\text{H}$ signature of this tissue. We compared signatures of fish of unknown origin to fish of known origin to obtain geographic estimates of nursery areas. Our results indicate that the upper Missouri River constitutes an important paddlefish production area and that downstream paddlefish entrainment through multiple dams is an important mechanism in range-wide paddlefish population dynamics.

Title: SWH Construction Activities and Design Update – Omaha District

Author(s): Daniel B Pridal

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Abstract: An update of the Omaha District shallow water habitat construction, design, and monitoring activities that were undertaken during 2009 will be presented. A discussion of lessons learned and performance of past projects will also be included. The presentation will also address future SWH project design activities and modifications.

Title: Using GIS to Prioritize Cottonwood Restoration Site Selection on the Missouri River

Author(s): Lisa A. Rabbe¹, Kelly A. Burks-Copes², and Suzanne Boltz³ 1 US Army Corps of Engineers, Alaska District 2 Environmental Laboratory, US Army Engineer Research and Development Center 3 EA Engineering, Science and Technology

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Abstract: Today, the USACE is faced with the problem of carrying out engineering and construction activities while balancing competing social, environmental and economic demands in highly developed and highly controlled large river systems across the country. The challenge is to employ an integrated, risk-informed approach to decision making that encourages collaborative stakeholder participation from conception to implementation. The problem is one of transparency – negotiating trading offs of disparate information proffered by numerous stakeholders and interests groups in a holistic, yet adaptive manner. Expert-based sieve mapping offers one solution to integrating diverse attitudes and knowledge of system-wide drivers and stressors within a highly engaging visual medium that informs decision making in a cost effective and timely manner. Here we introduce CRISIS: Cottonwood Restoration Integrated Site Identification System – a participatory sieve-mapping GIS-based decision support system developed by the Cottonwood Management Team to engage experts in the identification of potential restoration and preservation targets. This GIS-based platform offers a visually engaging medium that promotes straightforward assimilation of criteria in a spatially meaningful manner, that can be implemented and “ported” to each of the priority segments up- and downstream with relative ease. Here, we will provide a detailed look at the site selection process and describe the process, the criteria, and the decision support tools we are using to locate and screen potential sites for our plan. We will conclude with a discussion of how these tools and processes have been automated to facilitate the site selection process in support of future segment evaluations.

Title: Ecosystem Modeling for the Missouri River Cottonwood Management Plan and It's Potential Uses and Relationship to MRERP

Author(s): Lisa A. Rabbe¹, Kelly A. Burks-Copes², and Suzanne Boltz³ 1 US Army Corps of Engineers, Alaska District 2 Environmental Laboratory, US Army Engineer Research and Development Center 3 EA Engineering, Science and Technology

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Abstract: In compliance with the USFWS Bi-Op regarding the Missouri River Operation activities, the USACE is pursuing restoration and preservation initiatives to offset past losses of cottonwood forests due in part to damming and channelizing the Missouri River in the early 1950s. Because the study area encompasses an enormous geographic range (1,500+ river miles flowing through 7 states), a decision was made to study the segments as identified by USFWS as moderate and high priority for bald eagle use and focus efforts on the local level. However, the functioning of the system's cottonwood riparian ecosystem can be affected by the current and future conditions at the local, regional and basin-wide scales. As such, the emphasis placed on a “systems” approach to the planning process has given rise to the need for methods to characterize habitat conditions now and in the future in a portable, adaptive manner with landscape-level sensitivity. As part of the cottonwood management planning effort, we have developed and applied a community-based cottonwood index model to characterize the current state of the ecosystem today, and evaluate/compare the outputs of proposed preservation. Here we provide a detailed look at the cottonwood model – its variables, formulas, and overall composition. A discussion of the modeling and application process will include our reference-based approach to calibration; the strategies used to forecast landuse conversion, forest succession, and potential global climate change factors; and ultimately the development of a standardized, integrated planning procedure that we plan to use to systematically evaluate the remaining segments indicated in the Missouri River Bi-Op's cottonwood management plan. In addition, MRERP is beginning a study that looks at several focal natural resources, and both the data and model used for this study can be adapted for potential use in that program as well.

Title: Laboratory Examination of Juvenile Pallid Sturgeon Habitat Preferences with Focus on Predation

Author(s): Tobias Rapp, Brian D.S. Graeb, Steven R. Chipps, Robert A. Klumb

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Abstract: Information on habitat requirements of pallid sturgeon (*Scaphirhynchus albus*) is crucial to support recovery efforts for this endangered species. We conducted a laboratory study to identify preferred water velocity, water depth, and substrate type and the effects of predation on habitat choice. Three velocity ranges (0 cm/s, 5-15 cm/s and 16-25 cm/s), two water depths, and three substrate types (sand, gravel and control) were tested. Investigation of velocity preferences indicated that juvenile pallid sturgeon prefer moderate velocities. Juvenile pallid sturgeon used shallow segments less than deep segments and positively selected sand and negatively selected gravel. Introduction of predators to the preferred substrate type (sand) resulted in a shift to less preferred substrates (primarily control) at no and low velocity treatments, but juvenile pallid sturgeon maintained positive selection for sand in high velocity trials. Preferred habitats identified in our study comprise moderate velocities, deep water, and sand substrate, but habitat selection changed under the threat of predation.

Title: Benthic Fishes Response to Chute Construction at Dalbey Bottoms: Results from Pre-construction Monitoring

Author(s): Clayton, J, Ridenour Tracy, D, Hill

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Abstract: Habitat restoration was identified as an important component to recovery of pallid sturgeon and other declining native fishes on Missouri River. Off-channel and backwater areas adjacent to the main river channel were once a common feature on Missouri River and many existing areas provide important nursery habitat for young fishes. Restored secondary channels create shallow-water habitat that benefit native species in other large rivers, and many young sturgeons have been found in reclaimed chutes on lower Missouri River. Construction of an off-channel chute at Dalbey Bottoms (RM 417) provided the opportunity to plan pre- and post-construction monitoring to assess its impact on pallid sturgeon and other native fishes. We collected over 2,700 fishes during three sampling events in the pre-construction phase of our monitoring plan. Small-bodied fishes (≤ 100 -mm) comprised 96% of our catch from small-mesh trawls; 117 were age-0 sturgeon. Shovelnose ($n = 140$, 57%) and pallid ($n = 14$, 6%) sturgeon were the first and fourth most abundant species, respectively, from trotlines. Most young fishes (except sturgeons) were found in slow velocity areas associated with two kicker- (spur-) dikes. Most age-0 sturgeons were found in a narrow band of moderate current associated with wing-dikes. Preliminary monitoring data suggests a constructed chute at Dalbey Bottoms could provide an important opportunity to significantly increase the quantity of nursery habitat for Missouri River fishes.

Title: Economic Impacts of Upper Missouri River Reservoir Fisheries

Author(s): Jim Riis, Chris Longhenry, Robert Hanten, Dave Fryda, Paul Bailey, Heath Headly, Jason Sorensen, Wes Bouska, and Jeff Schuckman

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Abstract: The Missouri River reservoirs contain quality fish populations and provide ample angling opportunities, which in turn, contribute significantly to the local and state economies in Montana, North Dakota, and South Dakota. Angler use and harvest surveys are frequently used to evaluate pressure and harvest on these fisheries, but also provide a means of evaluating the economic impact of that fishery. Total economic impact in 2009 was 77 million dollars on upstream reservoirs in the Dakotas. This presentation will describe fish harvest, fish catch rates, angler use, and the economic impact generated from Fort Peck, Sakakawea, Oahe, Sharpe, Francis Case, and Lewis and Clark reservoirs. The recent increase in water yield and the subsequent increase in water levels in Lake Oahe have improved angler access throughout the reservoir. Currently, 57 out of 60 Lake Oahe boat ramps in North and South Dakota are in usable condition after the most current rise in water levels and relate to increased use of the reservoir. In 2009, anglers spent an estimated 343,000 boat days fishing Lake Oahe compared to 155,000 boat days in 2003 when access was limited because many boat ramps were out of water. Water level management, water yield, and system storage along with environmental conditions all affect fish population dynamics in the Missouri River reservoirs. Production of both sport fish and prey fish species can be negatively influenced by poorly timed water management actions. For example, falling water levels during fish spawning seasons can leave fish eggs out of water and frequent water level fluctuations can decrease overall productivity in the system.

Title: Collaboration: It's Not for Sissies - The Storming, Norming, and Performing of the Missouri River Recovery Implementation Committee (MRRIC)

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Abstract: Section 5018 of the Water Resources Development Act of 2007 directed the establishment of the Missouri River Recovery Implementation Committee (MRRIC) to provide recommendations and guidance to federal agencies with respect to the Missouri River Recovery Program and mitigation activities as well as on a study that will result in a long-term plan. The Charter for the MRRIC was approved by the Assistant Secretary of the Army (Civil Works) on July 1, 2008, marking the culmination of 18 months of work by the MRRIC Planning Group, comprised of committed residents from throughout the basin. The Charter's foremost feature is its basis in consensus decision making. Following a membership selection process, the MRRIC held its first meeting at the end of September, 2008. Members include representatives from eight basin states, sixteen basin tribes, fifteen federal agencies, and twenty-eight stakeholder categories. During its first year of operation, seven MRRIC meetings were held throughout the basin. To allow members to better understand the recovery program and the issues facing fellow members, most meetings include an optional pre-meeting field trip. Plenary sessions include agency reports, information sharing, and business sessions. Much of MRRIC's work occurs in Work Groups, which focus on issue-specific topics. Achieving consensus recommendations on the existing Missouri River Recovery Program and the study that will result in the Missouri River Ecosystem Restoration Plan has challenged the members of the MRRIC. While much work remains, the first year of operation of the Committee has laid a firm foundation for the coming years.

Title: Proposed National Sediment and Water-Quality Monitoring Network Piloted in the Mississippi River Basin – A Synopsis

Author(s): David L. Rus, Dale W. Blevins, Charles R. Demas, John R. Gray, David C. Heimann, Arthur J. Horowitz, Chuck E. Shadie, James E. Stefanov, Richard C. Wilson, Andrew C. Ziegler

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Abstract: A National Sediment and Water-Quality Monitoring Network for rivers in the conterminous U.S., proposed by the U.S. Geological Survey and U.S. Army Corps of Engineers, would provide data that will help address the environmental, engineering, and socioeconomic impacts associated with water-borne sediments, nutrients, and sediment-associated chemical constituents. In addition to establishing a long-term record, the proposed multi-agency network also would improve the science of sediment and water-quality monitoring and the capability to manage water resources. This monitoring program will augment existing water-quality programs and provide a nationally consistent framework for smaller-scale monitoring and research by enabling source-to-sink tracking of sediments, and solid- and aqueous-phase chemicals, from headwater regions, through medium- and large-size river basins, and ultimately to coastal outlets. The network would be composed of some 400 to 450 sites at an annual estimated cost of \$75-\$90 million. Although the cost of this program is not minor, it can be shown to amount to less than 1-percent of the current annual estimated costs related to chemical, physical, and biological damages wrought by the movement and deposition of sediment. The initial phase of the proposed network focuses on the 2012 initiation of a Mississippi River Basin Pilot Program that would include some 68 monitoring sites and would be combined with the National Network once it is operational.

Title: An Initial Response of Pallid and Shovelnose Sturgeon

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Abstract: Freshwater ecosystems are increasingly vulnerable to anthropogenic shifts in the abiotic processes influencing their biotic communities. The biotic responses to these shifts vary, and can range from subtle changes in community composition to the extirpation of one or more species. The Missouri River, a highly modified freshwater ecosystem, traditionally had a diverse aquatic community. To document and assess the effects of shallow-water habitat restoration on fish communities in the Missouri River, the Habitat Assessment and Monitoring Program (HAMP) was initiated in 2005 by the U.S. Army Corps of Engineers. We will present the results from 2007-2009 HAMP data collected in five segments of the lower Missouri River. The analyses are being completed to determine the extent of differences in the relative abundance of target groups among bends of different types. Although most of the emphasis is placed on delineating how sturgeon and forage fishes respond to shallow-water habitat reconstruction, we also examine responses to some types of within-bend covariates (e.g. mesohabitat characteristics), as well as the variability of catch-per-unit-effort at different spatial and temporal scales. Within this context, the ecological needs of the target groups can be explored as they relate to the design and implementation of restoration efforts.

Title: Historical Riparian Cover Types in the Missouri Breaks National Monument

Author(s): Michael Scott¹, Gregor Auble¹, Mark Dixon², W. Carter Johnson³, Lisa Rabbe⁴, and Tammy Fancher¹
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Abstract: The Missouri River between Fort Benton and Fort Peck Reservoir retains much of the character it had when traversed by Lewis and Clark. However, the riparian cottonwood forest is generally sparse and discontinuous. Historical cover types are an important reference in considering the relative influences of natural geomorphic (valley width) and climatic (episodic ice drives) constraints and human actions (water management, grazing, direct cover type conversions, introduction and control of non-native Russian olive) on the current cottonwood forest.

We examined changes in riparian cover types derived from Missouri River Commission maps (1890's) and aerial imagery (1950's and 2006). There are three relatively distinct reaches: Fort Benton to the Marias River confluence; the Marias River confluence to Grand Island; and a short reach from Grand Island to Fort Peck Reservoir. All of these reaches have experienced channel narrowing or loss of channel area since the 1890's, likely a result of a combination of flow attenuation from upstream water management and climatic shifts from the 1800's.

In the middle, most constrained reach the relatively small area of riparian forest has changed very little from the 1890's to 2006. Most conversion to urban and other developed cover types has occurred in the Fort Benton to Marias River reach. Riparian forest has increased in this upper reach since the 1890's with some of the increase composed of Russian-olive stands. The short reach near Fort Peck reservoir has substantially more riparian forest per river length than the other reaches.

Title: The Big Muddy: Do Sediments from Agriculturally Intense Tributary Watersheds Affect Water Quality?

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Abstract: Bow Creek, a tributary of the Missouri River, drains a watershed characterized by intense row crop and beef cattle production; therefore, the presence of agrichemicals, would be expected. The objectives of this study were to determine the occurrence and biological effects of agrichemicals in the Bow Creek watershed and to determine if sediments from this watershed act as a source of biologically-active contaminants. To accomplish the first objective, polar organic chemical integrative samplers (POCIS) and caged fathead minnows were deployed at four sites within the watershed – Pearl Creek, Bow Creek, East Bow Creek (EB) and the confluence with the Missouri River (CON). POCIS were analyzed for pesticides and steroid hormones, while minnows were analyzed for the expression of estrogen-responsive genes. Females deployed at EB and CON experienced significant reductions in expression of estrogen receptor (an estrogen-responsive gene) relative to females deployed at the other sites indicating that these females had been defeminized. While pesticides were detected in POCIS, the observed defeminization could not be linked to any specific pesticide. To satisfy the second objective of this study, a laboratory study in which minnows were exposed to water, sediment or water and sediment from CON was conducted. Females exposed to sediment from the CON experienced reductions in estrogen receptor relative to unexposed and CON water-exposed females suggesting that the agent responsible for the defeminization of females is associated with sediments, rather than water. The results of this study highlight the potential importance of sediments in determining water quality.

Title: Survival of Least Tern and Piping Plover Nests on the Garrison Reach of the Missouri River

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Abstract: The Missouri River below Garrison Dam, North Dakota is an important component of the breeding range for federally listed least terns (*Sternula antillarum*) and piping plovers (*Charadrius melodus*). Understanding factors related to survival of least tern and piping plover nests is essential to identifying management needs critical to recovery of these species. In 2006 and 2007, we conducted intensive monitoring of least tern and piping plover nests within 17 4-RM segments between Garrison Dam (RM 1388) and River Mile 1304 south of Bismarck, ND. We examined the relation between nest survival and several potentially influential covariates, and evaluated the relative importance of each covariate. We grouped these variables into 5 broad categories representing principal mechanisms potentially influencing nest survival: (1) management activity, (2) human disturbance, (3) predation, (4) environmental conditions and habitat characteristics, and (5) temporal variation related to nest age and timing of nest initiation. Least terns and piping plovers nest in mixed colonies but may respond differently to these factors. Thus, we conducted separate analyses for terns and plovers to determine if similar factors were important to nest survival of these coexisting species. Patterns of variation in nest survival have implications for making management decisions consistent with the recovery of populations of these species and for designing programs to monitor progress toward recovery.

Title: Oil Production and Associated Demand for Water in Western North Dakota

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Abstract: The Oil and Gas Division of the North Dakota Industrial Commission estimates that up to 1800 new oil wells will be drilled annually for the next 10 to 15 years in western North Dakota. Enhanced oil recovery requires that the producing formation in each well be hydraulically fractured. The hydraulic fracturing process will require the injection of between 1.5 to 4.0 million gallons of water per well. Total maximum water demand over the next 15 years is estimated at about 331,400 acre-feet (22,100 acre-feet/year). Ground water sources in western North Dakota cannot provide the estimated quantities of water on a sustained basis for oil field applications. These aquifers can provide some water to enhance oil recovery. Currently, the North Dakota State Engineer has approved the appropriation of 2,340 acre-feet of water annually from glaciofluvial aquifers and there are additional ground water appropriations from glaciofluvial aquifers under evaluation requesting an additional annual appropriation of 5,534 acre-feet. All streams and rivers in western North Dakota, with the exception of the Missouri River, do not have sufficient year round flow to provide reliable water supplies for enhanced oil recovery. The only reliable source of water to meet the needs of the oil industry, in terms of both quantity and quality, is the Missouri River/Lake Sakakawea. The estimated annual oil field demand of 22,100 acre-feet amounts to about 60.5 acre-feet per day. To put this demand in perspective, the average daily flow of the Missouri River at Bismarck, North Dakota is 59,177 acre-feet. Currently, the State Engineer has approved an annual appropriation of 370 acre-feet from Lake Sakakawea for oil field applications. In addition, 5 water permit applications requesting a total annual appropriation of 31,170 acre-feet from Lake Sakakawea are in various stages of processing and evaluation.

Title: Alternative Energy Projects in the Missouri River Basin and EPA's Regulatory Role

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Abstract: Unique environmental challenges have been identified during EPA's participation in the regulation of the production of energy using alternative technologies. In addition to the discharge of process wastes to the air and water or storage of waste on the land, potential environmental impacts associated with actions supporting these technologies could constitute a greater threat to the environment than is off-set by the development of these alternative energy technologies. The 'net sum' of the impacts of these alternative technologies is difficult to identify and assess using available data and traditional regulatory tools. The Environmental Protection Agency develops regulations and administers accompanying regulatory programs which ultimately affect the development, construction and continuing operation of alternative energy projects and technologies. Many of these programs are implemented directly by or in conjunction with other Federal or State agencies. Within the Missouri River Basin, examples of alternative energy projects include coal bed methane production, uranium mining and milling, biofuel production, hydrokinetic processes and wind, geothermal and solar power production. Many of the potential impacts to the environment linked to these technologies are unknown or have not been studied, particularly those which are indirect or which might not be evident in the immediate future.

Title: Concentrations of Selected Metals in Uncontaminated Alluvial Deposits of the Cheyenne and Belle Fourche Rivers, South Dakota

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Abstract: Sediments contaminated with various metals from mining activities in the Black Hills have been deposited throughout downstream reaches of the Belle Fourche and Cheyenne Rivers in western South Dakota. Herein, we summarize the concentrations of selected metals in alluvial sediment deposited prior to the effects of mining and other anthropogenic activities that may have contributed to contamination in the basin. Such data provides estimates of concentrations of metals in "uncontaminated" sediment. Of particular interest are the concentrations of arsenic and mercury in sediment. Five sites identified as uncontaminated were selected for sampling. Samples were collected from terraces that were well above historical maximum flood levels at each of these sites. The chronology of terraces on the lower Cheyenne River is largely unresolved, but previous work, and results from this study, indicate that terraces as much as 75 meters above the channel may be as young as late Pleistocene to early Holocene. Samples were also collected from the active channel and floodplain at two sites on the Cheyenne River above its confluence with the Belle Fourche River. Arsenic concentrations from a total of 88 samples from terrace and channel sites had a geometric mean of 7.5 parts per million (ppm). The maximum arsenic concentration of the sample population was 34 ppm. An arsenic concentration of 35.6 ppm is three standard deviations greater than the geometric mean for arsenic concentrations from the 88 samples. In most samples, mercury was undetected or less than laboratory analytical reporting limits.

Title: Evaluation of Vegetation Removal and Control Methods to Create Emergent Sandbar Habitat on the Upper Missouri River

Author(s): Jared A. Stirling¹, Coral J. Huber¹, Michael J. Anteau², and Mark H. Sherfy² ¹ U.S. Army Corps of Engineers, Omaha District, Threatened and Endangered Species Section, Yankton, SD ² U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND

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Abstract: The Missouri River system provides important breeding habitat for the federally listed least tern (*Sternula antillarum*) and piping plover (*Charadrius melodus*). High flows in 1997 created abundant breeding habitat, but quantity and quality of this habitat has declined over time due to erosion and vegetation encroachment. The Corps, through the Emergent Sandbar Habitat (ESH) program, has undertaken vegetation removal efforts as one action to address this decline. We conducted an experiment to evaluate 4 different techniques for vegetation removal (combinations of herbicide and mechanical treatment) on vegetated sandbar habitat within 4 river segments (Gavins Point, Fort Randall, Lewis and Clark Lake, and Garrison) of the Upper Missouri River. Habitat data were collected at test sites and experimental controls during pre- and post-treatment periods. We will present the results from the first year of a two-year study. The final results of this experiment will be used to help select techniques for vegetation removal under the ESH program.

Title: Emergent Sandbar Variability as Affected by Mechanical Habitat Creation, Discharge, Erosion, and Plant Succession on 5 Segments of the Missouri River in 2006-2008

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Abstract: Recent technological advances in remote sensing and image analysis provide new tools to inventory and monitor riverscapes. We developed a prototype knowledge- and object-based method to inventory, map, and monitor interior least tern (*Sterna antillarum*) and piping plover (*Charadrius melodus*) habitat on the Missouri River. The partially automated method uses image segmentation and classification processes and rules developed from general knowledge of the spectral reflectance of land cover types, river landforms, and tern and plover habitats to construct a hierarchical representation of land cover and landform concepts, classes, and objects. Sandbar, island, and floodplain landform objects are classified, based on their land cover composition, into 1 of 10 fuzzy set classes. We applied the method to QuickBird imagery acquired annually in 2006-2008 for 5 segments of the Missouri River. QuickBird images for a river segment were acquired at a range of discharges within and among years, which confounds the interpretation of habitat availability for a segment at a point in time but provides information about habitat availability in relation to discharge. We describe variation in the area of landforms and land cover for the 5 segments of the Missouri River in relation to mechanical habitat creation, discharge, erosion, and plant succession. We describe the area and land cover composition of landform objects with known locations of least tern and piping plover nests. Maps of the current state of the riverscape together with the geomorphic potential of river reaches are an important monitoring component for adaptive management of the Missouri River.

Title: Assessment of Least Tern Foraging Habitats and Small Fishes of Gavins Point Reach and Lewis and Clark Lake

Author(s): Jennifer H. Stucker, Deborah A. Buhl, and Mark H. Sherfy

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Abstract: Federally endangered least terns (*Sternula antillarum*) nest on emergent sandbar habitats of the Missouri River, and forage in adjoining waters on small fishes. We conducted field research in 2006-2008 to quantify and describe fish, and foraging habitats used by least terns in proximity to mechanically created and naturally formed emergent sandbar habitats of the Gavins Point Reach, and Lewis and Clark Lake (2007). In the field, we measured habitat characteristics at successful Least Tern foraging sites, and nearby random locations. Mini-Missouri trawls (Missouri DOC) were used to sample fish every 2 weeks within shallow water habitat at 16 locations through the nesting season (late May to July). Successful tern foraging habitats (n=266) were best described by variation in depth. Using a matched pairs logistic regression, foraging site characteristics were evaluated for their importance, including depth, fish habitat types, substrate composition, and turbidity. Analysis of fish sampling focused on evaluating abundance of fish within size classes known to be used by Least Terns, <52 mm, and used a mixed modeling approach incorporating a strip-plot design. Fish abundance (total, shiner), and species richness were related to depth, but showed some variability within the season and across years. The smallest fish size classes, <33mm, important for tern chicks, were most abundant later in the reproductive period. Shiner abundance was greatest in late July. These results aid our understanding of the association between habitats used by least terns for foraging with the abundance and diversity of prey in shallow water habitats associated with emergent sandbar habitats.

Title: The Challenge of Identifying Sediment Sources in Superimposed Fluvial Channels: The Missouri and James Rivers, South Dakota

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Abstract: At the confluence of the James and Missouri rivers near Yankton, SD, mapping has revealed that historic channels of the James occupy former channels of the Missouri. Although the sources of sediments from these two rivers are different, identification of James versus Missouri River sands in superimposed channels has proven difficult. In order to accurately identify James and Missouri River sands, grain size and geochemical analyses of the sediments were performed. Samples were taken by hand auger from historic channels in the Meckling, Mission Hill, Jamesville, and Menno quadrangles in South Dakota, and Menominee and St. Helena quadrangles in Nebraska. In addition, sediments were collected from the modern Missouri and James River channels for comparison. Grain size analysis revealed few differences between Missouri and James River sediments. Sands from each river show a different stage of maturity: Missouri River sand is distinctly subrounded whereas James River sand contains an abundance of angular grains. Grain shape is a good indicator of source area and distance traveled, with rounder grains signifying greater distance traveled. Geochemical analysis of sand reveals that these river sediments have distinct major element concentrations reflecting different source areas and provides the most diagnostic criteria for sediment differentiation. Geochemical fingerprinting has allowed the identification of a historic James River channel that may correlate to a channel mapped by Lewis and Clark in 1804.

Title: Gap Analysis for the Missouri River Recovery Program

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Abstract: A Gap Analysis of the Missouri River Recovery Program (MRRP) was conducted in the summer of 2008 and updated during the winter of 2009. The focus was to evaluate the program's status in meeting applicable authorization and mandates (document any gaps and make recommendations on potential program refinements). The MRRP encompasses two major efforts: the Missouri River Bank Stabilization and Navigation Mitigation Project (BSNP) and activities under the 2000 Biological Opinion and 2003 Amended Biological Opinion (BiOp). The primary goals/objective for this effort are to achieve the BSNP authorization (3 items) and BiOp Reasonable and Prudent Alternative, RPA (69 elements); Reasonable and Prudent Measures, RPMs (21 measures); and Conservation Recommendations, CRs (15 recommendations). Metrics derived from the BSNP and BiOp allow the USACE to determine the level of effort needed in attaining goals set forth in the MRRP.

Title: Hydrokinetics: What's it All About

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Abstract: Randy Thoreson is an outdoor recreation planner with the Rivers, Trails and Conservation Assistance Program (RTCA) of the National Park Service. In addition, Randy has knowledge and works on a wide variety of hydroenergy projects that the NPS has authority to review and comment on. The latest hydro technology that has received local, national, and international attention is that of "hydrokinetics"-basically harnessing the energy from ocean, tidal, and river flow environments through a wide variety of methods. Mr. Thoreson will give an overview of hydrokinetics and its implications for river settings. He will also review recent proposals for the Missouri River, currently removed from formal action, for which a working understanding is still felt relevant.

Title: Independent External Peer Reviews (IEPR) of Decision Documents, Implications & Lessons Learned for Missouri River Recovery Program Projects

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Abstract: Recently published guidance regarding the U.S. Army Corps of Engineers' peer review process has implications for decision and implementation documents of Missouri River Recovery Program projects. In particular, Independent External Peer Review (IEPR) requirements impact documents of the Planning, Programs and Project Management Division as well as the Integrated Science Program. Corps policy establishes an accountable, comprehensive review strategy for Civil Works products, ensuring a) consistent application of policy, guidance, design criteria and more across the nation, b) the provision of scientifically sound, sustainable water resource solutions for the U.S. and c) compliance with numerous statutory and Administration requirements. Independent reviews are expected to be conducted on some projects of the Missouri River Recovery Program. Currently, an IEPR is being conducted on the Programmatic Environmental Impact Statement for the Mechanical Creation and Maintenance of Emergent Sandbar Habitat (ESH) on the Upper Missouri River. The review process for MRERP EIS, which could include multiple IEPRs, will result in a comprehensive watershed plan used to identify priorities for ecosystem restoration in the Missouri River basin undertaken by USACE and others. In addition, the Integrated Science Program is considering various science reviews in coordination with the Missouri River Recovery Implementation Committee (MRRIC). Lessons learned from the current reviews will be discussed.

Title: Intake Diversion Dam Modification, Collaborative Partnerships Lead to a Streamlined Process

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Abstract: The diversion dam associated with Bureau of Reclamation's Lower Yellowstone Project likely has impeded migration of the endangered pallid sturgeon for more than 100 years. In addition, monitoring indicates that an average of 500,000 fish of 36 species are annually entrained into the main irrigation canal. Section 3109 of WRDA 2007 authorized the Secretary of Army to utilize funding from the Missouri River Recovery Program to assist Reclamation with modifying the Lower Yellowstone Project for the purpose of ecosystem restoration. In October 2009, the Service amended the 2003 Missouri River Biological Opinion to include passage and entrainment protection at Intake as a RPA element. Pallid sturgeon are one of the rarest fish in the Missouri and Mississippi Rivers. The declining population of mostly mature pallid sturgeon in the Yellowstone River and Missouri River between Fort Peck Dam and Lake Sakakawea is expected to be locally extinct by 2018 if reproduction and survival of young fish does not occur. With the time sensitivity of the resource, the fish passage and entrainment protection project has been on a compressed schedule for planning and design. While there have been challenges associated with two agencies serving as co-leads, the collaborative partnerships between the Corps, Bureau of Reclamation, US Fish and Wildlife Service and the State of Montana have allowed project planning to proceed in a more streamlined, efficient manner. Commitment at all levels within these agencies is paving the way to success.

Title: Missouri River Mitigation, Wetland Restoration Functional Assessment

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Abstract: The Missouri River Mitigation Monitoring and Evaluation Subcommittee of the Mitigation Agency Coordination Team (ACT) was established in 2003. In 2007, the subcommittee determined that reptiles and amphibians were a good faunal group to use as an indicator of the quality of wetland restorations that have occurred as part of the Missouri River Mitigation Project. As a result, a technical team consisting of herpetofauna experts from Nebraska, Iowa, Kansas, and Missouri was established to develop protocols for an effective herp monitoring program. Protocols were developed to quantify the occurrence and recruitment of herpetofauna at existing mitigation sites and formulate models of quality wetland restoration based on this data. These models can then be used by biologists, engineers, and decision makers when planning future wetland restorations and making changes to existing wetland restorations using adaptive management.

Title: Asian Carp in the Missouri River: Analysis from Multiple Missouri River Habitat and Fisheries Programs

Author(s): Greg A. Wanner and Robert A. Klumb

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Abstract: Bighead carp *Hypophthalmichthys nobilis*, silver carp *H. molitrix*, black carp *Mylopharyngodon piceus*, and grass carp *Ctenopharyngodon idella*, collectively referred to as Asian carp, are invasive species introduced into the Missouri River. Knowledge of Asian carp population characteristics within this river were lacking. The objectives of this study were to describe the spatial and temporal trends of relative abundance, size structure, and condition of Asian carp using data from three long-term fish community monitoring programs in the Missouri River downstream of Gavins Point Dam, South Dakota and Nebraska from 2003 to 2007. A total of 1,307 bighead, 1,280 silver, 624 grass, and 0 black carp were captured. The majority of adult bighead carp were captured in overnight hoop nets (38%) and adult silver (14%) and grass carp (23%) were most commonly caught in overnight experimental gill nets. Mini-fyke nets captured almost exclusively, young of the year Asian carp (≤ 80 mm), while gill, trammel, and hoop nets collected a wide length range of fish (81 – 1,200 mm). The relative abundance of all three Asian carp species did not significantly differ among years; however, relative abundance was higher downstream of the Platte River. Asian carp condition also differed among Missouri River reaches. We found that multiple sampling gears are necessary to monitor Asian carp population characteristics in the Missouri River. Asian carp populations appear to be well established in the Missouri River and it is increasingly important to understand the affects these invasive species have on the native fish community.

Title: Comparison of Fish Communities in Recently Constructed Side-channel Chutes with the Main Channel Missouri River

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Abstract: Channelization of the Missouri River for navigation has drastically altered habitats historically found on the river. The result has been a loss of natural side-channels and shallow water spawning habitat for many river species. The Water Resources Development Acts have authorized the Corps of Engineers to re-established lost habitats including side-channel chutes. A recently conducted mitigation study looked at the fish communities in these constructed chutes but little has been done to compare the fish community in the main river to those in the chutes. Using data from the Pallid Sturgeon Assessment and the Chute Mitigation study (two similar studies funded by the Corps of Engineers), fish communities were compared for species richness, diversity and similarity. Both studies used a suite of gears (mini-fyke nets, trammel nets, and trawls) to sample available habitats and life stages of fish. Data was collected from 2006 to 2008 from April through October. Overall, fish communities differed little between the two habitats according to non-metric multidimensional scaling. However, chutes as a whole tended to have higher species richness. To this date chute design has not been very different from what is found in the main river and may be a leading factor in why there is similarity between the two communities. New designs or modifications of previous designs need to be evaluated to assess the value of these mitigated habitats.

Title: Techniques for Scientific Peer Review - A Perspective on Several Government Agencies and Professional Organizations

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Abstract: Water-resources-management decisions are being made based on results from scientific studies. It is important that the studies are valid. A basic premise of scientific study is the independent peer review of the methodology, results, and conclusions of the study. The peer review process for a report may vary depending on the originating government agency or professional organization. This presentation will compare the differences in peer review between several agencies and organizations.

Title: Sediment Distribution within Two Constructed Missouri River Chutes in Nebraska

Author(s): Brenda K. Woodward and David L. Rus

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Abstract: The Omaha District, U.S. Army Corps of Engineers has constructed 17 off-channel chutes along the channelized Missouri River. To better understand sediment transport within these constructed chutes, the U.S. Geological Survey Nebraska Water Science Center investigated specific aspects of chute sediment transport, including: (1) the effect of the inlet structure; (2) changes occurring between the inlet and the outlet of the chute; (3) the effect of the chutes on sediment transport in the main channel; and (4) the difference in chute dynamics between the two chutes sampled. The two chutes studied were Upper Hamburg near Nebraska City, and Glover's Point near Winnebago, Nebraska. Suspended- and streambed-sediment samples were collected from five transects within each site (two chute transects and three main-channel transects) along with turbidity and streamflow between June and November 2008. Samples were collected at Glover's Point on four separate occasions and on five separate occasions at Upper Hamburg. These data were compared using paired and standard t-tests. Comparative results showed that the chute-inlet structure reduced the amount of coarse suspended sediments entering the chutes. In addition, the Upper Hamburg chute was characterized by coarser streambeds, a wider channel, and much greater streamflows than the Glover chute. However, the other aspects of sediment transport that were explored (changes occurring within the chute and the effect of the chute on sediment transport in the main channel) did not indicate significant differences in the samples that were collected.

Title: Historic Changes and Water Quality Characteristics of Backwater Habitats on the 59-mile Segment of the Missouri National Recreational River

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Abstract: We evaluated historic changes in off-channel habitats and monitored water quality on restored and natural backwaters along the 59-mile segment of the Missouri National Recreational River (MNRR). Based on GIS analyses of historic aerial imagery, the total area of off-channel habitat declined from 186 hectares in 1941 to only 56 hectares in 2008. The total number, mean length, distance to the main channel, and mean area of the off-channel features also decreased from 1941 to 2008. Three backwater habitats have recently been restored within the 59-mile segment of the MNRR. Monitoring of the Gunderson Backwater (RM 777) was conducted in 2008 and 2009. Additionally, two other restored backwaters at Ponca State Park (RM 754) and Yankton, SD (RM 806), as well as two naturally occurring backwater complexes at RM 774 and RM 766 were added to the monitoring program in 2009. The water chemistry of these backwaters differed significantly from the adjacent main channel for phosphorus ($p=0.0533$), suspended solids ($p=0.0293$), total dissolved solids ($p=0.0182$), alkalinity ($p=0.0103$), specific conductivity ($p=0.0047$) and temperature ($p=0.0008$). Each individual backwater also revealed water chemistry patterns. These backwater features provide a valuable and unique habitat not found within the main channel of the river and the continued loss of this habitat could be detrimental to the overall river ecosystem.
