Upper Mississippi River Restoration–Environmental Management Program
Long Term Resource Monitoring Program Element
FY2014 Scope of Work

Outcome 1

Outcome 2

Outcome 4

Strategy

This Scope of Work (SOW) describes tasks in support of the US Army Corps of Engineers' Upper Mississippi River Restoration-Environmental Management Program (UMRR-EMP), authorized by Congress in the 1986 Water Resources Development Act and reauthorized in the 1999 Water Resources Development Act, to be performed by the USGS-Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, and six state-operated field stations (Illinois, Iowa, Minnesota, Missouri, and Wisconsin).

This SOW supports the UMRR-EMP Long Term Resource Monitoring Program (LTRMP) element's "Strategic and Operational Plan for the Long Term Resource Monitoring Program on the Upper Mississippi River System, Fiscal Years 2010-2014" (www.umesc.usgs.gov/ltrmp/ateam/Strategic_Operational_Plan_FINAL_30June2009.pdf). The top priority in the Strategic Plan and this SOW is collection, management, and serving of monitoring data. The tasks in this SOW align with priorities stated in the Strategic Plan.

Aquatic Vegetation Component

The objective of the LTRMP Aquatic Vegetation Component is to collect quantitative data on the distribution and abundance of aquatic vegetation in the Upper Mississippi River System (UMRS) and to conduct research related to aquatic vegetation for the purpose of understanding its status, trends, ecological functions, and responses to natural disturbances and anthropogenic activities. Aquatic vegetation in the UMRS is desirable because of its many values, most notably as food for migratory waterfowl (Korschgen et al. 1988) and habitat for fish. Monitoring data are collected within three LTRMP study reaches in the UMRS (Pools 4, 8, and 13 on the Upper Mississippi River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols. (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Methods

For monitoring aquatic vegetation, sampling will be conducted following the LTRMP aquatic vegetation standard sampling protocol (Yin et al. 2000). A total of 1,350 sites will be surveyed, including 450 in Pool 4, 450 in Pool 8, and 450 in Pool 13 (Table 1). The presence/absence and abundance of aquatic plant species at each site will be measured and recorded. Pool-wide estimates of abundance and percent frequency of occurrence will be derived by pooling data over all strata.

Product Descriptions

2014A5: A Summary of Data Collected in 2013 by the Wisconsin Department of Natural Resources in Navigation Pool 8 for the LTRMP.

We will develop a 2013 annual summary of data that combines current year observations from LTRMP with previous years' data, for the fish, aquatic vegetation, and water quality components. This information will serve as a tool to inform and remind Wisconsin decision-makers of the value of the resource to the state and the importance of the LTRMP. The summary will be distributed throughout the WDNR as an executive summary of our sampling program for those who do not have the time or inclination to analyze our data themselves, but have an interest in our activities and findings. The report will primarily utilize data from the graphical browsers and will

incorporate anecdotal observations, textual narratives, and new analyses where needed. We will include a hydrologic summary, sampling methods and effort, and component-specific findings of interest. We will reference the graphical browsers for routine tabular and graphical information, displaying specific examples where useful for illustrating key points. UMRR-EMP and Mississippi River managers will find the report to be a timely and useful synopsis of the past year's conditions as related to the period of record. This work ties to the LTRMP Strategic Plan Outcome 1; Output 1.1, Output 4.1

2014A6: Annual Field Station Data Summary Report Template Development

Using the Wisconsin data summary (see above 2014A5) as a template, this report template will be developed in FY14, for implementation at all remaining field stations in 2015. Estimated level of effort per field station to develop this report template is 1.5 weeks per component, 1.5 weeks final editing.

This work supports the UMRR-EMP Long Term Resource Monitoring Program 2010-2014 Strategic and Operational Plan, dated 30 June 2009, Outcome 1; Output 1.1, Output 4.1: Providing information to the partnership and managers has been identified as a recurring need.

Priority products for FY14 include: Final template for annual field station data summary from each LTRMP Field Station, using the FY13 Wisconsin product as a template, for implementation in FY15, annual updates thereafter.

Products and Milestones

Tracking number	Products	Staff	Milestones
2014A1	Complete data entry and QA/QC of 2013 data; 1250 observations.		
	a. Data entry completed and submission of data to USGS	Moore, Langrehr, Petersen	30 November 2013
	b. Data loaded on level 2 browsers	Schlifer	15 December 2013
	c. QA/QC scripts run and data corrections sent to Field Stations	Sauer, Schlifer	28 December 2013
	d. Field Station QA/QC with corrections to USGS	Moore, Langrehr, Petersen	15 January 2014
	e. Corrections made and data moved to public Web Browser	Sauer, Schlifer, Caucutt	30 January 2014
2014A2	WEB-based annual Aquatic Vegetation Component Update with 2013 data on Public Web Server.		
	a. Develop first draft	Sauer	30 March 2014
	b. Reviews completed	Moore, Langrehr, Petersen, Sauer, Yin	15 April 2014
	c. Submit final update	Sauer	30 June 2014
	d. Placement on Web with PDF	Sauer, Caucutt	31 July 2014
2014A3	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	Yin, Moore, Langrehr, Petersen	31 August 2014
2014A4	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2013 data	Yin, Rogala, Schlifer	31 July 2014
2014A5	Wisconsin DNR annual summary report 2013 that combines current year observations from LTRMP with previous years' data, for the fish, aquatic vegetation, and water quality components.	Fischer, Langrehr, Bartels, Giblin, Hoff	30 Sept 2014

2014A6	Annual Field Station Data Summary Report Template Development	Popp, Bierman, Chick, Herzog, Casper, Hagerty	30 Sept 2014
2014A7	Final draft report: Identification of maximal flow velocity threshold for colony of *Vallisneria americana* along the channel border of the Upper Mississippi River (2013A8)	Yin	15 Sept 2014
	On-Going		
2012A6	Draft LTRMP completion report: Fifteen years (1998–2012) of aquatic vegetation in Pool 4 of the Upper Mississippi River.	Moore	30 April 2014
2013A8	Draft report: Identification of maximal flow velocity threshold for colony of *Vallisneria americana* along the channel border of the Upper Mississippi River–Extension of modeling capabilities for aquatic vegetation (contract award July 2013)	Yin	15 June 2014

Intended for distribution
Completion report: LTRMP Aquatic Vegetation Program Review (2007A9; Heglund)
LTRMP Technical Report: Ecological Assessment of High Quality UMRS Floodplain Forests (2007APE12; Chick, Guyon, Battaglia)
LTRMP Technical Report; Experimental and Comparative Approaches to Determine Factors Supporting or Limiting Submersed Aquatic Vegetation in the Illinois River and its Backwaters (2008APE5, Sass)
LTRMP completion report: FY05-07 data--Analysis and support of aquatic vegetation sampling data in Pools 6, 9, 18, and 19 (2008APE4a; Yin)
Manuscript: Have the recent increases in aquatic vegetation in Pools 5 and 8 been the result of water level management drawdowns, HREPs, or natural fluctuations? (2009APE1a; Yin)
Manuscript: A statistical model of species occupancy using the LTRMP aquatic vegetation data (2013A7; Yin)
WI DNR annual 2012 data summary report (2013A5; Fischer, Langrehr, Bartels, Giblin, Hoff)

Literature Cited

Hirst, S. M. 1983. Ecological and institutional bases for long-term monitoring of fish and wildlife populations. Pages 175–178 in John F. Bell and Toby Atterbury, editors. Renewable Resource Inventories for Monitoring Changes and Trends. Proceedings of an International Conference, August 15–19, 1983, Corvallis, Oregon. College of Forestry, Oregon State University. 737 pp.

Ickes, B. S., and R. W. Burkhardt. 2002. Evaluation and proposed refinement of the sampling design for the Long Term Resource Monitoring Program's fish component. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, October 2002. LTRMP 2002-T001. 17 pp. + Appendixes A–E. CD-ROM included. (NTIS PB2003-500042)

Korschgen, C. E., L. S. George, and W. L. Green. 1988. Feeding ecology of canvasbacks staging on Pool 7 of the Upper Mississippi River. Pages 237–250 in M. W. Weller, editor. Waterfowl in winter. University of Minnesota Press. Minneapolis.

McDonald L., T. McDonald, and D. Robertson. 1998. Review of the Denali National Park and Preserve (DENA) Long-Term Ecological Monitoring Program (LTEM). Report to the Alaska Biological Science Center Biological Resources Division, USGS. WEST Technical Report 98–7. 19 pp.

Moore, M., H. Langrehr, and T. Angradi. 2012. A submersed macrophyte index of condition for the Upper Mississippi River. Ecological Indicators 13:196–205.

Strayer, D., Glitzenstein, J. S., Jones, C. G., Kolasoi, J., Likens, G. E., McDonnell, M. J., Parker, G. G. and Pickett, S. T. A. 1986. Longterm ecological studies: an illustrated account of their

design, operation, and importance to ecology. Occasional Publication of the Institute of Ecosystem Studies, No.2. Millbrook, New York.

Yin, Y., J. S. Winkelman, and H. A. Langrehr. 2000. Long Term Resource Monitoring Program procedures: Aquatic vegetation monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. April 2000. LTRMP 95-P002-7. 8 pp. + Appendixes A–C.

Fisheries Component

The objective of the LTRMP Fisheries Component is to collect quantitative data on the distribution and abundance of fish species and communities in the UMRS and to conduct research related to fishes for the purpose of understanding resource status and trends, ecological functions, and response to natural disturbances and anthropogenic activities. The UMRS is probably the most biologically productive and economically important large floodplain river system in the United States (Patrick 1998; U.S. Geological Survey 1999), and fish are one of the most important goods and services the UMRS provides to humans (Carlander 1954). Fishes within the UMRS are the subject of commercial and recreational fisheries, both of which contribute substantially to local economies (Fremling et al. 1989). Scientists and fishery managers also recognize fish communities as an integrative index for a complex set of physical and biological conditions on the UMRS.

Data are collected within six LTRMP study reaches in the UMRS (Pools 4, 8, 13, and 26 and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Gutreuter et al. 1995; Ickes and Burkhardt 2002). (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Methods

For monitoring fish, sampling will be conducted following the LTRMP study plan and standard protocols (Gutreuter et al. 1995), as modified in 2002 (Ickes and Burkhardt 2002). Species abundance, size structure, and community composition and structure will be measured over time. Between 250 and 400 samples will be collected in each study area (Table 1). Sample allocation will be based on a stratified random design, where strata include contiguous backwaters, main channel borders, main channel wingdams, impounded areas, and secondary channel borders. Tailwaters in the impounded reaches and tributary mouths in the Open River will be sampled under a fixed site design. Sampling effort will be allocated independently and equally across 3 sampling periods (June 15–July 31; August 1–September 15; September 16–October 31) to minimize risks of annual data loss during flood periods and to characterize seasonal patterns in abundance and habitat use. Pool-wide estimates of abundance will be derived by pooling data over all strata.

Product Descriptions

2014B7: Asian Carp Age and Growth(This is a continuation of the work carried out in FY2013 (2013B6) by the Illinois River Biological Station [IRBS].)

Population age structure is critical to understanding about population responses of fishes. For invading species, growth is often an early indicator of changes in population density. Illinois River Biological Station (IRBS) staff began collecting and archiving unprocessed Asian Carp cleithral bone samples (the major bony component of the pectoral girdle of carp) in 2011 from LTRMP and other projects for future age and growth analysis. Developing this archive was a low cost hedge against the programs future need to know what the response of this invasive species to UMRR-EMP activities might be. As a next step, we are also proposing to begin laboratory method development and initial exploratory analysis as part of the FY14 scope. If this initial data area is validated, then the analysis and application can be expanded and integrated into the UMRR-EMP during future scopes of work.

To ensure that a representative sample of the bighead and silver carp populations is obtained from the La Grange Reach, cleithrums are removed from Asian carp captured from all the major habitat strata within this reach of the Illinois River: main channel border, side channel border, and backwaters. Asian Carp cleithral bones are extracted from fish collected during routine LTRMP fish sampling and processed in the laboratory. Age and growth analysis will follow established fisheries methods (Slipke and Maceina 2010: Fisheries Analysis and Modeling Stimulator). These collections will be supplemented by information and labor from other ongoing projects at the IRBS funded by the Illinois Department of Natural Resources. We will opportunistically seek funding to process these collections and analyze these data in future years, either through funding sources outside of LTRMP or through a defined project under LTRMP. Preliminary analyses of a limited number of cleithrum samples will be conducted in FY2014 with the goal of identifying and defining the logistics of laboratory processing efforts needed to age Asian carp with these structures.

The goals of this effort are: 1) to continue to develop an archive of Asian Carp cleithrum samples; 2) to develop written lab protocols; and 3) to perform exploratory analysis of the a sub-sample of the archive to validate laboratory methods. This work addresses the LTRMP Strategic Plan Outcome 2: Enhanced knowledge about system process, function, structure, and composition, Output 2.1: Insights about river process, function, structure, and composition based on long-term data sets: Understanding how Asian carp alter ecosystem processes and impact native species is important in order to restore the UMRS and design HREPs to promote native species versus Asian Carp.

2014B8: Native Fish Community Response to Asian Carp Reduction Effects (This is a continuation of the work carried out in FY2013 (2013B7) by the Illinois River Biological Station.)

LTRMP staff at IRBS will assist with ongoing Asian Carp Reduction project led by Dr. Jim Garvey, Southern Illinois University Carbondale. LTRMP-funded staff will leverage LTRMP fisheries and water quality data to assist in investigations conducted by Dr. Garvey to assess changes in the fish community associated with reduced Asian carp populations in the Illinois River (project funded through the Great Lakes Research Initiative). Initiation and completion of these analyses will depend on when and if the Asian carp reduction goals are achieved. Furthermore, it will take time for the native fish community to respond to reductions in Asian carp populations, so we only anticipate assisting with preliminary analyses during FY2014. These analyses will be conducted by Casper through support from INHS.

The Asian Carp Reduction project (funded through the Great Lakes Restoration Initiate (GLRI)) is based on the idea that lowering numbers of Asian Carp in the Illinois River through a variety of approaches will keep Asian Carp density below the level where the basic structural and functional attributes are affected. Sharing data with the GLRI reduction project, LTRMP data provides an opportunity to test whether this approach may be another tool useful for UMRR-EMP to better understand impacts to ecosystem processes the program is seeking to restore. This work supports the LTRMP Strategic Plan, Outcome 2: Enhanced knowledge about system process, function, structure, and composition, Output 2.1: Insights about river process, function, structure, and composition based on long-term data sets: Understanding how Asian carp alter ecosystem processes and impact native species is important in order to restore the UMRS and design HREPs to promote native species versus Asian Carp.

2014B9: Exploring Years with Low Total Catch of Fishes in Pool 26

In Pool 26 of the UMRS, the total number of fishes captured through LTRMP sampling declined by 55 to 65% for the years 2009 – 2011, relative to our long-term average total catch. We will explore the underlying dynamics of this pattern, identifying which species showed declines and exploring whether unusual physical-chemical conditions were present that may have influenced gear performance (catchability), or the fish populations through ecosystem dynamics.

We envision our work during the FY2014 fiscal year to be largely exploratory. We will: 1) ascertain whether the observed trends in total catch were equally distributed among species or concentrated in a few species, 2) identify physical-chemical factors with distinct or anomalous patterns during this time period, and 3) identify further data needs and analyses that should be carried out after this fiscal year. We anticipate that more detailed analyses, possibly incorporating other LTRMP (e.g., water quality data, data from other trend areas) and non-LTRMP data sources (e.g., LTEF, state DNR collections) may ultimately be required to more fully understand potential factors influencing the observed total catch trends. These efforts would not be completed in FY2014, but may be submitted as proposals for future work. A power-point presentation detailing our preliminary findings will be given at the 2014 Mississippi River Research Consortium meeting. This project links directly to the LTRMP Strategic Plan via Outcome 1: Enhanced knowledge about system status and trends; Output 1.1: Status and trends information based on long-term data sets for aquatic vegetation, water quality, fish, and land use/land cover; Outcome 2: Enhanced knowledge about system process, function, structure, and composition; Output 2.1: insights about river process, function, structure, and composition based on long-term data sets. This project will be limited to statistical analysis of LTRMP fisheries data and physical-chemical data.

2014B10: Paddlefish population characteristics in the Mississippi River Basin

Historically, paddlefish (*Polyodon spathula*) were once abundant throughout the Mississippi River basin; however, recent studies (insert citations) suggest these paddlefish populations have declined. Most studies suggest the major reason for declines relates to habitat modifications and overharvest. In terms of habitat modifications: channelization, river training structures, levees (disconnection of the main river to its floodplain), and dams have altered traditional habitats leading to reduced populations. Dams impede spawning migrations, thus reducing available spawning habitat and subsequently creating areas of massive congregation, which increases their susceptibility to exploitation. Furthermore, paddlefish are vulnerable to harvest by both commercial and recreational fishing due to their predictable spawning runs and habitat preference. Commercial fishing predominantly targets the roe bearing females for caviar while recreational fisheries are predominately flesh fisheries (i.e., generally smaller immature paddlefish). Because these sectors are harvesting different portions of the population, the relative influence on the dynamic rate functions (i.e., recruitment, growth, and mortality) must be taken into account for fishery management decisions. We will use data from the LTRMP along with existing Missouri Department of Conservation Mississippi River information to report previously unknown paddlefish demographic information.

This project addresses the 2010-2014 LTRMP Strategic and Operational Plan:

Output 1.1 Output 1.1 – status and trends information based on long-term data sets for aquatic vegetation, water quality, fish, and land use/land cover

- Identify the existing population characteristics of paddlefish in the UMRS.

- The LTRMP data can couple with state agency data and be used for state and federal agencies responsibilities in species management.

Output 3.1: Use of LTRMP infrastructure, data sets, and expertise to help formulate, design, and evaluate ecological restoration projects

- Floodplain habitats are critical to many native fishes –including the paddlefish. Linkage of paddlefish population characteristics to habitat availability can be investigated given a baseline data set exists.

Output 4.1: Key decisions are informed by LTRM data, research, and decision support tools.

- Paddlefish are the largest native planktivore in the UMRS. Invasive planktivores have been identified as an emerging issue that requires further development within the partnership. Population characteristic baseline data will assist managers in determining long term trends relative to invasive planktivores.
- River managers can use the data to further understanding of harvest sector. The USFWS office of Scientific Authority wishes to understand paddlefish harvest sustainability in the UMRS.

The purpose of this evaluation is to assess baseline demographic information for paddlefish in the Mississippi River basin. Specifically, we seek to assess the age structure, size structure, and sex ratio of paddlefish throughout the above mentioned location. This will provide a suite of information needed to properly manage paddlefish population throughout the Mississippi River basin.

2014B11: Examining recruitment patterns in Fishes in the Mississippi River

Environmental factors are often influential in shaping biotic communities and can have a vital impact on fish reproduction and recruitment in large rivers. The Upper Mississippi River is a highly regulated river, with channelization, dams, and disconnected floodplains all influencing riverine fish population structure and dynamics. Therefore it is important for river managers to understand the interaction of environmental variables (i.e., river stage/discharge and temperature) and annual variation in riverine fish recruitment and to understand recruitment variability of the most commonly collected riverine fish species in the Mississippi River is important for big river fisheries management. Historic LTRMP fish data will be analyzed along with current 2013 data, to determine age–0 abundance of the most commonly collected species. Existing literature will be used to develop age-0 size ranges for each specific species. USGS hydrological data (river stage and flow patterns) coupled with temperature data will be used to evaluate the relationship between these environmental variables and annual recruitment of riverine fish species.

This project addresses the 2010-2014 LTRMP Strategic and Operational Plan:

Output 1.1 Output 1.1 – status and trends information based on long-term data sets for aquatic vegetation, water quality, fish, and land use/land cover

- Identify and examine fish recruitment patterns of UMRS using fisheries and water quality data.
- Fish recruitment will be investigated using environmental relationships of system processes.

Output 3.1: Use of LTRMP infrastructure, data sets, and expertise to help formulate, design, and evaluate ecological restoration projects

- Patterns in recruitment may be linked with physical habitats in the UMRS. Examining data relationships will allow managers to enhance or restore lacking processes.

Output 4.1: Key decisions are informed by LTRMP data, research, and decision support tools.

- River managers can use the data to further understanding of recruitment and expectation of out-year harvest. The regulatory process will be informed regarding trends in recruitment relevant to available year classes in the populations.

2014B12: Collection and exploratory analysis of age and grow data for catfish in the La Grange Pool

Continued collection and exploratory analysis of the age and growth data for catfish and potentially for other dominant La Grange Pool/UMRS species based on otolith and cleithrum bone structure methodology. Collections are made during routine sampling by plucking spines (in the case of catfish) or field dissection (other species) and placing the structures in archive envelopes that are stored in the office for eventual processing. Depending on species these bony structures have been collected over several years and the resulting age and growth calculations can be used to assess population structure and function. We propose to process and analyze a sub-set in an attempt to assess how useful this type of data might be for evaluating UMRR-EMP activities and projects. This on-going data mining work will be secondary to the collection and processing of data and maintenance of field capability. All aspects can be done during periods without collection or processing responsibilities. Asian Carp cleithral bones are extracted from fish collected during routine LTRMP fish sampling and processed in the laboratory. Age and growth analysis will follow established fisheries methods (Slipke and Maceina 2010: Fisheries Analysis and Modeling Simulator version 1).

This work benefits the UMR-EMP and river managers by supporting several components of the 2010-2014 LTRMP Strategic Plan (30 Jun 2009 version); Outcome 2: Output 2.1: Insights about river process, function, structure, and composition based on long-term data sets; Outcome 3: Output 3.1: Use LTRMP infrastructure, data sets, and expertise to help formulate, design, and evaluate ecological restoration projects - - Understanding how Asian carp impact native species is important in order to design future HREPs and accurately evaluate their influence on the UMRS.

LEVERAGED PRODUCTS (L)

2014B13(L): Assessment of Asian Carp Exploitation by native Piscivores in the Illinois River

This is leveraged work carried out in collaboration with Western Illinois University (WIU - Dr. James Lamer's laboratory) and the Illinois River Biological Station (IRBS). The funding, design and execution of this project are the responsibility of WIU. The IRBS will serve in a supporting role by providing LTRMP expertise and building workspace. This is an independent project receiving no direct UMRR-EMP and is not requesting any UMRR-EMP funding; therefore this effort should not be part of the UMRR-EMP funding/timeline schedule. It is simply presented here to illustrate a leveraged LTRMP expertise activity. Upon completion of this thesis project, UMRR-EMP could potentially gain knowledge on native-invasive interactions that may 1) help explain some of

LTRMP monitoring results; 2) guide future LTRMP research frameworks; and 3) have implication for other LTRMP activities and HREP design.

The LTRMP staff at IRBS will assist with ongoing Master's thesis project through Dr. James Lamer at Western Illinois University. LTRMP-funded staff will provide LTRMP fisheries and water quality data, access to Survey funded space and equipment, and expertise to assist in investigations conducted by Dr. Lamer and his MS student to assess the likelihood that Asian Carp may be a food resource for native piscivores.

Goals and Objectives: Collection and gastric lavage of 30-50 individuals of 5 different native piscivores (Blue catfish, White Bass, Bowfin, Gar, and other depending on catch). This effort that leverages LTRMP data from routine samplings with separate site-specific, ad-hoc analysis conducted as part of a Master's thesis at WIU (tentatively scheduled for FY15, but subject to change), therefore should not be considered as a pilot study for UMRR-EMP.

2014B14: State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2013

This State report contains summaries and analyses of selected features of fish communities and fish populations from data collected since the LTRMP fish component was initiated on Pool 13. This report will focus on: 1) the relative abundance of commonly collected species; 2) trends in catch-per-unit-effort (CPUE) of selected game and prey species; and, 3) the detection of uncommon or rare species. This work supports Outcome 4 the LTRMP's Strategic Plan: Enhanced ecological understanding to inform decisions.

DONATED PRODUCTS (D)

2014B15(D): Database addition; Special Project—Stratified random day electrofishing samples collected in Pools 9, 10, and 11.

The Iowa DNR's Guttenberg Fisheries Management Station began collecting SRS fisheries data in Pools 9 - 11 this summer. These data will expand the spatial extent of the current LTRMP sampling. Species richness and relative abundance are among some the fisheries metrics that can be gleaned from these data, and they can be directly compared to similar metrics in the LTRMP key pools. These data may also serve as a control to assess natural variation when evaluating fisheries responses to HREP projects. At this time, this project only includes data storage. No plans currently exist within LTRMP to analyze these data unless funding becomes available. Data are available by contacting the LTRMP Data Manager at USGS-Upper Midwest Environmental Sciences Center. This work supports Outcome 1; output 1.4 of the LTRMP's Strategic Plan: Enhanced knowledge about system status and trends.

2014B16(D): Database addition; Special Project—Stratified random day electrofishing samples collected in Pools 16–18

The Iowa DNR's Fairport Fisheries Management Station has six years of what may be the equivalent of LTRMP "outpool sampling" data (2006–present) This data will potentially bridge the gap of the fundamental lack of consistent and standardized fisheries information between key LTRMP pools—Pools 13 and 26, in this case. Species richness and relative abundance are among some the fisheries metrics that can be gleaned from this data, and they can be directly compared to similar metrics in the LTRMP key pools. This data may also serve as a control to assess natural variation when evaluating fisheries responses to HREP projects. This is something that the larger

contingencies of river managers have asked for a long time. At this time, this project only includes data storage. No plans currently exist within LTRMP to analyze these data unless funding becomes available. Data are available by contacting the LTRMP Data Manager at USGS-Upper Midwest Environmental Sciences Center. This work supports Outcome 1; output 1.4 of the LTRMP's Strategic Plan: Enhanced knowledge about system status and trends.

Products and Milestones

Tracking number	Products	Staff	Milestones
2014B1	Complete data entry, QA/QC of 2013fish data; ~1,590 observations		
	a. Data entry completed and submission of data to USGS	DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Michaels	31 January 2014
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	Schlifer	15 February 2014
	c. Field Station QA/QC with corrections to USGS	DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Michaels	15 March 2014
	d. Corrections made and data moved to public Web Browser	Sauer and Schlifer	30 March 2014
2014B2	Update Graphical Browser with 2013 data on Public Web Server.	Sauer, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Michaels, Schlifer	31 May 2014
2014B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool (Table 1)	Ickes, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Michaels	31 October 2014
2014B4	Final draft fact sheet: Tree map tool for visualizing fish data, with example of native versus non-native fish biomass (2013B16)	Schlifer, Sauer	30 Sept 2014
2014B5	Final draft completion report: summary of data extraction & metadata for archiving of UMRS floodplain disturbance histories (2008APE1a/2013B4)	Ickes	30 September 2014
2014B6	Summary letter on Asian carp age and growth: collection of cleithral bones	Solomon, Casper	31 January 2014
2014B7	Preliminary analysis and summary letter: Asian Carp Age and Growth	Solomon, MeClelland, Casper	30 Sept 2014
2014B8	Letter Summary: Native fish community response to Asian Carp reduction efforts	Casper, McClelland, Solomon	30 Sept 2014
2014B9	Letter Summary: Exploring Years with Low Total Catch of Fishes in Pool 26	Gittinger, Ratcliff, Lubinski, Chick	30 Sept 2014
2014B10	Presentations, draft completion report: Paddlefish population characteristics in the Mississippi river Basin	Hupfeld, Phelps	Dec 2015
2014B11	Presentations, draft completion report: Examining recruitment patterns in Fishes in the Mississippi River	West, Sobotka, Hupfeld, Phelps	30 Sept 2014
2014B12	Database increment, Letter summary:	Solomon, Casper	30 Sept 2014

	Collection and exploratory analysis of age and growth data for catfish in La Grange Pool		
2013S3	Prepare read ahead on use of LTRMP fish monitoring methods to EMPCC	Solomon, Casper	31 Dec 2013
2013S4	Present findings at EMP CC and UMRCC and/or MRCC conference (if funding for travel available)	Solomon, Casper	Spring 2014
2014B13(L)	Advisory role for Assessment of Asian carp exploitation by native piscivores in the Illinois River (Western Illinois University)	Casper	NA (WIU product)
2014B14	IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2013	Bowler	30 June 2014
2014B15(D)	Database increment: Stratified random day electrofishing samples collected in Pools 9 - 11	Bowler	30 Sept 2014
2014B16(D)	Database increment: Stratified random day electrofishing samples collected in Pools 16–18	Bowler	30 Sept 2014
2014B17	Draft LTRMP Program Report: Monitoring Rationale, Strategy, Issues, and Methods (UMRR-EMP LTRMP Fish Component; off-shoot of 2013B5)	Ickes, Sauer, and Rogala	30 June 2014
2014B18	Final Draft LTRMP Technical Report: Annotated empirical response curves for Upper Mississippi River System fishes" (AHAG 2.0), (2013B28)	Ickes, Sauer, Richards, Bowler, and Schlifer	30 Sept 2014
	On-Going		
2006B6	Draft manuscript: Spatial structure and temporal variation of fish communities in the Upper Mississippi River. (Dependent on 2008B9 acceptance into journal)	Chick	30 Sept 2014
2008B9	Draft manuscript: Standardized CPUE data from multiple gears for community level analysis (a previous manuscript was submitted and rejected by the journal, 2006B5; 2008B9 is a revised manuscript) (Chick)	Chick	15 Dec 2013
2012B8	Draft manuscript: Influence of Asian carp on planktivorous fish	Phelps	31 Dec 2013
2013B12	Final draft LTRMP report: Testing the Fundamental Assumption underlying the use of LTRMP fish data: Does variation in LTRMP catch-per-unit-effort data reflect variation in the abundance of fishes? (2007APE3)	Chick	22 Nov 2013
2013B17	Shovelnose sturgeon habitat use in the UMR (data sets, analysis, presentations, draft manuscript)	Phelps	31 Dec 2013
2013B19	Channel catfish habitat evaluation (data sets, analysis, presentations, draft manuscript)	Phelps	31 Dec 2013
2013B26	White Paper: UMRR-EMP LTRMP Capability Related to Asian Carps	Hubbell, Chick, Casper, Phelps, Solomon, Lubinski	31 Dec 2013
	Intended for distribution		
Completion report: LTRMP Fisheries Component collection of six darter species from 1989–2004. (2006B13; Ridings)			
Evaluating the effectiveness of a mandatory catch and release regulation on a riverine largemouth bass population (2007B7; Bowler)			

LTRMP Report: An Evaluation of Macroinvertebrate Sampling Methods For Use In The Open River Reach of The Upper Mississippi River; Kathryn N. S. McCain, Robert A. Hrabik, Valerie A. Barko, Brian R. Gray, and Joseph R. Bidwell (2005C2)
LTRMP technical report: Relationship of juvenile abundance of select fish species to aquatic vegetation in Navigation Pools 4, 8, and 13 of the Upper Mississippi River, 1998-2007 (2007B5; 2009B5; Popp and DeLain)
LTRMP technical report; Setting quantitative fish management targets for LTRMP monitoring (2008APE2; Sass)
LTRMP Completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish; Chick et al.)
Manuscript: American eel population characteristics in the Upper Mississippi River (2012B7; Phelps)
LTRMP fisheries component procedures manual (2013B5; Ratcliff, Gittinger, Ickes)
Manuscript: Determining environmental history of three sturgeon species in the Upper, Middle, and Lower Mississippi Rivers. (2013B22; Phelps)
Manuscript: A pilot evaluation of the commercial and recreational harvest of paddlefish (*Polyodon spathula*) in Missouri, (2013B24; Phelps)
Manuscript: Sauger life history in the lower portion of the Upper Mississippi River (2013B20, Phelps).
Manuscript: Age-0 sturgeon habitat associations in the free flowing portion of the Upper Mississippi River (2012B5; Tripp, Phelps, Herzog)
Manuscript: development of an Asian Carp Size Structure Index and Application through Demonstration (Phelps, Willis) (2013)

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Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long Term Resource Monitoring Program procedures: Fish monitoring. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P002-1. 42 pp. + Appendixes A–J

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Ickes, B. S., M. C. Bowler, A. D. Bartels, D. J. Kirby, S. DeLain, J. H. Chick, V. A. Barko, K. S. Irons, and M. A. Pegg. 2005. Multiyear synthesis of the fish component from 1993 to 2002 for the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. LTRMP 2005-T005. 60 pp. + CD-ROM (Appendixes A–E). (NTIS PB2005-107572)

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Addendum: Long-term changes in fish community structure in relation to Asian carp establishment

Introductions of non-native species have the potential to alter existing community structure within aquatic habitats. Using data from the LTRMP, we will assess similarity of the fish community within the La Grange Reach of the Illinois River before and after the establishment of Asian carp (*Hypothalmychthyes* spp.). Data will include mean annual species catch-per-unit effort among several sampling gears (day electrofishing, hoop nets (large and small), fyke nets, mini fyke nets, and trawling) and river habitats (main channel border, side channel border, and backwaters). Non-metric multidimensional scaling (NMDS) and analysis of similarities (ANOSIM) will be used to compare the pre- (1993-1999) and post-establishment (2000-2012) fish communities among multiple gears in multiple habitats. Both fixed sites and stratified random sites will be used in analysis. Analysis will be done under base, and this project supports several aspects of the LTRMP Strategic Plan including: Outcome 1 (Enhanced knowledge of system status and trends), Output 1.1 (status and trends based on long-term data), Outcome 2 (Enhanced knowledge about system process, function, structure and composition), and Output 2.1 (Insights about river process, function, structure, and composition based on long-term data).

Tracking number	Products	Staff	Milestones
2014AC1	Assemble data set for analysis	Solomon, Pendleton, Casper	30 January 2014
2014AC2	Complete all analyses	Solomon, Pendleton, Casper	30 October 2014
2014AC3	Present results	Solomon, Pendleton, Casper	TBD
2014AC4	Draft manuscript	Solomon, Pendleton, Casper	30 December 2014

Water Quality Component

The objective of the LTRMP's water quality component is to conduct monitoring and research to obtain basic limnological information required to (1) increase understanding of the ecological structure and functioning of the UMRS, (2) document the status and trends of ecological conditions in the UMRS, and (3) contribute to the evaluation of management alternatives and actions in the UMRS. The water quality component focuses on a subset of limnological variables related to habitat quality and ecosystem function that includes physicochemical features, suspended sediment, and major plant nutrients known to be significant to aquatic habitat in this system.

Data are collected within six LTRMP study reaches in the UMRS (Pools 4, 8, 13, 26, and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Soballe and Fischer 2004). (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Methods

For monitoring water quality, limnological variables (physicochemical characteristics, suspended solids, chlorophyll a, phytoplankton [archived], and major plant nutrients) will be monitored at both stratified random sites (SRS) and at fixed sampling sites (FSS) according to LTRMP protocols.

Fixed site sampling
Fixed site sampling will be conducted as in FY2006 except for modifications made in 2010 for Pools 4 and 8 (Table 1).

Stratified random sampling
Stratified random sampling will be conducted at full effort levels (same as FY2000) for fall, winter, spring, and summer episodes (Table 1).

In situ data collection
For both FSS and SRS in situ data will be collected on physicochemical characteristics per the standard protocols (Soballe and Fischer 2004).

Laboratory analyses
Samples for chemical analysis (nitrogen (total N, nitrate/nitrite N, ammonia N), phosphorus (Total P, SRP), and silica) will be collected at all fixed sites and at approximately 35% of all stratified random sampling locations as specified in the sampling design. Samples for chlorophyll and suspended solids (total and volatile) will be collected at all SRS and Fixed sites Sampling and laboratory analyses will be performed following LTRMP protocols (Soballe and Fischer 2004) and Standard Methods (American Public Health Association 1992).

Product Descriptions

2014D11: Evaluation of water quality data from an automated sampling platform

This project continues activities initiated in FY2013 (2013D19). The National Great Rivers Research and Education Center has invested in automated sampling platforms for water quality data to establish the Great Rivers Ecological Observatory Network (GREON). The platforms are YSI Pisces platforms equipped with YSI 6600 sondes for measuring water temperature, conductivity, dissolved oxygen, pH, turbidity, chlorophyll-a, and blue-green algae; and a Satlantic SUNA sonde for measuring nitrate. This platform has been deployed in Ellis Bay, an impounded backwater, in Pool 26 of the UMRS, adjacent to an LTRMP fixed water quality site. In FY2014, we will be upgrading the YSI sonde to the new EXO2 model, and likely will be moving the platform to the main channel in Pool 26, adjacent to other LTRMP fixed water quality sites. We will compare and contrast data collected from this GREON buoy with LTRMP water quality data from the fixed sites.

There are two primary objectives for this work: 1) to assess the accuracy of the data collected from the GREON buoy, and 2) to begin to evaluate whether automated sampling platforms would be a useful and logistically feasible addition to the LTRMP water quality component. This project links directly to the LTRMP Strategic Plan via Outcome 1: Enhanced knowledge about system status and trends; Output 1.1: Status and trends information based on long-term data sets for aquatic vegetation, water quality, fish, and land use/land cover.

Fixed site data collection and sample processing will follow the normal methods, procedures, and timeline described in the water quality component section of this SOW. Routine maintenance and care for the GREON buoy will take place during fixed site sampling and other routine LTRMP sampling events (i.e., water quality SRS, possibly fish sampling). Data from the GREON buoy will be downloaded remotely from our offices at NGRREC. The GREON Buoy will be placed in winter storage in December, 2013, and re-deployed in March 2014. Data analysis will be conducted from November 2013 through March 2014. A power-point presentation detailing results from the FY2013 data comparisons will be given at the 2014 Mississippi River Research Consortium meeting.

2014D12: Nutrients and dissolved oxygen in the UMRS: improving our understanding of winter conditions and their implications for structure and function of the river

This analysis will improve our understanding of winter conditions in the UMRS and their implications for the structure and function of the ecosystem. Specifically, it will address the following questions:

Question #1. How do recent years' data affect our understanding of the extent and distribution of low dissolved oxygen conditions during winter in the upper study reaches of UMR? What factors are associated with variability in the extent of low DO conditions? Are there long-term, or recent, trends in the extent of low DO conditions?

Question #2. What is the distribution of nutrient concentrations (phosphorus (P) and nitrogen (N)) across contrasting aquatic areas during winter? Particular attention will be paid to backwater nutrient concentrations during winter. These conditions are the "initial conditions" in backwaters

before the spring flood. As such, they provide insight into both "pre-growing season" conditions, and the role of the spring flood pulse in delivering nutrients to backwater areas. An important aspect of this analysis is the contrast between the upper LTRMP study reaches (which generally freeze over and exhibit extremely low suspended solids concentrations during winter), and the lower LTRMP study reaches (which do not), and what this suggests about the role of the spring flood in delivering nutrients to backwaters in these contrasting river reaches.

Relative to what is known about growing seasons conditions, remarkably little is known about overall winter limnological conditions in large rivers. The accumulated LTRMP data on winter conditions in the UMR is extremely valuable and under-used resource for addressing this topic.

Importance of Question #1: Some restoration projects explicitly address improvement of winter habitat for centrarchids. Oxygen concentration is only one of several criteria used to determine habitat suitability, but it is a critical one. A more comprehensive understanding of the range of existing oxygen conditions, whether they are changing over time, and factors commonly associated with low or high dissolved oxygen concentrations may inform future restoration efforts aimed at improving winter habitat conditions in the UMR.

Importance of Question #2: The spring flood is generally believed to be of primary importance in delivering nutrients to off channel areas. However, nutrient availability in winter and the factors that affect it are poorly understood. A better knowledge of winter nutrient concentrations will improve our understanding of the role of the spring flood, and by extension, hydraulic connectivity, in delivering nutrients to off channel areas. Connectivity of off-channel areas is actively managed at various places in the UMRS and understanding winter nutrient availability under a variety of conditions may help to inform management decisions related to altering hydraulic connectivity of some of these areas.

In addition, under clear ice conditions, algal production can be extremely high (as indicated by extremely high dissolved oxygen concentrations). The frequency of occurrence of this phenomenon is poorly known. Understanding the frequency and extent of these occurrences of high winter algal production is the first step to understanding how important such winter production might be for the upper reaches of the UMRS.

Previous work

An initial analysis of the extent of low dissolved oxygen conditions during summer and winter was included in Houser (2005). That analysis (which included data through 2001) found DO < 5mg L-1 occurred at >10% of backwater sites. Subsequent work found no evidence for long-term trends (through 2002) in the percent of backwaters that contained suitable habitat for sunfishes (based on a criterion that included DO; Johnson and Hagerty 2008). The FY2014 work described here will build on the previous efforts by including an additional 10 years of data, and investigating the factors that appear to be associated with high and low dissolved oxygen conditions.

Some fundamental temporal and spatial patterns in nutrients (N and P) have been described previously. Houser et al. (2010) addressed longitudinal patterns in long-term, seasonal means of main channel nutrient concentrations. Houser et al. (in revision) addressed contrasts in nutrient concentrations among various aquatic areas during the growing season and how those relationships vary with discharge among years. The FY2014 work will build on the previous work, by focusing on winter nutrient concentrations and factors that may affect their variability among aquatic areas, study reaches, and years.

2014D13: A Comparison of Side and Main Channel Fish Community and Water Quality Characteristics

Previous research suggests that main channel and side channel locations may play a key role in large river structure and function. Specifically these two distinct locations contribute to overall fish community diversity, but quantitatively the role each location provides is unknown. We expect fish community diversity (including species of conservation concern, such as pallid sturgeon) will differ between these two distinct habitats (likely as a function of water quality characteristics). Information garnered from this evaluation may be used to guide management efforts needed to preserve fish community diversity through conservation of their associated habitats (including water quality).

The objective of the project is to determine the relative importance of two large scale river features and the associated water quality characteristics to the Mississippi River fish community.

This project addresses the 2010-2014 LTRMP Strategic and Operational Plan:

Output 1.1 Output 1.1 – status and trends information based on long-term data sets for aquatic vegetation, water quality, fish, and land use/land cover

- Identify and examine fish community characteristics of side channel and main channel habitats in the UMRS.

Output 3.1: Use of LTRMP infrastructure, data sets, and expertise to help formulate, design, and evaluate ecological restoration projects

- Fish community structure of each habitat will assist managers in determining long term trends relative to water quality relationships of system processes.
- Select species relative habitat use can be determined (e.g. invasive versus native planktivores).
- Diverse habitats are purported to provide diverse fish communities. Linkage of water quality characteristics in habitat availability will provide quantitative assessment of habitat contribution to the fish community allowing managers to enhance or restore lacking processes.

We will use previously collected data from the long-term resource monitoring program along with existing Missouri Department of Conservation Mississippi River information to compare water quality characteristics and fish community diversity between these two distinct locations.

Products and Milestones

Tracking number	Products	Staff	Milestones
2014D1	Complete calendar year 2013 fixed-site and SRS water quality sampling	Houser, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	31 December 2013
2014D2	Complete laboratory sample analysis of 2013 fixed site and SRS data; Laboratory data loaded to Oracle data base.	Yuan, Schlifer	15 March 2014
2014D3	1st Quarter of laboratory sample analysis	Yuan, Kreiling,	30 December 2013

	(~12,600)	Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	
2014D4	2nd Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	30 March 2014
2014D5	3rd Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	29 June 2014
2014D6	4th Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	28 September 2014
2014D7	Complete QA/QC of calendar year 2013 fixed-site and SRS data.		
	a. Data loaded on level 2 browsers; QA/QC scripts run; SAS QA/QC programs updated and sent to Field Stations with data.	Schlifer, Rogala, Houser	30 March 2014
	b. Field Station QA/QC; USGS QA/QC.	Houser, Rogala, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	15 April 2014
	c. Corrections made and data moved to public Web Browser	Rogala, Schlifer, Houser	30 April 2014
2014D8	Complete FY2013 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool (Table 1)	Houser, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	30 Sept 2014
2014D9	WEB-based annual Water Quality Component Update with 2013 data on Public Web Server.	Rogala	30 May 2014
2014D10	Final draft fact sheet: Tree map tool for visualizing fish data with example of native versus non-native fish biomass	Schlifer, Sauer	30 Sept. 2014
2014D11	Letter Summary: Evaluation of water quality data from an automated sampling platform	Soeken-gittinger, Lubinski, Chick	30 Sept 2014
2014D12	Draft manuscript: Nutrients and dissolved oxygen in the UMRS: improving our understanding of winter conditions and their implications for structure and function of the river	Houser	30 Sept 2014
2014D13	Presentations, draft completion report: A Comparison of Side and Main Channel Fish Community and Water Quality Characteristics	Sobotka, West, Phelps	Dec 2015
	On-Going		
2013D10	Final draft completion report: changes in substrate, water quality, aquatic vegetation, zooplankton, and fish community from Geomorphic Reach 1 (above Lake Pepin) to Geomorphic Reach 3 (below Lake Pepin) (2010D6)	Popp, De Lain, Burdis, Moore	30 Dec 2013

2013D17	Draft manuscript: Relationship between the temporal and spatial distribution, abundance, and composition of zooplankton taxa and hydrological and limnological variables in Lake Pepin	Burdis	30 Dec 2013
2013D19	Letter Summary: Assessment of the efficacy of monitoring water quality in the UMRS using a YSI real-time Environmental Monitoring System (Pices Platform) (continued work on 2012D15)	Chick, L. Gittinger, Lubinski	31 Oct 2013

Intended for distribution
Completion report: Examining nitrogen and phosphorus ratios N:P in the unimpounded portion of the Upper Mississippi River (2006D9; Hrabik & Crites)
LTRMP report: Main channel/side channel report for the Open River Reach. (2005D7; Hrabik)
Manuscript: Ecosystem metabolism in the main channel and backwaters of the Upper Mississippi River: the role of submersed vegetation and hydraulic connectivity. (2008D8; Houser et al.)
Manuscript Nutrient cycling, connectivity, and free-floating plant abundance in backwater lakes of the Upper Mississippi River. (2009APE3, Houser)
Manuscript: Lateral contrasts in nutrients, chlorophyll, and suspended solids within the Upper Mississippi River System (2012D10; Houser)
Completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis)
Manuscript: Temporal evaluation of factors influencing metaphyton biomass, distribution and composition within UMR backwaters (2010out2a; Giblin et al.)
Manuscript: Trends in suspended solids, nitrogen, and phosphorus in select upper Mississippi River tributaries, 1991-2011 (Kreiling and Houser, 2013D14)

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Sprague, L.A., R. M. Hirsch, B.T. Aulenbach. 2011. Nitrate in the Mississippi river and its tributaries, 1980 to 2008: are we making progress? Environmental Science & Technology 45:7209-7216.

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Executive Committee. http://www.umrba.org/publications/wq/umr-wq-science-needs3-3-11.pdf

Land Cover/Land Use with GIS Support

In FY2010-11, systemic digital aerial photography was collected in cooperation with USFWS Region 3. The main task under Land Cover/Land Use will be in processing these data (See Development of 2010/11 Land Cover/Land Use GIS Database and Aerial Photo Mosaics). (Strategic Plan Outcome 1; Output 1.1)

However, we will continue to provide on demand GIS technical assistance, expertise, and data production to the Environmental Management Program partnership including, but not limited to:

- Aerial photo interpretation
- Interpretation automation into a digital coverage
- Flight planning and acquisition of aerial photography
- Change detection and habitat modeling
- Georeferenced aerial photo mosaics (pool wide, Habitat Rehabilitation and Enhancement Projects (HREPs), land acquisition areas)
- Georeferenced archival map/plat mosaics (Brown Survey, Mississippi River Commission data, Government Land Office data)
- Produce graphics and summary tables for partnership publications, posters, and presentations
- Conversion of ASCII coordinate data from a GPS to a spatial data set
- Conversion of all georeferenced data to a common projection and datum for ease of use in a GIS
- Conversion of all new GIS data to KMZ (Google Earth) formats for ease of viewing and sharing (as requested).
- Maintain, update, and oversee the aerial photo library of over 50,000 print and digital images.
- Maintain, update, and enhance over 20 million acres of land cover/land use and aquatic areas data spanning the late 1800s through the year 2000. This includes improving existing or developing new crosswalks for comparison of existing data sets, cropping data sets to common extents, and ensuring that all data sets are in a common coordinate system.
- Assist in the maintenance and updating of the USGS-Upper Midwest Environmental Sciences Center's (UMESC) web based geospatial data repository.
- Provide hardware and software technical support to UMESC staff and partners, as needed.
- Continue to assess advances in computer technology (hardware and software) for accurate and efficient GIS data production.

Product Descriptions

2014LC1: Although the primary focus of this component is to provide technical assistance and maintain existing databases, *as time allows* work may occur on the following LTRMP projects. As work is accomplished for each project, it will be reported in the quarterly activities. When a project is completed, that will be announced to the partners and reported in the quarterly activities. The percentage completion for each project will be updated in each subsequent scope of work.

- Continue to update the detailed spreadsheet of all LTRMP aerial photography currently housed at UMESC, including date, pool location, format (color infrared, natural color, black-and-white), scan status (yes/no, dots per inch), interpreted status, photo scale, and extent of coverage (partial or complete). This document will be served on-line and updated as necessary. (70% complete)
- Complete summaries detailing differences in land cover between 2000 and 2010/11 for the key pools (25% complete)
- Create a Google Earth help page to assist partners and public in using Google Earth to view and query LTRMP data being served in the KMZ format. (50% complete)
- Develop KMZ files for 2010/2011 aerial photo positions that include date, time, approximate water level at time of acquisition, and link to closest stream gage. This work will enhance the scope "Geospatial upgrades". (50% complete)
- Convert 1989 and 2000 LCU and other relevant GIS vector and raster data sets to Google Earth KMZ files and distribute online. (99% complete)
- Clip HREP boundaries (based on boundaries as defined in HREP web pages for individual projects, or through consultation with the Corps) across years and create a geodatabase for each HREP site. (20% complete)

Products and Milestones

Tracking number	Products	Staff	Milestones
2014LC1	Updates on progress for land cover products listed above.	Robinson	New progress reported in the quarterly activities. Percent complete updated 30 Sept 2014.

2010–2011 Land Cover/Land Use Data Development and Accuracy Assessment/Validation for the UMRS

Development of the 2010/2011 Land Cover/Land Use (LCU) Geographic Information System (GIS) database will provide a third systemic dataset to compare the 1989 and the 2000 systemic coverages. Though a crosswalk was needed to compare 1989 and 2000 since different vegetation classification systems were used, the 2000 and 2010/11 LCU datasets will use the same classification and classifiers, making them directly comparable. Once completed, the 2010–2011 dataset will be invaluable in assessing and evaluating long-term vegetation trends and habitat changes over the past 20 years, and in assessing the current state of floodplain vegetation. (Strategic Plan Outcome 1; Output 1.1 and Outcome 4)

Since the last LCU systemic data set was developed in 2000, there has been a growing interest in completing thematic accuracy assessments (AA) for the LTRMP LCU spatial data sets. The objective of an AA is to measure the probability that a particular location has been assigned its correct vegetation class. An AA estimates thematic (map class) errors in the data, giving users information needed to determine data suitability for a particular application. At the same time, data producers are able to learn more about the nature of errors in the data. Thus, the two views of an AA are "producers' accuracy," which is the probability that an AA point has been mapped correctly (also referred to as an error of omission), and "users' accuracy," which is the probability that the map actually represents what was found on the ground (also referred to as error of commission). Producers' and users' accuracies can be obtained from the same set of data by using different analyses.

A pilot thematic accuracy assessment study was completed on an UMRS 2001 LCU spatial data set of Pool 8 (May 2002). At the genus level, results of this study calculated the overall accuracy produced with a kappa index to be 83.8%. At the General Wetland Vegetation Map Class (Dieck and Robinson 2004) level, the overall accuracy was calculated with a kappa index to be 88.5%. Currently, the goal is to expand on this work and complete a thematic accuracy assessment on select pools throughout the UMRS using LCU data from the 2010/2011 LCU spatial data sets of the UMRS. (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

The effort to compare the thematic accuracy assessment and validation methodology to determine the accuracy of the 2010-2011 LCU data is nearing completion. All field data collection and accuracy assessment analyses have been completed. Only the assessment of the validation method and final report comparing the two methods remain. These tasks are considered to be included in the LTRMP Base Monitoring Program since they are considered to be one component of the LTRMP standardized monitoring. However, due to their importance to the UMRR-LTRMP Partners, some or all of the remaining work will require additional funding. Funding levels and tasks for FY14 are identified below.

Objectives

Develop a 2010/11 LCU GIS database for Pools 1–26, the Open River Reach, the entire Illinois River, and the navigable portions of Minnesota, St. Croix, and Kaskaskia Rivers of the UMRS and provide an accuracy assessment and validation of select pools to determine the accuracy of this database. Note: Extensive flooding on the Middle Mississippi River below the Quad Cities

required aerial photography on Pools 14-Open River to be postponed until the late-summer of 2011. The upper pools of the Illinois River (Lockport, Brandon, and Dresden Pools) were reflown in 2011 due to heavy cloud cover in 2010.

Methods

Aerial photographs of Pools 1-13 of the Upper Mississippi River (at 8"/pixel) and the Alton, La Grange, Peoria, Starved Rock, and Marseilles Pools of the Illinois River (at 16"/pixel) were collected in color infrared (CIR) in August of 2010 using a mapping-grade Applanix DSS 439 digital aerial camera. In August 2011, CIR aerial photographs for Pools 14-Open River South of the Upper Mississippi River and the Dresden, Brandon, Lockport Pools of the Illinois River were collected at 16"/pixel with the same camera. These CIR aerial photos were orthorectified, mosaicked, compressed, and served via the UMESC Internet site. The CIR aerial photos will be interpreted and automated using a 31-class LTRMP vegetation classification (see Attachment A). The 2010/11 LCU databases will be prepared by or under the supervision of competent and trained professional staff using documented standard operated procedures and will be subject to rigorous quality control (QC) assurances.

Land Cover/Land Use data currently available include Pools 3-10, 12-14, and 18-26, Open River South, and Alton, La Grange, Peoria, Starved Rock, and Marseilles Pools on the Illinois River (http://www.umesc.usgs.gov/data_library/land_cover_use/2010_lcu_umesc.html). Open River North, at over 400,000 acres, is the largest pool in the UMRS and the only pool scheduled for completion in FY14. Pools 1, 2, 15, 16, and 17 of the UMR and Lockport, Brandon, and Dresden of the Illinois River along with the Lower Minnesota, Lower St. Croix, and Lower Kaskaskia are scheduled to be completed in FY15 if funding is available.

Products and Milestones

Tracking number	Products	Staff	Milestones
2014V1	Complete 30% of the 2010/11 LCU database for UMR Open River North	Robinson, Hoy, Hanson, Langrehr, Ruhser, Nelson	30 April 2014
2014V2	Complete remaining 70% of the 2010/11 LCU database for UMR Open River North	Robinson, Hoy, Hanson, Langrehr, Ruhser, Nelson	TBD
2014V3	Complete accuracy assessment and validation analyses	Ruhser, Jakusz	30 April 2014
2014V4	Final LTRMP Completion Report on Accuracy Assessment	Ruhser, Jakusz	TBD

Budget

Base Funding

$ 31,836	Annual software maintenance fees
$ 29,805	Complete accuracy assessment/Validation analyses
$ 91,359	Complete 30% of the Open River North LCU database
$153,000	**Total base funding**

Additional Funding

$ 19,870	Complete the accuracy assessment and validation LTRMP Completion Report
$189,449	Complete remaining 70% of the Open River North LCU database
$209,319	**Total additional funding provided by UMRR-EMP HREP support funds for FY14**
$362,319	**Total Funding to complete**

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ATTACHMENT A

LTRMP 31-Class General Vegetation Classification, Version 1.0

CODE	CODE DESCRIPTION	HYDROLOGY DESCRIPTION	DESCRIPTION
OW	Open Water	Permanently Flooded Non-Forest	Open Water; Default to Anderson Classification
RFA	Rooted Floating Aquatics	Permanently Flooded Non-Forest	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
SV	Submerged Aquatic Vegetation	Permanently Flooded Non-Forest	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
DMA	Deep Marsh Annual	Semipermanently Flooded Non-Forest	Semipermanently flooded temperate or subpolar grassland
DMP	Deep Marsh Perennial	Semipermanently Flooded Non-Forest	Semipermanently flooded temperate or subpolar grassland
MUD	Mud	Seasonally Flooded Non-Forest	Seasonally/Temporarily flooded mudflats
SMA	Shallow Marsh Annual	Seasonally Flooded Non-Forest	Seasonally flooded temperate or subpolar grassland
SMP	Shallow Marsh Perennial	Seasonally Flooded Non-Forest	Seasonally flooded temperate or subpolar grassland
SM	Sedge Meadow	Temporarily Flooded Non-Forest	Temporarily flooded temperate or subpolar grassland
WM	Wet Meadow	Saturated Soil Non-Forest	Saturated temperate or subpolar grassland
DMS	Deep Marsh Shrub	Semipermanently Flooded Shrubs	Semipermanently flooded cold-deciduous shrubland
SMS	Shallow Marsh Shrub	Seasonally Flooded Shrubs	Seasonally flooded cold-deciduous shrubland
WMS	Wet Meadow Shrub	Temporarily Flooded Shrubs	Temporarily flooded cold-deciduous shrubland
SS	Shrub/Scrub	Infrequently Flooded Shrubs	Temperate cold-deciduous shrubland
WS	Wooded Swamp	Semipermanently Flooded Forest	Semipermanently flooded cold-deciduous closed tree canopy
FF	Floodplain Forest	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
PC	Populus Community	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
SC	Salix Community	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
BHF	Bottomland Hardwood Forest	Temporarily Flooded Forest	Temporarily flooded cold-deciduous closed tree canopy
CN	Conifers	Infrequently Flooded Forest	Rounded-crowned temperate or subpolar needle-leaved evergreen forest
PN	Plantation	Infrequently Flooded Forest	Plantation
UF	Upland Forest	Infrequently Flooded Forest	Lowland or submontane cold-deciduous closed tree canopy
AG	Agriculture	Infrequently Flooded Non-Forest	Annual row-crop forbs or grasses
DV	Developed	Infrequently Flooded Non-Forest	Developed; Default to Anderson Classification
GR	Grassland	Infrequently Flooded Non-Forest	Tall sod temperate grassland
LV	Levee	Infrequently Flooded Non-Forest	Levee; Default to Anderson Classification
PS	Pasture	Infrequently Flooded Non-Forest	Perennial Grass Crops
RD	Roadside Grass/Forbs	Infrequently Flooded Non-Forest	Roadside Grass/Forb; Default to Anderson Classification
SB	Sand Bar	Temporarily Flooded Non-Forest	Temporarily flooded sand flats
SD	Sand	Infrequently Flooded Non-Forest	Dunes with sparse herbaceous vegetation
NPC	No Photo Coverage	n/a	No Photo Coverage; n/a

VEGETATION MODIFIERS

Density A = 10-33% B = 33-66% C = 66-90% D = > 90%

Height* 1 = 0-20 ft. 2 = 20-50 ft. 3 = > 50 ft. *Trees only

Bathymetry Component

The overall goal of the LTRMP's Bathymetry Component is to complete a system-wide GIS coverage of UMRS bathymetry used to quantitatively and qualitatively assess the suitability of essential aquatic habitats. Bathymetric surveys of the UMRS have been completed. Presently, the data processing for nine pools (Pools 4, 7, 8, 9, 10, 13, 21, 26, and La Grange Pool) is complete, and these data are served in standard formats on the LTRMP's website (www.umesc.usgs.gov/aquatic/bathymetry.html) The remaining unprocessed data have been delivered to UMESC, are available upon request, and will be processed into standard products under separate SOW's as funding becomes available. Under Output 1.1, the LTRMP will maintain some level of expertise to provide basic assistance with using the existing bathymetry data, as described below. (Strategic Plan Outcome 1; Output 1.1 & 1.3 and Outcome 4)

Provide on demand technical assistance related to the bathymetric database to the EMP partnership including, but not limited to:

- Deliver data in non-standard formats, such as raw point data in GIS or text files.
- Adjust bathymetry data to selected water surface conditions (presently only available at "flat-pool" conditions)
- Calculate summary statistics (e.g., hypsographic curves and volume) for geographical subsets of the data
- Advise partner agencies on data collection methods and locations that meet LTRMP need
- Assist in spatial modeling using the bathymetric data
- Processing of bathymetry point data available upon request as time allows www.umesc.usgs.gov/aquatic/bathymetry.html

Jim Rogala will be the principal investigator.

Statistical Evaluation

Statistical support for the LTRMP provides guidance for statistical analyses conducted within and among components, for contributions to management decisions, for identifying analyses needed by the Program, for developing Program-wide statistical projects, and for reviewing LTRMP documents that contain statistical content. The 'Guidance for statistical analyses' purpose is designed to save money for the LTRMP, at both UMESC and the field stations, by helping LTRMP staff use data and analytical time more efficiently. The statistician is also responsible for ensuring that newly developed statistical methods are evaluated for use by LTRMP. Guidance for management includes assistance with modifications to program design and with standardizing general operating procedures.

The statistical component will help ensure that potentially useful analyses of data from within and across components are identified, that methods for analysis are appropriate and consistent, and that, when possible, multiple analyses work together to achieve larger program objectives regardless of which group (UMESC, field stations, COE, etc.) conducts analyses. The statistician is also responsible for reviewing LTRMP documents that contain substantial statistical components for accuracy, and for ensuring that quality of analyses is consistent among products. A primary goal of statistical analyses is to avoid drawing inappropriate conclusions leading to ineffective or even harmful management actions. Within the UMR, there are a variety of confounding factors and conditions that could produce spurious correlations or lead to inappropriate conclusions regarding cause and effect. Appropriate statistical analysis and interpretation is critical to understanding the inferences from LTRMP data. This, in turn, is critical in efforts to distinguish between natural variation and human effects and in evaluating the long-term effects of management actions, such as HREPs, water level manipulations, or increases in navigation. (Strategic Plan Outcome 2, Output 2.1, and Outcome 4)

Product Description

2014E2: Depiction of trend estimates on water quality graphical browser pages

This project will coordinate the overlay of trend estimates, with confidence bands, on graphical database summary ("browser") output for the LTRMP water quality component. At present, the LTRMP depicts sample means or medians for each year. However, the LTRMP has not routinely supplied multi-year trend estimates. This effort will be designed to meet this need for one component, the water quality component. One of the four LTRMP goals is "monitor resource change." Change may be interpreted, for the LTRMP sampling designs, as a difference from the previously-sampled year ("change in status") and also as a long-term trend. The proposed work addresses the latter interest. For river managers, an inference on a long-term trend in a resource may lead to management action. Such may not be the case with changes in annual status. Estimating long-term trends is considered high priority by the LTRMP: "Program partners have identified monitoring resource status and trends as the highest priority of LTRMP because of our need to understand recent and long-term trends in indicators of management success (see Output 1.2), cyclical changes in important ecological components, and the status of indicators used for analyzing relationships among components" (p. 2, Strategic and Operational Plan for the Long Term Resource Monitoring Program on the Upper Mississippi River System).

This work will build on a survey of trend estimation methods with application for LTRMP water quality data (LTRMP 2013E1). The FY2014 work will augment the FY13 work by applying the findings from FY13 to actual web summary pages.

Products: Modifications to current or new water quality web pages to include graphical depiction of estimated trends, with confidence bands.

Products and Milestones

Tracking number	Product	Staff	Milestone
2014E1	Final draft completion report: Long-term trend reporting, water quality component (2013E1)	Gray, Houser, Rogala	30 Sept 2014
2014E2	Water quality web page: Depiction of trend estimates on water quality graphical browser pages	Gray, Houser, Rogala, Schlifer	30 Sept 2014
On-Going			
2013E2	Final draft completion report: an assessment of trends in water temperature in La Grange Pool (2012E3)	Gray, Robertson, Rogala, Houser	30 Dec 2013
Intended for distribution			
Completion report that describes methods of estimating variance components from LTRMP water quality data (2008E1; Gray)			
Completion Report: Duckweed and filamentous algal associations with submersed aquatic vegetation in contiguous floodplain lakes of the Upper Mississippi River. Gray and Holland. (2009APE3a)			
Manuscript: Inferring decreases in among- backwater heterogeneity in large rivers using among-backwater variation in limnological variables (2010E1, Rogala, Gray, Houser)			
Completion Report: summer water temperature in the Upper Mississippi River (2012E2). Gray, Robertson, Houser, Rogala.			
Completion report: An assessment of trends in water temperature in La Grange Pool (2012E3; Gray, Robertson, Rogala, Houser)			

Data Management

The objective of data management for the LTRMP is to provide for data collection, correction, archive, and distribution of a 90 million dollar database that consists of over 2.2 million records located in 195 tables. The 2.2 million data points currently in the system require regular maintenance and upgrading as technologies change. Also, having a publicly accessible database requires a significant level of security. This is accomplished by having the systems Certified and Accredited by a rigorous, formal process by the USGS Security team. (Strategic Plan Outcome 4 and Strategy 1)

Methods

Data management tasks include, but are not limited to:

- Review daily logs to ensure data and system integrity and apply application updates.
- Develop and maintain field notebook applications to electronically capture data and begin the initial phase of Quality Control/Quality Assurance (QA/QC).
- Administer and maintain the Oracle LTRMP database.
- Administer and maintain LTRMP hardware, software, and supplies to support LTRMP program needs.
- Administer, maintain, and update the LTRMP public and intranet data browsers to insure access to all LTRMP data within USGS security policy.

Product Description

2014M3: Webinar on LTRMP data access and use

The UMRR-EMP has made considerable investments in gathering baseline data on key ecosystem components across 1200 miles of river for over 20 years. In addition, we have made considerable investments to develop applications that help get these data and the information they provide into the hands of the public, program managers, natural resource managers, students, faculty, and decision/policy makers. To make these data and applications more widely known and useful to program partners, UMESC will conduct a webinar of 0.5 days to review how to access LTRMP data (fish, aquatic vegetation, water quality) and how to use data tools for addressing management questions. The webinar will be open to all interested parties.

The webinar will include presentations by the LTRMP component PI's to introduce participants to the basics of database structure, access tools, processing data for analyses, and any special considerations for using LTRMP data from the fish, water quality, and aquatic vegetation components. Presentations will be followed by discussion and question-answer sessions. This could include brief discussions of specific analyses or applications of interest to participants. Following the webinar, if interest is generated in specific analyses, component PI's will follow up with identified participants regarding the potential for additional work.

Logistics and planning for the webinar will be developed by primarily by Sauer and Lowenberg with input from the LTRMP component specialists. The component specialists will conduct the webinar and discussions. The webinar will not cover macroinvertebrates, land cover, landscape ecology, bathymetry, or LiDAR.

This work helps to fulfill objectives in the 2010-2014 LTRMP Strategic Plan including:

- Output 2.1 (*Conduct analyses of LTRMP … data sets*.), by providing information that will help others, both within and outside of LTRMP, to conduct analyses of LTRMP data.
- Output 3.1 (*Use LTRMP … to help … restoration projects*.), by engaging staff involved with HREP's and improving their knowledge about the availability and use of LTRMP data for HREP planning and design.
- Output 4.1 (*Key decisions are informed by LTRMP data, …*), by improving the ability of partners and others to use LTRMP data and information to help inform management decisions.

The product will be the webinar. The webinar will be scheduled and coordinated with other LTRMP work. The most likely time is probably winter or spring. If the webinar generates interest in specific analyses or follow-up work, any such work will be considered for inclusion in future scopes of work or for other funding opportunities by staff interested in conducting the work. After the webinar, UMESC staff will discuss the outcome and make recommendations regarding whether to repeat the webinar, and if so, on what schedule and in what manner. Future webinars could include, or focus on, other LTRMP components.

Products and Milestones

Tracking number	Products	Staff	Milestones
2014M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	Schlifer	30 May 2014
2014M2	Load 2013 component sampling data into Oracle tables and make data available on Level 2 browsers for field stations to QA/QC.	Schlifer	30 June 2014
2014M3	Webinar on LTRMP data access and use	Sauer, Johnson, Houser, Ickes, Yin, Rogala, Schlifer, Lowenberg	spring or fall

Landscape Pattern Research and Application

The goal of landscape pattern research on the Upper Mississippi River System is to develop concepts, maps and indicators that provide both regional-level decision makers and local-level resource managers with information needed to effectively manage the UMRS.

As described in the LTRMP's Landscape Pattern Research Framework (http://www.umesc.usgs.gov/ltrmp/ateam/landscape_patterns_research_framework_final_june2011.pdf) (De Jager 2011a), landscape pattern research on the UMRS focuses on linking decisions made at regional scales with restoration actions carried out at local scales. While regional program managers and decision makers are concerned with improving the overall ecological condition of the entire UMRS, local resource managers work to address site specific habitat and resource limitations. Landscape ecology, which focuses on the linkages between patterns visible at broad scales and ecological patterns and processes that occur at local scales, can help to integrate these two scale-dependent management activities. (Strategic Plan Outcome 2, Output 2.2, Outcome 4)

Objectives

1) To develop broad-scale indicators of habitat amount, connectivity and diversity for the purposes of a) identifying areas for ecosystem restoration across the entire system and b) to track status and trends in habitat area, diversity and connectivity.

2) To connect broad-scale landscape pattern indicators with local-scale ecological patterns and processes critical to HREP project development.

2014L1: Draft manuscript: Nitrification in an Upper Mississippi River floodplain forest impacted by flooding, herbivory, and invasive reed canarygrass

Beginning in 2010, N. De Jager has been providing assistance and information to local US Army Corps of Engineers foresters (Randal Urich et al.) to guide forest restoration at a site just south of La Crosse, Wisconsin. In cooperation with personnel at the University of Wisconsin-La Crosse, studies were conducted from winter 2010 to summer 2011 on the role(s) herbivory by white-tailed deer and flooding play in forest recruitment (Cogger et al. In Press, De Jager et al. 2013). In 2012, a collaborative experiment involving Whitney Swanson (student) and Eric Strauss (faculty) of the University of Wisconsin-La Crosse was initiated to examine rates of nitrification across the elevation gradient of the floodplain and in response to management actions that created different plant community types. In 2013 we begin analyzing this data for differences among the community types (e.g. reed canary grass meadow, mature forest, young forest) along the elevation gradient. Results will help managers understand the consequences of different management approaches for nutrient processing and export. In FY 14 a draft manuscript will be completed. This research partially addresses objective 2.2 (Floodplain Soil Nutrient Dynamics) of the Landscape Patterns Research Framework (De Jager 2011a).

2014L2: Maps and metrics: Floodplain inundation duration maps and metrics posted to online landscape indicators web browser. Jason Rohweder (This is from De Jager 2011b)

2014L3: Draft manuscript: Differences in fish community composition between patches of high TN:TP and low TN:TP: the role of water flow velocity. (This is also from De Jager 2011b)

Products and Milestones

Tracking number	Products	Staff	Milestones
2014L1	Draft manuscript: Effects of flood inundation duration on litter decomposition and nitrogen cycling during different states of forest succession.	Strauss, Swanson, (UWL) & De Jager	30 September 2014
2014L2	Maps and Metrics: Floodplain inundation duration maps and metrics added to online landscape indicators web browser	Rohweder and De Jager	30 September 2014
2014L3	2014L3: Draft manuscript: Differences in fish community composition between patches of high TN:TP and low TN:TP: the role of water flow velocity	De Jager	30 September 2014

Intended for distribution
Manuscript: Cogger, B.J. , De Jager, N.R. and Thomsen, M. . In Press. Winter browse selection by white-tailed deer and implications for bottomland forest restoration in the Upper Mississippi River valley, USA. (2012L4)
Fact Sheet: De Jager, N.R. 2013. Landscape Ecology on the Upper Mississippi River: lessons learned, challenges, opportunities (2013L3).
Manuscript: De Jager, N.R. and T.J. Fox. 2013 Curve Fit: a pixel-level raster regression tool for mapping spatial patterns (2013L1)
Manuscript: De Jager, N.R. The allometry of community level stem size-density distributions in a floodplain forest.

Literature Cited:

Cogger, B.J., De Jager, N.R. and Thomsen, M. In Press. Winter browse selection by white-tailed deer and implications for bottomland forest restoration in the Upper Mississippi River valley, USA. Natural Areas Journal.

De Jager, N.R., Cogger, B.J., and Thomsen, M. 2013. Interactive effects of flooding and deer (*Odocoileus virginianus*) browsing on floodplain forest recruitment. Forest Ecology and Management 303: 11-19.

De Jager, N.R. and Rohweder, J.J. 2010. Spatial scaling of core and dominant forest cover in the Upper Mississippi and Illinois River floodplains, USA. Landscape Ecology 26: 697-708

De Jager, N.R. 2011a. Scientific Framework for Landscape Pattern Research on the Upper Mississippi and Illinois River Floodplains. June 2011.

De Jager, N.R. 2011b. Scope of Work: Landscape Pattern Research and Application on the Upper Mississippi River System. For the U.S. Army Corps of Engineers, Rock Island District.

Science Planning

The LTRMP developed a Science Management Process that was presented to the EMP-CC in May 2012. The process is designed to help LTRMP staff and managers prioritize and coordinate science effectively within the overall priorities defined in the 2010 Strategic Plan. We will continue the process begun FY2014 by prioritizing scientific questions and uncertainties that form the basis for advancing our knowledge of ecosystem structure and function relative to management and restoration needs. (Strategic Plan Outcome 2)

2014N1: Science Coordination Meeting

In winter 2014, UMESC will host the initial Science Coordination Meeting as called for in the "Science Coordination Process for the Long Term Resource Monitoring Program Component" which was adopted by the EMP-CC in 2012. Persons invited to participate in the 2-day meeting will be LTRMP funded researchers (UMESC, Field Stations, graduate students/faculty, partners, contractors, etc.), the A-Team, the LTRMP management team, and interested managers and partners. The purpose is to review and exchange information on research conducted during the past year. This would include work on analyses of LTRMP data, focused research projects, modeling, new data collection, HREP evaluations, literature reviews, tool development, etc.

The meeting will be conducted as described in the Science Coordination Process document (http://www.umesc.usgs.gov/ltrmp/documents/science_%20coordination_plan_final.pdf), with short summaries of current research and analyses provided by PI's before the meeting, and presentations at the meeting by researchers on projects that are near completion. Based on discussions and input from participants at the meeting, the Science Director and component specialists at UMESC will draft a 3-year plan that identifies and sequences annual increments of work based on science priorities in the Strategic Plan. The 3-year plan will provide the basis for selecting science projects and activities to include in the annual scope of work and will provide short-term (3-year) continuity in planning for multiple year projects.

The 3-year plan will be due in early March and will be sent to the A-Team and to the LTRMP management team for review. Comments on the plan will be considered by UMESC and revisions made. The plan will then be distributed to LTRMP staff, cooperators, and the EMP-CC.

Products and Milestones

Tracking number	Products	Staff	Milestones
2013XZ	Final Draft report to EMP-CC	Johnson	Nov. 2013
2014N1	Science Planning Meeting	Johnson, Sauer, Lowenberg	Winter 2014
2104N2	Draft 3-year research plan	Johnson, UMESC staff	15 May 2014
2014N3	Final Draft research plan to EMP-CC	Johnson	August 2014

Involvement of LTRMP with monitoring on other rivers, nationally and internationally

Most large rivers in the world, including the UMRS, are greatly affected by human actions and ecological variability. Balancing objectives for social, economic, and ecological benefits in large rivers is a management concern worldwide. Understanding the structure and function of large rivers is critical for developing plans and actions that can achieve management goals. However, learning about structure and function of any large river is a slow process due to a general lack of information on ecological conditions in many rivers, difficulty of data collection on large rivers, high variability in these systems, and difficulty conducting controlled field studies. Although every large river has unique features, all large rivers share many driving variables and processes that underpin their structure and function.

Product Descriptions

2014P1: Development of a White Paper on UMRR-EMP's interactions with programs for other large rivers, nationally and internationally.

The UMRR-EMP has made considerable progress in understanding the structure and function of the UMRS. However, river scientists and managers would benefit greatly from being able to compare our understanding of the UMRS to that for other large rivers in the U.S. and worldwide. Such comparisons would allow all involved to learn more about differences and similarities among large rivers, and to transfer knowledge gained among rivers to all river scientists and managers. The end result should be a deeper understanding of river structure and function among multiple rivers; knowledge of similarities and differences in structure, function, and processes among rivers; a better understanding of why those similarities and differences exist; and increased ability to predict the effects of management actions under a wider variety of conditions. This should help increase the ability of river managers in the UMRS and worldwide to achieve ecological and socioeconomic objectives.

The LTRMP element's long history of successful monitoring, science, and data management has made it a world leader, and river scientists and managers, both nationally and internationally, have sought our advice on developing monitoring programs. If we can help others create monitoring programs that will provide data and information for comparing across rivers, we can greatly increase the pool of knowledge regarding conditions and processes in large rivers. Our vision for UMRR-EMP is to become a clearing house for large river monitoring data and knowledge by providing access to data, reports, and lessons learned from multiple large rivers. Once available, this information can be reviewed in collaborative forums with river scientists and managers, nationally and internationally, for mutual benefit.

The UMESC Science Director will lead development of a white paper describing UMRR-EMP's involvement with other larger river programs and the vision for the future. This will include LTRMP's interactions since 2000 to help develop large river monitoring efforts including: the Parana-Paraguay Rivers, Brazil, and the Yangtze River, China, supported by The Nature Conservancy; large rivers in Pennsylvania, through the Pennsylvania Fish & Boat Commission; the Columbia and Colorado Rivers, through the U. S. Geological Survey; and the Rio Grande through the U.S. Army Corps of Engineers. The paper will describe potential ways of developing

collaboration between UMRR-EMP and other programs, managers, and researchers that could lead to more comparisons of data across river systems, better understanding of how different rivers are structured and function, and improved predictions of responses to management actions on the UMRS and other large rivers.

Products and Milestones

Tracking number	Products	Staff	Milestone
2014P1	Draft white paper for review	Johnson	15 June 2014
2014P2	Final draft white paper	Johnson	30 Sept 2014
2014P3	Final Draft white paper to EMP-CC	Johnson	Nov. 2014

Quarterly Activities

To enhance communication with the UMRR–EMP Partnership, LTRMP staff at USGS-UMESC and the six state-run field stations will track activities not explicitly listed in this current scope of work. These quarterly activity lists will document activities and accomplishments by Program partners that are not tracked in the milestone table. Activities will include such items as presentations, outreach, technical assistance, data retrieval, and consultation for LTRMP Partners including state and federal agencies, NGOs, and academia. These activities demonstrate the value of LTRMP data and expert scientific knowledge to clients and customers, and help to identify potential new collaborations that will benefit EMP and river managers. Activity lists will be placed on the web under the LTRMP A-Team Corner page (http://www.umesc.usgs.gov/ltrmp/ateam.html). This effort addresses a need for increased communication and dissemination of information relevant to Outcome 4 (Output 4.1) of the Strategic Plan.

Products and Milestones

Tracking number	Products	Staff	Milestone
2014QR1	Submittal of quarterly activities	All LTRMP staff	30 January 2014
2014QR2	Submittal of quarterly activities	All LTRMP staff	13 April 2014
2014QR3	Submittal of quarterly activities	All LTRMP staff	13 July 2014
2014QR4	Submittal of quarterly activities	All LTRMP staff	12 October 2014

A-Team and EMPCC Participation

USGS-UMESC and Field Station staff are often called upon to participate at quarterly A-Team (http://www.umesc.usgs.gov/ltrmp/ateam.html) and EMP-CC (http://www.mvr.usace.army.mil/Missions/EnvironmentalProtectionandRestoration/UpperMississippiRiverRestoration/Partnership/CoordinatingCommittee.aspx) meetings. The field station team leaders, component specialists, and UMESC LTRMP management staff are expected to participate in the A-Team meetings, if possible. Additional staff may participate as appropriate. Participation at EMP-CC meetings will be by request only. This participation could include sharing of scientific knowledge and/or presentations on current projects. Any participation by LTRMP staff at A-Team and/or EMP-CC meetings will be listed in the quarterly activity products. (Strategic Plan Outcome 4).

USACE LTRMP Technical Support

This paper describes the roles of the U.S. Army Corps of Engineers district LTRMP Technical Representatives, which are supported by UMRR-EMP LTRMP funds to help facilitate the two directional communications between each home district and the Regional Program (UMRR-EMP). These individuals shall serve as a point of contact with each district for LTRMP data and information, and the use of LTRMP data in the identification, formulation, and evaluation of HREPs.

This SOW captures an anticipated level of effort to accomplish the tasks herein, which is reflected in the funding allocated. The identified level of effort in this SOW assumes that the UMRR-EMP annual appropriation will not be sufficient to fund LTRMP Base Monitoring in full. It is anticipated that the tasks in this SOW have been adjusted to reflect a 9% reduction in effort. This reduction would represent approximately 11.8% of each Representative's time or approximately 240 hours in fiscal year 2014; no change from FY2013.

[NOTE: In years when the annual appropriation is less than the amount needed to fully fund Base Monitoring (such as FY13), the amount available for the Corps' LTRMP Technical Representatives will be reduced proportionately and the SOW will be adjusted accordingly.]

MAJOR DUTIES

1. Technical Support to Regional UMRR-EMP LTRMP Manager (high priority)

Estimated Level of Effort (~40 hours)
For all Document Review – Each document review should be coordinated throughout home district as appropriate, all comments received should be consolidated, and transmitted to the UMRR-EMP LTRMP Manager (copy furnish the other 2 district LTRMP Representatives). A minimum of 2 weeks of review and comment preparation time should be provided, if possible.

   a. Annual SOW (translation of the 2010-2014 Strategic & Operational Plan annually for base and above base efforts) – participate in conf calls as needed (1-2)
   b. Other reports - varies, as needed, and could include research frameworks, research proposals, *ad hoc* Indicator Report, Science Coordination Plan
   c. Regular bimonthly conference calls with the UMRR-EMP Regional Manager, LTRMP Regional Manager, 2 HREP coordinators, 3 LTRMP Technical Representatives (~6)

2. Represent UMRR-EMP LTRMP and home district at all regular A-Team Meetings (high priority)

Estimated Level of Effort (~40 hours)
Work under this heading includes two directional communications – regional coordination, bringing information back to the districts, and bringing local knowledge, issues, or questions to the A-Team. The level of effort hours will vary with length of meeting, meeting location, and level of prep/follow up.

   a. Conference calls – 2/year
   b. Meetings – ~2/year
   c. Support A-Team activities as appropriate

3. Serve as LTRMP data and resource contact for district PDTs (HREP-LTRMP Integration) (high priority)

Estimated Level of Effort (~80 hours)
Generally, each district's LTRMP Technical Representative serves as a proactive resource, promoting the use and/or application of LTRMP data (including research, models, etc) in their home district, primarily for project planning and monitoring. Knowledge of the available datasets (online and others), models, graphical browsers, etc, and personnel at UMESC and the field station(s) is critical for this task.

In addition to funding through LTRMP and the work described above, each home district is expected to include the LTRMP Technical Representative on at least 2 HREP PDT's (funded through district UMRR-EMP-HREP funds).

Also funded by district HREP funds, each district LTRMP Technical Representative should be responsible for keeping up to date on HREP monitoring accomplishments, developing the annual monitoring program for each HREP, utilizing the standardized LTRMP monitoring methods when appropriate, determining who will do the monitoring work, evaluating and summarizing monitoring results, and coordinating with the LTRMP element at USGS-UMESC. All of the information could be used for each Report to Congress, as well as periodically updating the HREP Environmental Design Handbook and the HREP database.

4. Special Projects (not base monitoring) (require separate SOWs and funding)

Estimated Level of Effort (~up to 50 hours)
Some instances will arise when uses of LTRMP data or expertise are needed for more extensive investigations. For those instances, each district's LTRMP Technical Representative should lead the effort to identify and scope their district's needs from LTRMP. These needs must satisfy both of criteria below:

1. Identified need must directly support the UMRR-EMP authorization, and
2. Identified need must comply with the initiatives and priorities indentified in the LTRMP 2010-2014 Strategic and Operational Plan or other partner vetted program documents
3. Identified need must directly support improving ecosystem restoration, including system understanding.

All of the LTRMP technical representatives worked on proposals for additional UMRR-EMP funding. These proposals were submitted to the A-Team for ranking. Any of these proposals that are selected and funded will be the special projects for FY2014.

5. Other Meeting Attendance (if funding and time allow)

Supported Level of Effort (~30 hours)
Work under this heading includes dissemination of information, etc, from meeting/conference attendance to district personnel, PDT's, as appropriate. Discretion in choosing meetings is strongly recommended since the **funding level does not support attendance at all of these listed below**.

a. MRRC–Held in conjunction with April A-Team meeting
b. UMRCC –annual and/or technical session meetings
c. FWWG, FWIC or RRAT (tech) for meetings in home district

REPORTING

Each LTRMP Technical Representative will provide quarterly activity reports to the UMRR-EMP LTRMP Regional Manager; due one week after the end of each quarter of the fiscal year. These reports will capture specific activities under any of the items above and any other significant LTRMP activity.

BUDGET

Labor Budget per Representative

a. Salary for 240 hours annually for each Technical Representative, resourced annually but distributed quarterly, for regular duties described above. The individual dollar amounts allocated reflect the different pay grades of the Technical Representatives. The total labor amount budgeted for all 3 Representatives for FY14 is $76,870.
    1) Could be augmented for special projects to provide **regional** support UMRR-EMP-LTRMP (*e.g*. A-Team *ad hoc* Indicator Team or sub group work); must have supplemental SOW or formal agreement prior to funding (funding dependent).
    2) Could be augmented for special projects that address district needs, as described in Items 3 & 4 above; must have supplemental SOW prior to funding (funding dependent).
    3) Could be augmented for Above Base SOW projects (aka APEs), will be included in project SOW and funding, as appropriate (funding dependent).
b. Travel funds of $1,000 each representative will also be resourced annually, with a partial distribution in the 1st quarter, and full distribution upon receipt of final UMRR-EMP appropriation.

TOTAL estimated commitment

Approximately 11.8% of annual time (240 hours each)

$76,870 labor + $ 3,000 travel = **$79,870**

POC for the UMRR-EMP LTRMP Technical Representatives is the UMRR-EMP LTRMP Regional Manager, Karen Hagerty.

Products and Milestones

Tracking number	Products	Staff	Milestone

UMRR-EMP Strategic Planning

The FY2015–2019 UMRR-EMP Strategic Plan will be focused on ensuring that the UMRR-EMP Program will continue to be regionally relevant, nationally significant, internationally engaged, and technically sound.

The core team, estimated to be 17 individuals representing the makeup of the Partnership and key program functions, will consist of the following:

- 5 State members (EMP-CC, A-Team or Field Stations
- 2 USFWS member (Refuges and Ecological Services)
- 1 NGO member
- 1 member from USEPA, NRCS or Coast Guard
- 3 USGS members (LTRMP management staff, scientist)
- 1 UMRBA member
- 4 USACE members (EMP & LTRMP management, HREP/district managers)

The anticipated planning timeframe will be from April 2013 through September 2014 and will entail approximately 7–9 meetings with half being face-to-face. For FY14, active participation in 3 face-to-face meetings and 1 conference call is planned.

Science Management

Randy Hines is the Partnership Coordinator for UMESC and oversees the science communication program. He is responsible for coordinating the exchange of scientific and technical information requested by other agencies, organizations, and the general public. He also assists with outreach programs to provide educational opportunities and increase community awareness of Center and LTRMP activities.

Since the inception of USGS in 1879, the agency has maintained comprehensive internal and external policies and procedures for ensuring the quality and integrity of its science. This has led to the reputation of USGS being noted for science excellence and objectivity. In 2006, the scientific policies and procedures were updated, and are now known as USGS Fundamental Science Practices (FSP), a set of consistent practices, philosophical premises, and operational principles to serve as the foundation for research and monitoring activities related to USGS science. The FSP clarifies how USGS science is carried out and how the resulting information products (including maps, imagery, and publications) are developed, reviewed, approved, and released. Carol Lowenberg oversees the FSP process for LTRMP. Carol also coordinates the entry and tracking of all LTRMP abstracts, presentations, reports, and manuscripts, in the USGS Information Product Data System.

Tracking number	Products	Staff	Milestone
2014ER1	Property inventory and tracking	LTRMP staff as needed	15 Nov 2014

Equipment Refreshment

LTRMP field equipment (boats, motors, sampling equipment, etc.) need to be well maintained and replaced when necessary to maintain a safe and functional work environment. (Strategy 2)

Field Station	Equipment Needs FY14
Lake City Field Station	Flow Meter (WQ)
	Portable turbididmeter
La Crosse Field Station	Flow Meter (fish)
	Airboat Safety Inspection & Professional Evaluation
	Net boat
	Net Boat Trailer
	115 HP outboard (WQ)
	Portable turbididmeter
	Flow Meter (WQ)
Iowa DNR Mississippi River Monitoring Station	Net Boat
	Net Boat Trailer
	115 HP outboard motor (net boat)
	GPS/depth sounder (Fish)
	GPS/depth sounder (Veg)
	Field Rugged Laptop (Veg)
	GPS/depth sounder (WQ)
	Portable turbididmeter
	Flow Meter (WQ)
NGRREC	GPS/depth sounder (Fish)
	Flow Meter (fish)
	Portable turbididmeter
	Towing Vehicle (WQ)
	Peristaltic pump (field)
	Portable turbididmeter
	Flow Meter (WQ)
Illinois River Biological Station	GPS/depth (WQ)
Big Rivers and Wetlands Field Station	Field Rugged Laptop (Fish)
	Hydrolab Minisonde
	Portable turbididmeter
	Flow Meter (WQ)
	Nonportable vacuum/pressure station (lab)

Table 1. Sampling effort within the Long Term Resource Monitoring Program during fiscal years 2010–2014, and data collected by each component.

Component	Study Area						Summary of data collected[1]
	4	8	13	26	La Grange	Open River	
Aquatic Vegetation	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	—[2]	—[2]	—[2]	Species, abundance, frequency, distribution, depth, substrate, detritus
Fisheries	~160 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 82 samples	~180 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 82 samples	~200 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 100 samples	~180 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 92 samples	~270 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 120 samples	~165 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 82 samples	Species; catch-per-effort; length; subsample for weight, age, & diet; secchi; water depth, temperature, velocity, conductivity; vegetation density; substrate; dissolved oxygen
Water Quality	135 stratified random sites sampled in each episode (winter, spring, summer, and fall); 14 fixed sites[3] 14 fixed sites in Pools 4 biweekly during July and August.	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 19 fixed sites[3] 4 historic + 2 new fixed sites, biweekly from April through August.	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 12 fixed sites[3] none	121 stratified random sites sampled in each episode (winter, spring, summer, and fall); 11 fixed sites[3] none	135 stratified random sites sampled in each episode (winter, spring, summer, and fall); 11 fixed sites[3] none	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 9 fixed sites[3] none	Suspended solids, major plant nutrients, chlorophyll a, silica, pH, secchi, temperature, dissolved oxygen, turbidity, conductivity, vegetation type & density, wave height, depth, current velocity, depth of snow/ice, substrate, phaeophytin, phytoplankton (archived),
Land Cover/Land Use	Land Cover/Land Use digital aerial photography was acquired in 2010-2011 and processed in subsequent years. Systemic land cover data for the Upper Mississippi River System is collected approximately every 10 years. To date, systemic land cover has been mapped twice through the Long Term Resource Monitoring Program, in 1989 and 2000.						

[1]A full list and explanation of data collected by each component is available through the LTRMP data web site at http://www.umesc.usgs.gov/data_library/other/ltrmp_monitoring.html.
[2]Aquatic vegetation is not sampled in Pool 26 and La Grange because previous sampling revealed very low abundance, or in Open River due to a lack of suitable habitat.
[3]Frequency of fixed site sampling is bi-weekly in April, May, and June, and monthly in all other months, with no sampling in December and February (i.e., winter sampling in January only)

Product Definitions

Draft: A draft that has been submitted to the LTRMP's USGS Science Leader or his designee which is ready for review by USGS, USACE, A-Team, or blind review, as needed. This step begins the process of formal USGS peer-review unless the Science Leader deems the product needs more work by the author(s).

Final draft: A document that the authors have edited based on review comments and has been submitted to the LTRMP's USGS Science Leader or his designee.

Intended for Distribution: Indicates a final printed version or Web-based report is awaiting distribution and USGS final approval. For other products (i.e., manuscripts) this indicates submission to a journal. *Staff time is still expended at this stage of the report process.*

Summary Letter: A summary letter is a communication to Corps management and associated staff that provides quick information regarding progress on a project or product. They are often based on preliminary data and analyses, and represent interim information. Summary letters are reviewed internally by UMESC, but do not go through USGS peer review. Thus, they are not citable and should not be widely distributed. Summary letters are used only when a more complete and peer reviewed product is expected after more work on a specific project.

Leveraged Product: A product produced by LTRMP element staff and others outside of LTRMP; may include funding from non-UMRR-EMP sources.

Donated Product: A product produced by others, without including the LTRMP element staff and without investment of UMRR-EMP funds.