River Almanac

An Information Sharing Bulletin of the
Long Term Resource Monitoring Program

U.S. Department of the Interior
U.S. Geological Survey

Report to Congress recommends continuation of Upper Mississippi Environmental Management Program

The Upper Mississippi River System - Environmental Management Program (EMP) was established to help maintain the multiple use character of the river. In the eyes of many individuals, the program has evolved into a national model for the management of large floodplain river ecosystems. The Report to Congress (December 1997) is a requirement of the EMP authorizing legislation. The report describes and evaluates the effectiveness, strengths, and weaknesses of the programs of the EMP. It is required to contain recommendations for the modification and continuance or termination the program. The Report considers three alternatives and recommends continuation of the program with modifications. The Executive Summary of that report is included on the following pages.

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LTRMP staff readying equipment for the tenth consecutive season of field data collection. *(EMTC photo by Cheri Steage)*

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Draft EMTC Strategic Plan undergoing review

The Environmental Management Technical Center recently completed a draft Strategic Plan for the period 1998-2002. The draft is available through their web site (http://www.emtc.usgs.gov). Public comments are welcome and may be sent to the Center Director. Following is a summary of the Center's Mission, Vision, Guiding Principles, and five-year Goals:

EMTC Mission

Provide information needed to support the sound management of the Mississippi River.

Center Vision

To be recognized as a "Center of Excellence" in large river sciences—supporting theory, policy, and natural resource management activities on the nation's largest floodplain river.

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Executive Summary

The Upper Mississippi River System (UMRS), is defined as the reach of the Upper Mississippi River (UMR) between Minneapolis, Minnesota, and Cairo, Illinois; the entire length of the Illinois River; and the navigable portions of the Minnesota, St. Croix, Black, and Kaskaskia Rivers. The UMRS encompasses one of the world's few large river-floodplain ecosystems. Its complex mosaic of flowing main and side channels, floodplain lakes and forests, backwaters, and wetlands provides all or part of the food and habitat requirements of over 485 species of fish, mussels, birds, mammals, amphibians, and reptiles. Over 10% of these species are classified as rare, threatened, or endangered in one or more of the five UMR basin states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin), and nine species are federally listed as threatened or endangered. More than 40% of North America's migratory waterfowl and shorebirds depend upon the food resources and other life requisites (shelter, nesting habitat, etc.) that the UMRS provides. This diversity and abundance of species is supported in part by an extensive system of state and Federal land holdings that are managed for natural resource purposes. The U.S. Fish and Wildlife Service manages the Upper Mississippi and Illinois River National Wildlife and Fish Refuges and the Mark Twain, Trempealeau, and Minnesota Valley National Wildlife Refuges, which together encompass approximately 310,000 acres. The states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin manage over 190,000 acres for fish and wildlife purposes at more than 80 sites along the UMRS.

The UMRS supports many economic activities of regional and national importance. In 1995, shippers transported approximately 126.3 million tons of cargo on the system's 1,300 commercially navigable miles. Grain, petroleum products, and coal are the leading commodities shipped, with farm products accounting for approximately half of the total tonnage. Millions of visitors annually come to the river to pursue boating, swimming, camping, hunting, and fishing opportunities; visit its many historic towns and archeological sites; or just enjoy its natural beauty.

Many of the region's more than 24 million residents rely on the Upper Mississippi and its tributaries for municipal and industrial water supplies, power generation and power plant cooling, and waste water assimilation. The river system also provides opportunities for extractive industries such as commer-

EMTC Laboratory staff process more than 60,000 monitoring program water samples per year. *(EMTC photo by Cheri Steage)*

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River Almanac

River Almanac is an authorized publication of the U.S. Department of the Interior, published periodically by the Environmental Management Technical Center to provide an ongoing exchange of information between the EMTC and other Long Term Resource Monitoring Program participants and the general public.

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The Environmental Management Technical Center is a U.S. Geological Survey facility located in Onalaska, Wisconsin, USA. The Technical Center manages the Long Term Resource Monitoring Program (LTRMP), which is the largest river-related inventory and monitoring, research, spatial analysis, and information sharing program in the United States.

The Long Term Resource Monitoring Program for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information for maintaining the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character.

The LTRMP is a cooperative effort of the U.S. Geological Survey, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.

Questions or comments may be directed to the EMTC, River Almanac Staff, 575 Lester Avenue, Onalaska, WI 54650-8552, Telephone: 608/783-7550, Fax: 608/783-8058.

River Almanac is also available on the World Wide Web:

http://www.emtc.usgs.gov

Opinions expressed in this bulletin do not necessarily reflect the position of the U.S. Department of the Interior or any LTRMP participant.

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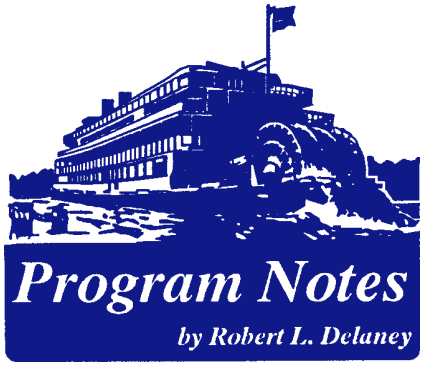

In this issue, we cover two documents that will have a major influence on the future of the LTRMP: a Report to Congress and the EMTC Strategic Plan. The Report to Congress will be used in legislative deliberations over the fate of the Program. The EMTC Strategic Plan is a "blue print" for focusing LTRMP and other Center activities over the next five years. These are significant publications, but two others are worth noting: the Ecological Status and Trends of the Upper Mississippi River System and an International Science Review Committee Report. The Science Committee periodically reviews LTRMP scientific activities and makes recommendations to strengthen the program. Many of their recommendations were included in the Report to Congress. The Science report is significant because it recommends, among other things, broadening the scope of the Program to include basin and watershed influences on the river. The Ecological Status and Trends Report is a milestone for the Program. Directed toward a broad public audience, this document summarizes all data collected since the start of the LTRMP in 1988. This integration is essential for presenting an objective, science-based evaluation of the UMRS to river managers, congressional representatives, and the general public.

I realize that keeping these documents straight may pose somewhat of a challenge given that all were released within the same time frame. To help avoid confusion, I created a table presenting key features for each document (see below). Should you have questions about these important documents, please contact me at 608-783-7550 ext. 51.❖

Document	Significance	Key Points
International Science Review Committee Report	Influences how scientific activities will be conducted within the Program	• In reauthorizing the Program, Congress should expand the scope of the program to allow greater emphasis on understanding the role of the UMR basin in controlling floodplain ecological health. • Increase use of historical data to enable quicker determination of long-term trends. • Incorporate societal goals and values into conceptual model of the river system.
Report to Congress	Provides Congress with recommendations regarding the Program's future	• Establish a continuing authority for the UMRS-EMP with a requirement for Reports to Congress every 6 years. • Reauthorize the LTRMP at a total annual Federal funding level of $10.42 million/year.
EMTC Strategic Plan	Action plan for focusing Center resources	• Mission Statement—provide information needed to support the sound management of the Mississippi River. • Center Vision—to be recognized as a "Center of Excellence" in large river sciences—supporting natural resource management activities on the nation's largest floodplain river.
Ecological Status and Trends of the UMRS	For the first time, all of the data collected from the beginning of the LTRMP are summarized in one report	• Annual water quality, vegetation, invertebrate, and fish monitoring data collected at six field stations since 1998 are presented and discussed. • Six criteria for assessing river ecological health are proposed. • The ecological health of four floodplain reaches is described in a report card format.

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cial harvesting of fish and mussels and sand and gravel mining operations.

In the 1986 Water Resources Development Act, Congress clearly recognized the uniqueness of the UMRS by declaring it to be "a nationally significant ecosystem and a nationally significant commercial navigation system." Consistent with that recognition and as part of the same legislation, Congress authorized both the construction of the second lock at Locks and Dam 26 and a multiple element program that has come to be known as the Upper Mississippi River System -Environmental Management Program (UMRS-EMP). The development and submittal of this Report to Congress was specifically mandated in the EMP's authorizing legislation.

Implementation of the EMP is providing many important outputs, including:

• Restoration, protection and enhancement of critical aquatic, wetland, and floodplain habitat types throughout the UMRS.

• Systemic resource monitoring, data analysis, and applied research resulting in an increased understanding of both the regulated and open reaches of the UMRS.

• Improved communications and expanded partnership among the many UMRS management agencies, interest groups, and the general public.

• A model program applicable to other river systems and water resources.

The EMP is truly a unique, multi-participant program consisting of three major elements (Habitat Rehabilitation and Enhancement Projects [HREPs], Long Term Resource Monitoring [LTRM], and Computerized Inventory and Analysis [CIA; note: the LTRM and CIA have come to be jointly referred to as the LTRMP]) dedicated to the study and restoration of the natural resources of the UMRS. To date, HREP construction has resulted in over 28,000 acres of aquatic, wetland, and floodplain habitat being restored, protected, or enhanced. When the 14 HREPs currently under construction are completed, this area will more than double to nearly 68,000 acres. It will increase to over 97,000 acres upon implementation of the 12 projects currently being designed. The LTRMP monitoring and research activities are providing invaluable information about the UMRS. New levels of partnership among the many river constituencies are being realized. The EMP is fundamental to successful comprehensive management of the system.

This report was developed in consultation with the many Federal and State agencies and non-governmental organizations that participate in the implementation of the UMRS-EMP. It presents the cumulative results of an extensive program review and evaluation process. Program outputs, specifically benefits accrued to the nation as a result of the planning, design, construction, and evaluation of multiple habitat rehabilitation and enhancement projects and the accomplishment of system-wide resource monitoring and applied research activities, are identified and assessed.

The following five overarching conclusions about the UMRS and the EMP were reached during the development of this report:

• The EMP has come to be the single most important and successful program authorized by the Federal government for the purposes of understanding the ecology of the UMRS and sustaining its significant fish and wildlife resources.

• The degradation and loss of UMRS aquatic, wetland, and floodplain habitat can be substantially offset by the application of habitat restoration, protection, and enhancement measures. Such measures must be based upon quantitative and qualitative goals that are compatible with the multiple purpose use of the resource.

Implementing the EMP has resulted in an unprecedented level of communication and cooperation among the Federal and State partner agencies responsible for UMRS management; however, greater public involvement, outreach, and education also are needed.

• A habitat needs assessment (HNA) should be completed to establish a technically sound, consensus-based management framework or "blueprint" for the restoration, protection, and enhancement of the UMR ecosystem. This assessment would begin to identify, at system, pool, and reach levels, long term habitat requirements. It would also serve to refine the focus of future system monitoring and research activities.

• Increasingly effective management of regulated river systems, such as the UMRS, is dependent upon long term monitoring to detect system changes and applied research to understand system dynamics and relationships.

• Implementing the EMP has resulted in an unprecedented level of communication and cooperation among the Federal and State partner agencies responsible for UMRS management; however, greater public involvement, outreach, and education also are needed.

Conclusions reached specific to the LTRMP and HREP program elements include:

The Long Term Resource Monitoring Program (LTRMP) …

• Is providing meaningful characterization of system conditions and identification of long term resource trends.

• Has established and is maintaining the institutional framework and infrastructure necessary to conduct systemic monitoring and applied research at levels not previously possible.

• Is increasing accessibility of UMRS data and information.

• Has and is continuing to adapt to evolving management data and information needs and advancements in ecological science and technology.

• Is playing an increasing role in the planning, design, and evaluation of UMRS habitat restoration, protection, and enhancement projects.

The Habitat Rehabilitation and Enhancement Projects (HREPs) …

• Have directly restored, protected, or enhanced over 28,000 acres of critical UMRS fish and wildlife habitat. By completing implementation of the 26 projects currently being designed or constructed, the number of acres of habitat improved will increase to over 97,000.

• Are providing unique opportunities to demonstrate experimental and innovative approaches to habitat restoration.

Resource managers and decisionmakers are increasingly using the data contained in LTRMP spatial data bases (*EMTC photo by Norman Hildrum)*

• Have met, if not exceeded in most cases, their physical, chemical, and biological design objectives.

• Have become increasingly cost-effective as evolving approaches to their planning, design, and construction are applied.

• Are site-specific improvements that provide important system level ecological benefits.

• Have been, to date, essentially confined to lands already under public ownership.

• In many cases, are adversely affected by sediment delivery from immediately adjacent uplands.

Additional programmatic conclusions included:

• Charters for the EMPCC and LTRMP Analysis Team, reflecting greater involvement and stronger empowerment of the EMP partner agencies, need to be established.

• The EMP would benefit from increased participation by all river constituencies.

The EMP authorization also contained three minor program elements—recreation projects, economic impacts of recreation, and traffic monitoring. These elements have either been successfully completed or are now being carried out under other authorities.

Three program alternatives are considered in this report. They were formulated and assessed utilizing a multi-participant approach. The Program's partner agencies, other Federal and State governmental agencies, and several interested non-governmental organizations all contributed tothe process of defining and evaluating these alternatives:

1. **End EMP.** No action to extend or otherwise change the existing program authorization would be taken, nor would any significant modifications of existing program implementation procedures be pursued. The current program authorization would be allowed to end as of fiscal year 2002. Ramping down of the program would be initiated immediately to allow completion of habitat rehabilitation and enhancement projects already in advanced stages of design or awaiting construction. Activities of the Long Term Resource Monitoring Program would be increasingly directed towards data analysis in preparation for program termination.

2. **Continue EMP.** The program, as currently authorized, would be reauthorized for an additional 15 years (2003-2018). Program funding levels and implementation roles and responsibilities would remain unchanged. Program capabilities and annual outputs would continue to decline over time as the erosive effects of inflation on the Program's fixed funding level are realized.

3. **Continue and Modify EMP.** The EMP would be reauthorized as a continuing authority with a requirement for formal Congressional reviews of the program (Reports to Congress) on a 6-year cycle. Currently authorized Program funding levels for the LTRMP and HREP program elements would be increased by a factor of 1.75 to offset

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Strategic Plan from page 1

Guiding Principles

In fulfilling its mission, the Center:

1. recognizes the Congressionally authorized Upper Mississippi River Environmental Management Program as the **primary focus** of Center activities;
2. shares the common USGS goal of providing the nation with reliable, impartial information to describe and understand the Earth;
3. understands that sound river management requires accurate and unbiased information;
4. recognizes that establishing partnerships with other research and management agencies is critical to achieving Center objectives;
5. works to ensure that science activities remain relevant to management questions; and
6. strives for excellence in its research, monitoring, spatial analysis, and information sharing activities through internal quality control and external peer review.

Center Goals

The Center has six goals in support of its mission. These goals closely match those of the authorizing legislation and the USGS. These goals are to:

1. develop a better understanding of the ecology of large rivers,
2. monitor resource change,
3. support the planning, implementation, and evaluation of management actions,
4. facilitate the integration of natural resources science throughout the Upper Mississippi River basin,
5. support natural resource management through geospatial technologies and analysis, and
6. support decision making through sound data management and information sharing. ❖

Mississippi River looking south from O.L Kip State Park, Winona County, Minnesota *(EMTC photo by Norman Hildrum)*

Selected Abstracts of ongoing studies

Blodgett, K. D., J. A. Stoeckel, R. E. Sparks, S. D. Whitney, and P. T. Raibley. 1997. Dispersal of nonindigenous aquatic species between The Great Lakes and Mississippi River basins. Poster presented at the Zebra Mussel Conference, New Orleans, Louisiana, January 28–31, 1997.

A significant portion of the native aquatic fauna of the Great Lakes resulted from the northward dispersal of species from the Mississippi Basin following the Wisconsin glaciation over 14,000 years ago. During the next 8,000 years, the basins were connected intermittently; the most recent natural connection was approximately 6,000 years ago. Since then, the aquatic communities of these two basins developed in relative isolation from each other, although seasonal flooding may have created temporary links, especially in southern Lake Michigan. In the 1800s, however, the interbasin connection was reestablished when the Chicago River was reversed to carry water away from Lake Michigan, its natural destination, and by way of the Illinois and Michigan Canal and the Des Plaines River, into the Illinois River, a tributary of the Mississippi. Additional conduits were constructed through the 1930s. While the artificial connection created a potential pathway for movement of aquatic organisms between the basins, poor water quality because of untreated municipal and industrial wastes from the Chicago metropolitan area probably maintained an effective dispersal barrier. Since the passage of the Clean Water Act of 1972 and ensuing environmental legislation, billions of dollars spent on water treatment significantly reduced this pollution barrier.

Invasive aquatic species can have severe economic and environmental effects. Notable recent examples of dispersal between the basins are the southward movement of the zebra mussel (*Dreissena polymorpha)*, established in the Great Lakes about 1986 and in the Illinois River by 1991, and the quagga mussel *(Dreissena bugensis)*, recently reported from the Mississippi River.

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Liaison from Natural Resources Conservation Service begins work at EMTC

By Jerry Cox

Fred Kollmann, a Resource Conservationist with the U.S. Department of Agriculture Natural Resources Conservation Service (USDA, NRCS), is the first of several on-site agency liaisons to arrive at the Environmental Management Technical Center (EMTC). The liaison's role will be to facilitate information exchange between the LTRMP and the Program's Federal partners who manage natural resources of the Upper Mississippi River Basin (UMRB). Representatives from other agencies, including the Environmental Protection Agency and the U.S. Army Corps of Engineers, are expected at the EMTC over the next year. The representatives will have offices at the EMTC, where they will work closely with EMTC and other state and Federal partner staff. The EMTC works closely with the U.S. Fish and Wildlife Service, which has an adjacent office facility. According to EMTC director, Robert Delaney, increased interaction means greater access to and sharing of important information about the UMRB—information that will further enhance the monitoring and research being performed by the LTRMP.

Fred Kollmann

Kollmann is a native of central Minnesota where his family was involved in dairy farming. His mother was a school teacher who undoubtedly influenced Kollmann in the pursuit of his goals. Kollmann attended the University of Minnesota, majoring in Mechanical Engineering, until he was drafted. He spent most of his military career at the U.S. Army Engineering School at Fort Belvoir, Virginia, drawing quadrangle maps for military operations. Kollmann later returned to the University of Minnesota to complete a bachelor's degree in Plant Pathology and Forestry.

In addition to a varied educational background, Kollmann brings to the EMTC a varied background in state and Federal service, one covering several parts of the country, from as far west as Idaho and east and south as Florida. Early in his career, Kollman taught Environmental Education courses for the Minnesota Department of Natural Resources. Following that, he was with the Bureau of Land Management, stationed in Cottonwood, Idaho. Later, Kollmann worked with the USDA in Plant Protection and Quarantine in Jacksonville, Florida. In that position, he inspected imported and exported foods for insect and disease problems. "Inspection routinely included the wood of packing crates," he said, "for the larvae of wood boring insects."

Kollmann then moved into the USDA Soil Conservation Service in Brevard County, Florida (often referred to as the Space Coast and home of the Kennedy Space Center). "Most people are unaware," he said, "of the vast agricultural industry just beyond the boundary of the space center and the very narrow strip of urban and tourist development along the coast. There is a heavy concentration of citrus and other fruit growers and ranchers, raising crops from oranges to watermelons."

In 1984, Kollmann returned to Minnesota as the District Conservationist in Twin Valley. In 1989, he became the Area Resource Conservationist in Thief River Falls, Minnesota, where he was until coming to the EMTC.

...the success of the Environmental Management Program...is tied to...cooperation with the partners.

One of the key ingredients in the success of the Environmental Management Program (EMP) of the Upper Mississippi River (UMR) is the cooperation of many different state and Federal agencies. Fostering these partnerships and the communication necessary to make them work is mandated in the authorizing legislation for the EMP, and is recognized by the Center in its Report to Congress and its Strategic Plan (this issue page 1). The incorporation of on-site agency liaisons can only enhance the cooperation that already exists between the Center and its partners.❖

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the effects of inflation since program inception. The Program would be periodically re-examined based upon future program evaluations and habitat needs assessments. Under this alternative, additional habitat projects would be implemented and an expanded program of monitoring and research carried out.

Alternative 3, **Continue and Modify EMP**, is the preferred alternative. It includes the following proposed program implementation modifications and recommendations to Congress:

Proposed Program Implementation Modifications

• Complete a habitat needs assessment for the UMRS.

• Delegate to the District level of the U.S. Army Corps of Engineers approval authority for habit projects costing $1 million or less.

• Delegate to the Division level of the U.S. Army Corps of Engineers approval authority for habitat projects costing $5 million or less.

• Review and possibly revise policies and guidance addressing acquisition of real estate interests (fee title or easement) from willing sellers.

• Review and possibly revise policies and guidance addressing upland sediment controls.

• Continue the important pre- and post-habitat project monitoring and evaluation efforts.

• Continue to implement a mix of small- and large-scale habitat projects with increasing emphasis on the use of natural river processes and innovative measures.

• Identify factors that may be limiting program innovation and review and revise any potentially constraining policies and guidance.

• Facilitate development of charters for the EMPCC and Analysis Team.

• Increase the level of public involvement in program planning and implementation.

Recommendations to the United States Congress

1. Establish a continuing authority for the UMRS-EMP with a requirement for Reports to Congress every 6 years (to coincide with Water Resources Development Act legislation).

2. Review the current authorization so as to formally merge the Long Term Resource Monitoring and Computerized Inventory and Analysis elements of the program into a single element called the Long Term Resource Monitoring Program.

3. Reauthorize the program at a total annual Federal funding level of $33.17 million.

• $22.75 million/year for the protection, restoration, and improvement of Upper Mississippi River System aquatic, wetland, and floodplain habitats (habitat rehabilitation and enhancement projects).

• $10.42 million/year for monitoring, data analysis, and applied research (long term resource monitoring program).

4. Continue program cost-sharing requirements as described in the Water Resources Development Act of 1986

• 100% Federal funding of HREPs “on lands managed as a national wildlife refuge”; 75% Federal/25% non-Federal cost sharing of all other HREPs and recommended in this report

• Allow up to 80% of the 25% non-Federal share of cost-shared HREPs to be in the form of in-kind services.

• Allow non-Federal interests to be reimbursed, subject to the availability of funds, for the Federal share, without interest, of studies, design documents, and implementation costs of approved HREPs.

This report and its appendixes provide, both quantitatively and qualitatively, the data, information, professional judgments, and determinations necessary to reach prudent, defensible decisions as to the strengths and weaknesses of the current UMRS-EMP and its future.

The conclusions, proposed program implementation modifications, and recommendations to Congress presented in this report were developed in consultation with the program’s partners, other appropriate government agencies, various non-governmental organizations, and the general public.

The preferred alternative, as identified, for the future of the UMRS-EMP is broadly supported by the UMRS’ many stakeholders. Its full implementation will assure that the future EMP is of the magnitude, standing, and duration necessary to: meet the long term data and information needs of river managers and users; offset the continuing degradation and loss of UMRS aquatic, wetland, and floodplain habitats; support emerging efforts to more comprehensively manage the UMRS and its basin; and ultimately, fulfill public expectations of a healthy, sustainable UMR ecosystem capable of accommodating equally important recreational and economic uses.

The Report has been provided to the Chief of the U.S. Army Corps of Engineers for review and approval prior to its being forwarded to Congress for action.❖

Personality Profile

A closer look at the people who make the LTRMP a success

by Madelon Wise

The Long Term Resource Monitoring Program can best meet the needs of its partners by combining technologies and expertise. Program biologists, for instance, learn geographic information systems (GIS) to study and map habitat, combining biological concepts with spatial information. Carol Lowenberg, a fish and wildlife biologist, has become an invaluable member of the Environmental Management Technical Center (EMTC) Geospatial Technologies Division (Decision Support and Applications) by combining just such skills.

Carol Lowenberg

Lowenberg came from an outdoors-oriented family; some of her earliest memories are of fishing in the Florida Everglades with her father. Along with family camping, Lowenberg was active in scouting and was a member of the Youth Conservation Corps in southern Illinois.

With the encouragement of these early experiences, Lowenberg earned her bachelor's degree in Fisheries and Wildlife Biology from Iowa State University at Ames. Her outdoors experience and formal education prepared Lowenberg for a number of related positions including a Missouri State Park seasonal naturalist; a U.S. Army Corps of Engineers (Corps), Omaha District, seasonal park technician; a biological technician with the Corps Operation Fish Run; an Inland Fisheries Technical Advisor in Cameroon, West Africa; and a physical science and biological technician at the Marquette Biological Station in Michigan.

While surveying streams for sea lamprey control in Michigan, Lowenberg injured her knee and was bound to the office for a month. Restricted to the office, she was error-checking data entry, working with the computer systems administrator, and learning more about computers.

Lowenberg continued honing her computer skills by learning geographic information systems (GIS) when she came to the EMTC in October 1992 as a part of the U.S. Fish and Wildlife Service Region 3 Cross Program Rotational Position (Spiral Program). The next year she took a wetlands delineation course through the Corps and combined these new skills with GIS.

Moving into GIS was a natural for Lowenberg, as she has "worked on spatially oriented projects, mapping and orienteering," throughout her career. "The sea lamprey studies were spatially linked with flows, water sources, and the extent of population," she says.

The biologists at Marquette are responsible for the U.S. tributaries of southern Lake Superior in Wisconsin and Upper Michigan and Upper Lake Michigan, and Lake Erie. They meet daily and plot their routes for the day. Working in groups of two on stream surveys, the biologists cover four to six sites a day, in areas that are usually heavily wooded and fairly remote. The biologists often travel on old logging roads into back areas. Spatial skills are crucial as Lowenberg explains, "In Marquette, we carried stacks of U.S. Geological Survey quadrangle maps with the sites circled."

Lowenberg spent three years as a volunteer in the Peace Corps in Cameroon, West Africa, where her fisheries skills were dedicated to teaching fish farming. In West Africa, Lowenberg lived in a mountainous province the size of several Wisconsin counties. Her spatial skills were challenged by much cross-country traveling using topographic contour maps originally drawn by French cartographers. "The province did not have many roads," says Lowenberg, " and most of the roads turned out to be footpaths. The road and trail positions indicated on the maps were not necessarily to be trusted. Much of the navigating in Africa was from guessing and hearsay."

...customized..training to meet the needs of her..audience.

In her position in the Geospatial Technologies Division, Lowenberg fills many roles. She has concentrated on getting data to the field stations for use as personal computer (PC) applications. "When preparing the data," she says, "the needs of the field stations come first."

Lowenberg has collaborated on two pilot projects, the U.S. Army Corps of Engineers Waterways

Continued from previous page

Experiment Station navigation studies and the migratory bird project. The Manager's Information System with migratory birds is a cooperative experiment between the EMTC, the Upper Mississippi Science Center, and the U.S. Fish and Wildlife Service (USFWS). In this project, the cooperating partners linked bird data to GIS coverages. The strategy proposes an "integrated, ecological, proactive approach to management of habitats used by migratory bird populations," says Lowenberg.

In 1992, Lowenberg began teaching EPPL7 classes. Because staff found the users manual hard to understand, she designed a course for the field stations that addressed their particular work. Many staff members from the USFWS have also attended these courses.

"Presently," Lowenberg says, "ArcView has replaced EPPL7." Once again, she customized the training to meet the needs of her key audience. She continues to survey and communicate with her audience and to develop the ArcView training program accordingly. As an example of customer satisfaction with her training, Lowenberg finds that the refuges like GIS. "They have been very supportive of our work, and have begun training their staff. The trained biologists then provide support to the rest of the office."

Lowenberg also helps to maintain the EMTC web site (http://www.emtc.usgs.gov) and is currently restructuring the data library and linking the GIS data pages to monitoring data. She has placed much data online and is updating all of the pages showing GIS images of pools "to make it easier to navigate from one pool image to another. Pool images are online in two forms: a report quality image and a thumbnail. These pool pages are cross referenced to the 100K tile library."

The 100K tile library displays USGS 100 to 100K quadrangles in which the data are clipped to the boundaries of each quadrangle. The user can select on a particular quad and be linked to an enlarged picture of that quad. A current priority is for Program students to complete the links on all available quads.

Lowenberg, also serves LTRMP customers by customizing ArcView projects with Avenue programming (ArcView's programming language). "I have been going through commonly used scripts and adding extensions. In ArcView a user can write programs in script; however, the procedure for using a script program is complicated and not very user-friendly," she says. Lowenberg has been creating extension programs that will automatically add functionality to a script program. These new extensions are available through the EMTC web site, along with data. Carol Lowenberg is the epitome of customer service: by combining her special talents and skills and providing support, she helps the LTRMP fulfill its information-sharing mission.❖

...combining..special talents and skills and providing support..helps the LTRMP fulfill its information sharing mis-

Carol assisting a participant in an ArcView training class. (*EMTC photo by Mark Wenger)*

Upcoming meetings

April 23-24 The 30th Anual Mississippi River Research Consortium meeting at the Yacht Club Resorts, La Crosse, WI.

June 7-12 The Land-Water Interface: Science for a Sustainable Biosphere, St. Louis, MO, jointly sponsored by the American Society of Limnology and Oceanography/Ecological Society of America.

June 8-12 The GEWEX Continental-Scale International Project (GCIP) Mississippi River Climate Conference, St. Louis, MO, co-sponsored by the National Oceanic and Atmospheric Administration (NOAA), the Department of Energy, and the American Meterological Society.

President announces a Clean Water Action Plan to restore and protect America's waters

President Clinton recently announced a Clean Water Action Plan to restore and protect America's waters. Twenty-five years after enactment of the Clean Water Act, the President is launching a major new initiative to fulfill its promise—clean, healthy water for all Americans. To carry out the initiative, the President's budget proposes $568 million in new resources in Fiscal Year 1999—a 35 percent increase—and a total increase of $2.3 billion over five years. The President also is challenging Congress to join him in strengthening and reauthorizing the Clean Water Act.

The Long Term Resource Monitoring Program helps understand changing water quality patterns in the Upper Mississippi River System *(EMTC photo by MiAe Butterbrodt)*

New Pollution Challenges. We have made tremendous strides in cleaning up our rivers, lakes and coastal waters, largely by controlling pollution from factories and sewage plants. Yet 40 percent of our surveyed waterways are still too polluted for fishing and swimming. The largest remaining challenge is reducing nonpoint pollution: runoff from farms, city streets and other sources.

Water quality is best protected by looking at the entire watershed.

A Second Generation of Clean Water Protection. These new challenges demand a new approach. The Action Plan aims to protect public health and restore our precious waterways by setting strong goals and providing states, communities, and landowners the tools and resources to meet them. It charts a new course emphasizing collaborative strategies built around watersheds and the communities they sustain.

Clean Water, Healthy Communities. The Action Plan supports efforts by states and communities to prevent the contamination of beaches, fish, and drinking water sources. It will reduce polluted runoff, increase wetlands, and protect coastal waters from outbreaks of harmful organisms like Pfiesteria and alarming conditions like the dead zone in the Gulf of Mexico.

Incentives for Conservation. To promote private conservation efforts, the Action Plan provides increased incentives to farmers and other landowners to adopt practices that protect water quality. For instance, it expands Department of Agriculture programs that compensate farmers for creating protective forest and grassland buffers along rivers and streams.

Community-Based Planning. Water quality is best protected by looking at the entire watershed—all the land, from forest to farm to urban neighborhood, that contributes runoff to a river system. The Action Plan encourages states and communities to work with the public and all affected stakeholders to identify priorities and the most cost-effective cleanup strategies.❖

White House Press Release
February 19, 1998

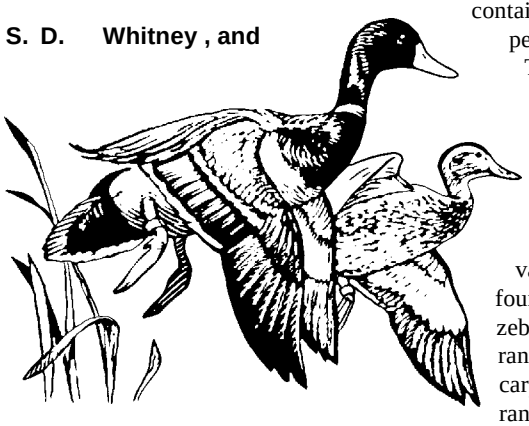
Abstracts from page 6

Recent fish transfers southward include white perch *(Morone americana*) and rudd *(Scardinius erythrophthalmus)*. Other species are poised to invade the Mississippi Basin from the Great Lakes.

Not all recent transfers have been from the Great Lakes into the Mississippi River Basin. In the 1970s, the Asiatic clam *(Corbicula fluminea)* probably invaded the Great Lakes from the south. Other nonindigenous species may invade the Great Lakes via the Mississippi and Illinois Rivers. These upriver transfers may be facilitated by commercial and recreational boat traffic.

Reestablishing a dispersal barrier could reduce future movement of species between the basins while maintaining navigation and the flow of water from Lake Michigan for dilution and water supply. Furthermore, a barrier could help control established species such as zebra mussels that have populations maintained in the Illinois River by downriver drift of larvae. Potential barrier technologies include bubble curtains, ultrasound, warm water, low oxygen, followed by reaeration, chemical treatment, or combinations of such methods.

Blodgett, K. D., J. A. Stoeckel, S. D. Whitney , and R. E. Sparks. 1997. A dynamic population model for unionid mussels. Paper presented at the Annual Meeting of the Illinois Chapter American Fisheries Society, Collinsville, Illinois, March 5-7, 1997. Poster presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.



Management of native mussels is hampered by the inability to quantitatively assess the impacts of natural and anthropomorphic stresses, such as harvest mortality, on populations of this economically and ecologically important resource. Sound science-based management requires a tool that combines data on current populations with knowledge of population dynamics to predict future conditions under various management scenarios.

A single-species dynamic population model for native mussels was developed using Stella II software running on a personal computer. The model was developed using data for the threeridge mussel (*Amblema plicata*) from Reach 15 of the Upper Mississippi River at Rock Island, Illinois, but it can be adapted for other locations and species. Input parameters include initial density (number per square meter), age-frequency distribution, growth rate, age at maturity, and age-specific mortality rates. In this model, recruitment is density dependent and can be calculated as a percentage of the reproductive population or by using a submodel incorporating fecundity rate, sex ratio, density-dependent fertilization rate, and glochidial attachment, transformation, and survival rates. The model outputs standing stocks (numbers per square meter) of different age classes over time.

The model allows harvest that can be regulated by minimum size (the current management practice in Illinois), minimum density, maximum harvest rate (number per square meter), assorted closure strategies, or various combinations of these. Model outputs include annual and cumulative harvest (numbers and kilograms per square meter). The model also can use size-dependant price estimates to calculate dollar values for standing stocks and both annual and cumulative harvest.

Cronin, F. A., D. W. Soergel, J. K. Tucker, and T. B. Mihuc. 1997. Predation on zebra mussels *(Dreissena polymorpha)* by common carp (*Cyprinus carpio)*. Paper presented at the Illinois Chapter American Fisheries Society Annual Meeting, Collinsville, Illinois, March 4-6, 1997.

The gut contents from 31 common carp *(Cyprinus carpio)* collected at Mississippi River Mile 217 in late August 1995 were examined for evidence of predation on zebra mussels *(Dreissena polymorpha)*. Between 1 and 407 zebra mussel beaks were present in 83.9% of the fish examined. For all fish examined, common carp contained an average of 118.2 beaks per fish or about 59 zebra mussels per fish. Excluding fish that did not contain one or more beaks, we found 140.9 beaks per fish or about 70 zebra mussels per fish. The survey did not indicate that larger fish consumed more zebra mussels than smaller fish. Estimated valve length for zebra mussels consumed by common carp ranged from 1.48 to 42.52 mm with a mean of 11.79 mm (SE = 0.10 mm). Individual variation existed among the 24 fish in mean valve length of zebra mussels consumed. We found that large fish tend to prey on larger zebra mussels than small fish. The general size range of zebra mussels consumed by common carp overlapped the upper portion of the size range of young-of-the-year zebra mussels living at the site and the lower portion of the size range of older zebra mussels living at the site. Other prey items found included fingernail clams (Sphaeriidae), the asian clam *(Corbicula nauilensis*, Corbiculidae), and yellow sandshell (*Lampsilis teres*, Unionidae). Notwithstanding the possible impact that the common carp may have on zebra mussel demographics, the study bears directly on the controversy surrounding proposals to import other exotic molluscivorous fishes such as the black carp *(Mylopharyngodon piceus)* to effect long-term control of zebra mussel populations. If predation by the common carp is found to be widespread where zebra mussels are numerous, then there is no reason to import other fishes. Further studies of the common carp in other areas with high zebra mussel densities are critically needed.

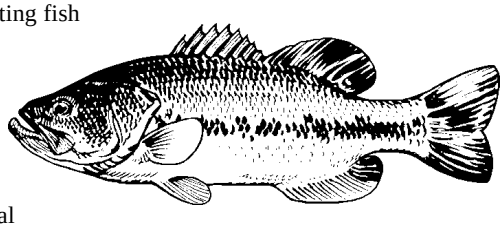
Hrabik, R. A 1997. A geographical information system application for aquatic disciplines: A conceptual method. Poster presented at the Missouri Forest, Fish, and Wildlife Conference, Tan-Tar-aResort, Osage Beach, Missouri, February 5-7, 1997.

Geographic information systems (GIS) are used in many scientific and engineering disciplines for environmental assessments, resource management, and urban and industrial planning.

In the natural resources field, GIS have been used to map, store, and retrieve copious amounts of data, including climatic variables, soil types, and land use and land cover information. Although the data storage, retrieval, and mapping capabilities are useful, the real power of GIS lies in its use in assessment and prediction. Examples of such use include predicting the spread of gypsy moth infestations in the United States and determining the extent and fragmentation of critical wildlife habitat. An important tool for understanding species and population distributions is called gap analysis. Physical, environmental, and biological factors are entered into a GIS database, and through analysis and manipulation of these data, gaps in critical habitat are identified and can be indicated on maps useful to researchers and managers. Aquatic researchers and managers have not extensively used this technique. Most aquatic applications of GIS involve spatial and temporal change of surface features and patterns of environmental perturbation to predict short- and long-term biological impacts. Geographic information systems, for example, have been used to store fish distribution and stream habitat features, then rank their biotic value, and they been used to store information about a particular species habitat. To date, the literature does not indicate that GIS have been used to predict species or population distributions in streams using in situ stream habitat variables. This paper describes a GIS application for predicting the distribution of sicklefin chubs (*Macrhybopsis meeki*) in a small section of the middle Mississippi River using water physical data. I used the IDRISI geographic information and image processing software to build this model. The accuracy and completeness of the data sets used in this model are inadequate to reliably predict *M. meeki* distribution in the middle Mississippi River. The data were adequate, however, to demonstrate the predictive ability of the conceptual model.

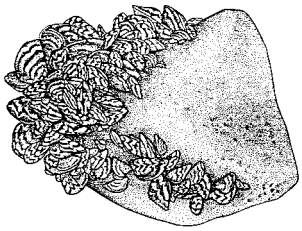
Raibley, P. T., K. S. Irons, T. M. O'Hara, K. D. Blodgett, and R. E. Sparks. 1997. Winter habitats used by largemouth bass in La Grange reach of the Illinois River. Paper presented at the Annual Meeting of the Illinois Chapter American Fisheries Society, Collinsville, Illinois, March 5-7, 1997.

During the winter of 1993–1994, habitats used by 17 radio-tagged largemouth bass were characterized in La Grange Reach of the Illinois River. Radio-tagged largemouth bass wintered in backwaters and off-channel coves, ditches and marinas from November through February. Electrofishing mean catch-per-unit-efforts were higher in the study areas during winter than in other seasons, indicating fish were more concentrated in these areas during winter. Five of nine study areas received thermal inputs from springs or powerplants and water temperatures in all nine study areas were warmer than the main channel during winter. Current velocities averaged 2 cm/s in the study areas and 19 cm/s in the main channel. No radio-tagged fish were documented moving into the main channel during winter. River levels played a major role in determining the suitability of wintering habitats. When river levels declined, temperatures increased and dissolved oxygen levels decreased in smaller areas with thermal inputs. Thousands of fish, including juvenile and adult largemouth bass, winterkilled near one study area when they became trapped in a backwater after river levels declined. Large numbers of age-0 fish wintering in the study areas and other off-channel habitats are susceptible to similar winterkill events which may deplete these cohorts. As sedimentation continues to fill in backwaters, river levels are critical to maintaining adequate depths and stable water quality for wintering fish. Perhaps the best strategy for providing adequate wintering habitat for Illinois River fish would be a combination of habitat rehabilitation and attempts to maintain stable winter river levels.



Stoeckel, J. A., T. A. Ferro, K. Stevenson, D. Adrian, and H. T. Keppner 1997. Seasonal abundance and fecundity of *Daphnia lumholtzi* in the Illinois and Kentucky Rivers. Poster presented at the Zebra Mussel Conference, New Orleans, Louisiana, January 28–31, 1997.

The ability of invading aquatic species to adapt to riverine conditions may be an important determinant of their dispersal potential. Planktonic invaders that are able to survive and reproduce in upriver areas can provide a constant source of recruits to downriver areas by passive drift. Boats traveling in and out of nearby (or connected) lakes and reservoirs can transport invaders in both upriver and downriver directions. Construction of canal systems can result in rivers such as the Illinois serving as an invasion route between major drainage basins (i.e., the Laurentian Great Lakes and the Mississippi Basins) that were formerly separated by land barriers.



Spined white fleas *(Daphnia lumholtzi)* were first detected in the Illinois and Kentucky Rivers in summer 1995 and probably occurred sporadically in the Illinois River as far back as 1991. In 1995, populations peaked in August with maximum abundances of 22.5 and 32.8 individuals/L in the Illinois and Kentucky Rivers, respectively. These abundances match or exceed many reported thus far in United States lakes and reservoirs suggesting that *D. lumholtzi* may be adapted to lotic as well as lentic conditions. River systems, such as the Illinois and Kentucky, are characterized by high sediment loads. In order to survive in turbid, riverine environments, filter feeders must be able to cope with the diluting effect of suspended sediments on food particle availability. Because suspended sediments are primarily inorganic (i.e., 94%) and food particles such as algae and bacteria are primarily organic, the inorganic to organic (I:O) ratio of suspended solids gives a rough estimate of food quality. Fecundity parameters (percentage of oviparous females, average brood size, etc.) will be compared with total suspended solids of riverine and backwater habitats. This will allow assessment of potential effects of various sediment loads, representing different food quality and quantity levels, with respect to *D. lumholtzi* reproduction. Range expansion and seasonal abundance patterns from the 1996 field season will also be reported. ❖

New Reports from page 16

Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-S005. 16 pp.

Kimber, A., C. E. Korschgen, and A. G. van der Valk. 1995. The distribution of *Vallisneria americana* seeds and seedling light requirements in the Upper Mississippi River. Canadian Journal of Botany 73:1966–1973. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, December 1997. LTRMP 97-R029. 8 pp.

Kimber, A., J. L. Owens, and W. G. Crumpton. 1995. Light availability and growth of wildcelery (*Vallisneria americana*) in Upper Mississippi River backwaters. Regulated Rivers: Research & Management 11:167–174. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R024. 8 pp.

Langrehr, H. A. 1997. Aquatic vegetation monitoring in Pool 8 of the Upper Mississippi River System, May–August 1995. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, October 1997. LTRMP 97-S004. 11 pp. + Appendixes A–C

Lowenberg, C. D. 1997. Geographic information system modeling procedures for the Upper Mississippi River System migratory bird pilot project. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, February 1997. LTRMP 97-T001. 46 pp. + Appendixes A–F (NTIS #PB97-155543)

Mihuc, T. B. 1997. The functional trophic role of lotic primary consumers: Generalists versus specialist strategies. Freshwater Biology 37:455–462. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R028. 8 pp.

Nelson, J. C. 1997. Presettlement vegetation patterns along the 5th principal meridian, Missouri Territory, 1815. American Midland Naturalist 137:79–94. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R026. 16 pp.

Olsen, D. A. 1997. Long Term Resource Monitoring Program Component Database Spatial Query Tool User's Guide. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-P010. 12 pp. + Appendix

Packard, G. C., J. K. Tucker, D. Nicholson, M. J. Packard, F. J. Janzen, and C. Phillips. 1997. Scientific investigations on turtles. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R027. 13 pp.

Paukstis, G. L., F. J. Janzen, and J. K. Tucker. 1996. Response of aerially-exposed zebra mussels (*Dreissena polymorpha*) to subfreezing temperatures. Journal of Freshwater Ecology 11(4):513–519. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, September 1997. LTRMP 97-R017. 7 pp.

Raibley, P. T., K. S. Irons, T. M. O'Hara, K. D. Blodgett, and R. E. Sparks. 1997. Winter habitats used by largemouth bass in the Illinois River, a large river–floodplain ecosystem. North American Journal of Fisheries Management 17:401–412. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, January 1998. LTRMP 98-R002. 12 pp.

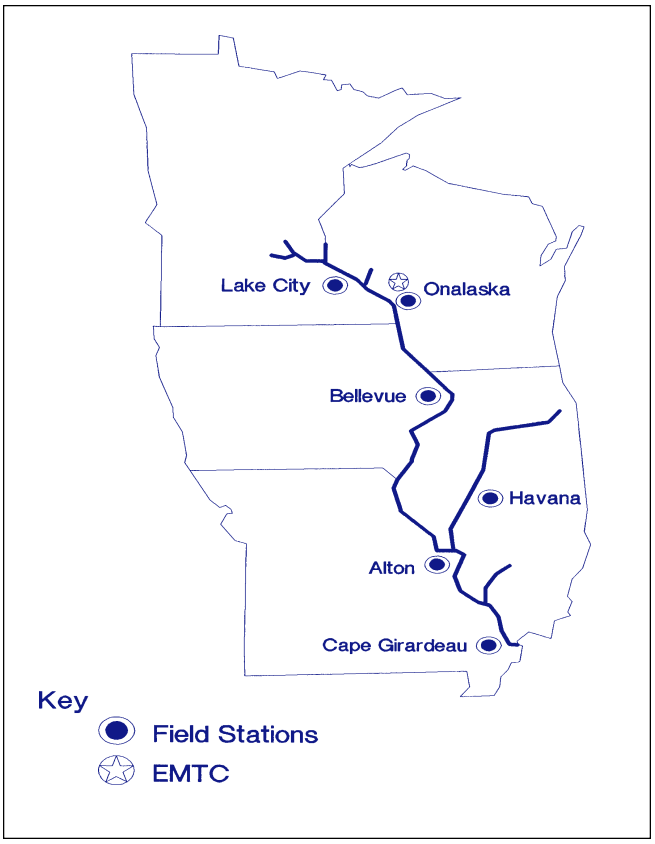
Rogers, S. J., D. G. McFarland, and J. W. Barko. 1995. Evaluation of the growth of *Vallisneria americana* Michx. in relation to sediment nutrient availability. Lake and Reservoir Management 11(1):57–66. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, July 1997. LTRMP 97-R011. 10 pp.

Sauer, J. 1997. Annual status report, 1996: Macroinvertebrate sampling. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, April 1997. LTRMP 97-P004. 18 pp.

Sauer, J. 1997. Annual status report, 1995: Macroinvertebrate sampling. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, April 1997. LTRMP 97-P003. 18 pp. (NTIS #PB97-159719)

Sauer, J. 1997. Annual status report, 1994: Macroinvertebrate sampling. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, February 1997. LTRMP 97-P002. 19 pp. (NTIS #PB97-153670)

Sauer, J. S. 1997. Annual status report, 1993: Macroinvertebrate sampling. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, February 1997. LTRMP 97-P001. 17 pp. (NTIS #PB97-153662)



Location of the Environmental Management Technical Center and Field Stations

Scarpino, P. V. 1997. Large floodplain rivers as human artifacts: A historical perspective on ecological integrity. Report prepared for U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, December 1997. LTRMP 97-S003. 7 pp.

Sparks, R. E. 1995. Need for ecosystem management of large rivers and their floodplains. BioScience 45(3):168–182. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, April 1997. LTRMP 97-R004. 15 pp.

Stoeckel, J. A., L. Camlin, K. D. Blodgett, and R. E. Sparks. 1996. Establishment of *Daphnia lumholtzi* (an exotic zooplankter) in the Illinois River. Note in Journal of Freshwater Ecology 11(3):377–379. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-R013. 3 pp.

Stoeckel, J. A., D. W. Schneider, L. A. Soeken, K. D. Blodgett, and R. E. Sparks. 1997. Larval dynamics of a riverine metapopulation: Implications for zebra mussel recruitment, dispersal, and control in a large-river system. Journal of North American Benthological Society 16(3):586–601. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, January 1998. LTRMP 98-R001. 16 pp.

Theiling, C., R. Maher, and R. Sparks. 1996. Effects of variable annual hydrology on a river regulated for navigation: Pool 26, Upper Mississippi River System. Journal of Freshwater Ecology 11(1):101-114. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, July 1997. LTRMP 97-R010. 14 pp.

Tucker, J. K. 1996. Post-flood strandings of unionid mussels. Journal of Freshwater Ecology 11(4):433–438. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, September 1997. LTRMP 97-R018. 6 pp.

Tucker, J. K., and F. A. Cronin. 1996. The western sand darter (*Ammocrypta clara)* in Pool 26 of the Mississippi River in Missouri and Illinois. Transactions of the Illinois State Academy of Science 89(3 and 4):221–224. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-R015. 4 pp.

Tucker, J. K., F. A. Cronin, N. I. Filoramo, B. J. Kerans, F. J. Janzen, R. J. Maher, D. Moll, G. L. Paukstis, and C. H. Theiling. 1997. Scientific investigations on the red-eared turtle, *Trachemys scripta elegans*. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-R012. 45 pp.

Tucker, J. K., F. A. Cronin, R. A. Hrabik, M. D. Petersen, and D. P. Herzog. 1996. The bighead carp (*Hypophthalmichthys nobilis*) in the Mississippi River. Note in Journal of Freshwater Ecology 11(2):241–243. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-R014. 3 pp.

Tucker, J. K., F. A. Cronin, D. W. Soergel, and C. H. Theiling. 1996. Predation on zebra mussels (*Dreissena polymorpha*) by common carp (*Cyprinus carpio*). Journal of Freshwater Ecology 11(3):363-372. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, September 1997. LTRMP 97-R020. 10 pp.

Tucker, J. K., F. J. Janzen, and G .L. Paukstis. 1996. Laboratory survivorship of aerially exposed pond snails (P*hysella integra)* from Illinois. Transactions of the Illinois State Academy of Science 89(3 and 4):225–231. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-R016. 7 pp.

Tucker, J. K., C. H. Theiling, and J. B. Camerer. 1996. Utilization of backwater habitats by unionid mussels (Bivalvia: Unionidae) on the lower Illinois River and in Pool 26 of the Upper Mississippi River. Transactions of the Illinois State Academy of Science 89(1 and 2):113–122. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, September 1997. LTRMP 97-R019. 10 pp.

U.S. Geological Survey. 1997. Annual Work Plan, Fiscal Year 1997, for the Upper Mississippi River System Long Term Resource Monitoring Program. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, January 1997. LTRMP 97-P005. 67 pp. + Appendixes A–D

Weinkauf, R. A. 1997. Satellite AVHRR temperature measurements of Pools 4, 7, and 8 of the Upper Mississippi River System. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-S007. 16 pp.

Whitney, S. D., K. D. Blodgett, and R. E. Sparks. 1996. A comprehensive evaluation of three mussel beds in Reach 15 of the Upper Mississippi River. Illinois Natural History Survey Aquatic Ecology Technical Report 1996(7), Havana. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, October 1997. LTRMP 97-R022. 15 pp. + Appendixes A–H

Wlosinski, J. H., D. A. Olsen, C. Lowenberg, T. W. Owens, J. Rogala, and M. Laustrup. 1995. Habitat changes in the Upper Mississippi River floodplain. Pages 234-236 *in* E. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: A report to the Nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington, D.C. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, June 1997. LTRMP 97-R008. 3 pp.

Wlosinski, J. H., and J. T. Rogala. 1997. Pool 25: Land ownership requirements in moving the control point to the dam. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, March 1997. LTRMP 97-T002. 15 pp. (NTIS #PB97-158059)

Yin, Y., J. C. Nelson, and K. S. Lubinski. 1997. Bottomland hardwood forests along the Upper Mississippi River. Natural Areas Journal 17(2):164–173. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R025. 10 pp.

Gowda, P. H. 1997. Evaluating agricultural nonpoint loadings on Pool 13 from Maquoketa River watershed, Iowa. Environmental Management Technical Center, Onalaska, Wisconsin, October 1997. Project Status Report 97-11. 2 pp.

Nelson, J. C., R. E. Sparks, and M. L. Bower. 1997. Reconstructing Lake Pepin's Natural History. Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. Project Status Report 97-12. 2 pp. ❖

New Reports

The following reports were recently completed and have been distributed to Program partners. LTRMP reports are available through the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (800/ 553-6847 or 703/487-4650).

Burkhardt, R. W., S. Gutreuter, M. Stopyro, A. Bartels, E. Kramer, M. C. Bowler, F. A. Cronin, D. W. Soergel, M. D. Petersen, D. P. Herzog, K. S. Irons, T. M. O'Hara, K. Douglas Blodgett, and P. T. Raibley. 1997. 1996 Annual Status Report: A summary of fish data in six reaches of the Upper Mississippi River System. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-P011. 15 pp. + Chapters 1–6

Dukerschein, J. T., R. Gent, and J. Sauer. 1996. Recovery of macroinvertebrates by screening in the field: A comparison between coarse (1.18 mm)- and fine (0.60 mm)-mesh sieves. Journal of Freshwater Ecology 11(1):61–65. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, June 1997. LTRMP 97-R009. 5 pp.

Fischer, J. R. 1995. Declines in aquatic vegetation in Navigation Pool No. 8, Upper Mississippi River, between 1975 and 1991. M.S. thesis submitted to the faculty of the graduate school of the University of Wisconsin-La Crosse. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, March 1997. LTRMP 97-R003. 47 pp. (NTIS #PB96-197884)

Gent, R. 1997. Waterfowl and wading bird use of potholes at the Potters Marsh Habitat Rehabilitation and Enhancement Project Upper Mississippi River, Pool 13. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, October 1997. LTRMP 97-R021. 10 pp.

Gent, R., J. Pitlo, Jr., and T. Boland. 1995. Largemouth bass response to habitat and water quality rehabilitation in a backwater of the Upper Mississippi River. *North American Journal of Fisheries Management* 15:784–793. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, March 1997. LTRMP 97-R002. 10 pp. (NTIS #PB97-151898)

Gritters, S. A. 1997. Comparison of catch between 3 × 6 and 2 × 4 fyke nets on Upper Mississippi River backwater lakes. Report prepared for the U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, May 1997. LTRMP 97-S001. 7 pp.

Gutreuter, S. 1997. Fish monitoring by the Long Term Resource Monitoring Program on the Upper Mississippi River System: 1990–1994. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-T004. 78 pp. + Appendix

Gutreuter, S., R. W. Burkhardt, M. Stopyro, A. Bartels, E. Kramer, M. C. Bowler, F. A. Cronin, D. W. Soergel, M. D. Petersen, D. P. Herzog, K. S. Irons, T. M. O'Hara, K. Douglas Blodgett, and P. T. Raibley. 1997. 1992 Annual Status Report: A summary of fish data in six reaches of the Upper Mississippi River System. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, December 1997. LTRMP 97-P006. 14 pp. + Chapters 1–6

Gutreuter, S., R. W. Burkhardt, M. Stopyro, A. Bartels, E. Kramer, M. C. Bowler, F. A. Cronin, D. W. Soergel, M. D. Petersen, D. P. Herzog, P. T. Raibley, K. S. Irons, and T. M. O'Hara. 1997. 1993 Annual Status Report: A summary of fish data in six reaches of the Upper Mississippi River System. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-P008. 15 pp. + Chapters 1–6

Gutreuter, S., R. W. Burkhardt, M. Stopyro, A. Bartels, E. Kramer, M. C. Bowler, F. A. Cronin, D. W. Soergel, M. D. Petersen, D. P. Herzog, P. T. Raibley, K. S. Irons, and T. M. O'Hara. 1997. 1994 Annual Status Report: A summary of fish data in six reaches of the Upper Mississippi River System. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, July 1997. LTRMP 97-P007. 15 pp. + Chapters 1–6

Gutreuter, S., R. W. Burkhardt, M. Stopyro, A. Bartels, E. Kramer, M. C. Bowler, F. A. Cronin, D. W. Soergel, M. D. Petersen, D. P. Herzog, K. S. Irons, T. M. O'Hara, K. D. Blodgett, and P. T. Raibley. 1997. 1995 Annual Status Report: A summary of fish data in six reaches of the Upper Mississippi River System. U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, August 1997. LTRMP 97-P009. 15 pp. + Chapters 1–6

Hrabik, R. A. 1996. A new distributional record of *Notropis topeka* (Teleostei:Cypriniformes) from the Mississippi River drainage in Missouri. Transactions of the Missouri Academy of Science 30:1–5. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, November 1997. LTRMP 97-R023. 5 pp.

Hunt, C. E. 1997. A natural storage approach for flood damage reduction and environmental enhancement. U.S. Geological Survey, Environmental

See New Reports on page 14

Environmental Management Technical Center
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575 Lester Avenue
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