USGS
science for a changing world

Environmental Management Program
Restoring & Monitoring on the Upper Mississippi River System

Taking the Pulse of a River System: Research on the Upper Mississippi River System

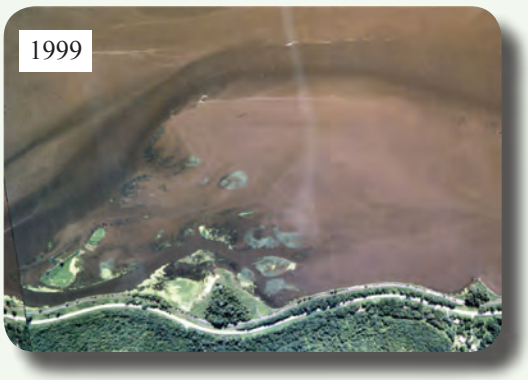
Product of the Long Term Resource Monitoring Program

"Majestic bluffs ... the shining river, winding here and there and yonder, its sweep interrupted at intervals by clusters of wooded islands threaded by silver channels"
— Mark Twain, Life on the Mississippi, 1883, describing the Upper Mississippi River.

Upper Mississippi River System

Mark Twain raved about the Mississippi River basin as, "the body of the Nation." The "upper body," upstream of the confluence with the Ohio River, includes commercially navigable reaches and branching tributaries that are recreationally and environmentally important. Together they feed and shelter an array of fish and wildlife in their flowing channels, floodplain lakes, backwaters, wetlands, and floodplain forests.

Effective river management requires knowledge about factors controlling the dynamics and interactions of important ecosystem components. The Long Term Resource Monitoring Program (LTRMP) is the prized diagnostic tool in the Environmental Management Program for the Upper Mississippi River System that provides critical information about the status and trends of key environmental resources.



Bringing 1890s Maps into the Digital Age

Maps detailing the Mississippi River floodplain about the time of Mark Twain's book Life on the Mississippi are now updated for use with geographical information systems. These georeferenced data of the original Mississippi River Commission maps give the best historical picture of the river's geomorphology and land use/land cover before impoundment of the river in the late 1930s. These maps contain detailed information on vegetation cover, water depths, and land elevations and are invaluable resources for change analysis and for habitat restoration planning. Island restoration efforts in particular use these maps to help determine where islands and higher land features existed historically. Often, remnants of these features lie below the surface of the water, thereby decreasing the amount of fill material needed for construction and increasing the likelihood of a successful restoration. (www.umesc.usgs.gov/data_library.html)

Contact: Larry Robinson; lrobinson@usgs.gov

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

Printed on recycled paper

Fact Sheet 2009–3045
June 2009

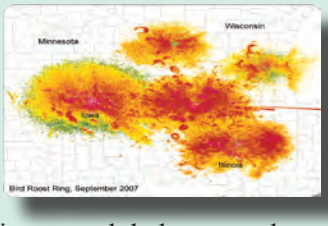
NATURAL CORRIDOR

The Upper Mississippi River System forms a nearly continuous natural corridor through the heart of the United States for migrating birds as well as fishes and other aquatic life.

Revealing Refueling Stops for Landbirds

Migrating birds use the river's natural corridor of wetlands, backwaters, floodplain forests and adjacent bluffs as they travel between southern wintering grounds and northern breeding places. Researchers track bird abundance and diversity, indices of habitat quality, and patterns of migration and stopover behavior.

Locations such as floodplain forests where birds stop to rest and feed are being revealed by a combination of field, laboratory, and high resolution radar (NEXRAD) techniques.



This research helps us understand when and how birds use upland and bottomland river forest habitats during their migration. With this information, agencies can target their land acquisition and restoration to important areas of bird use.

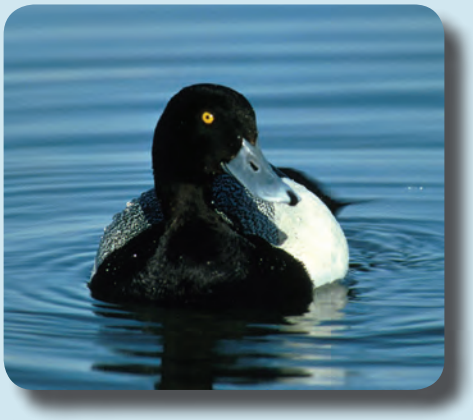
Contact: Pat Heglund; Patricia_Heglund@fws.gov
Eileen Kirsch; ekirsch@usgs.gov

How to Resupply the Banquet

Historically, Weaver Bottoms, located near Weaver, Minnesota, attracted thousands of migrating swans and ducks each fall to feed on aquatic plants. After years of impoundment and increased suspended sediments, its smorgasbord of aquatic plants became skimpy. In summer 2005, researchers simulated pre-dam, low flow conditions by drawing down the water in Pool 5 (including Weaver Bottoms). Emergent aquatic plants such as arrowhead increased as a result of the drawdown. Submersed aquatic plant abundance increased and water clarity improved following the drawdowns, however similar improvements were also seen in other pools. Ducks have returned in abundance to feed on the aquatic plants.

Additional studies are needed to determine the effect of drawdowns on these parameters. Continued monitoring will help us know: How long will the increase in vegetation persist? What frequency of drawdowns is most successful and cost effective?

Contact: Tim Schlagenhaft; Timothy.Schlagenhaft@state.mn.us
Walt Popp; Walter.Popp@state.mn.us



Invasive Snail Plays Role in Bird Deaths

Since 2002, up to 65,000 waterbirds have died along the Upper Mississippi River System from disease caused by three parasitic trematodes that are carried by the invasive faucet snail. Birds can swallow lethal doses of the trematodes while feeding on the faucet snail or infected aquatic insect larvae. Lesser scaup, American coots, blue-winged teal, and ring-necked ducks comprised the largest numbers of casualties.

Partners in the Long Term Resource Monitoring Program responded to this crisis by adding sampling for faucet snails to projects already underway to sample submerged vegetation. Knowing the distribution and abundance of this invasive snail alerts managers to its potential spread along bird migration routes that include critical habitat for waterfowl. Research will continue to search for ways to curtail and mitigate effects of this invasive snail and the associated trematodes.

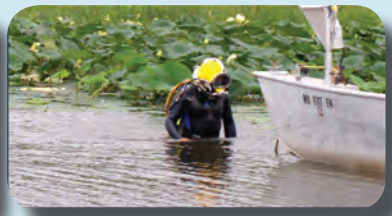
Contact: Jennifer Sauer; jsauer@usgs.gov; Rebecca Cole; rcole@usgs.gov;
James Nissen; james_nissen@fws.gov; Ed Britton; ed_britton@fws.gov

MANAGERS' TOOLBOX

Research can give river managers the tools they need to meet today's challenges.

Tips to Count Mussels

Freshwater mussels are the largest group of endangered animals in North America. Threats come from many sources including (1) changes in flow patterns within rivers, (2) increases in sediment loads, (3) chemical contaminants within rivers, and (4) invasive species. Conservation attempts have been thwarted by lack of such basic tools as an inexpensive and efficient way to estimate the presence and abundance of mussels in large rivers.



Researchers used computer simulations to evaluate various sampling designs for small (e.g., island construction) and large scale projects (e.g., pool-wide drawdowns). Their results have identified sampling designs that produce more accurate estimates of abundance with less effort than standard techniques. These designs can be used by managers to survey sites suggested for restoration projects and help to assess the effects of habitat restoration projects on mussels.

Contact: Teresa Newton; tnewton@usgs.gov;
Dave Smith; drsmith@usgs.gov

Looking at Oxygen and Primary Production

Primary production (the growth of algae and aquatic plants) is a key component of floodplain river ecosystems, ultimately determining the abundance of its fish and waterfowl, and regulating dissolved oxygen concentrations needed for favorable fish habitats. Researchers asked how connectivity to the main channel and vegetation abundance affect dissolved oxygen and nutrient concentrations in the backwaters, particularly as they relate to fish and vegetation abundance.

They found that nitrogen concentrations were higher in the main channel or in backwaters with strong flow connections to the river. Phosphorus levels were higher in backwater sites. Abundance of vegetation and water depth dictated dissolved oxygen dynamics more than connectivity. Knowing the link between nutrients and primary production can help managers evaluate nutrient problems in backwaters and other off-channel areas.

Contact: Jeff Houser; jhouser@usgs.gov
Bill Richardson; wrichardson@usgs.gov
John Sullivan; john.sullivan@wisconsin.gov

Identifying Limits on Fish Abundance in Backwaters

Habitat enhancement efforts along the Upper Mississippi River often focus on off-channel areas because of their ecological and recreational importance and degraded condition. Using 10 years of monitoring data, researchers compared fish diversity and abundance of various size classes of bluegill, black crappie, and largemouth bass in 42 off-channel areas. Of all environmental factors examined, they found that small fishes and large bluegill depend most on aquatic vegetation to flourish, probably because vegetation provides the habitat necessary for invertebrates that these fish need for food and hiding places from predators. Large black crappies and largemouth bass were less dependent on vegetation, probably because they are top predators which use other fish for food.

Contact: Brent Knights; bknights@usgs.gov

OTHER ON-GOING WORK:

1. Asian Carp in the Mississippi River: Their impact on native fish species and predicted dispersal within the system

2. Investigate effects of newly completed rehabilitation projects (Lake Chautauqua National Wildlife Refuge, Banner Marsh State Fish and Wildlife Area) in La Grange Pool in the Illinois River on fish production

3. Developing indicators of southern bottomland hardwood forest condition within the Upper Mississippi River ecosystem

4. Assessment of high-resolution digital imagery for vegetation mapping and software-based vegetation classification

5. Development of survey methods to spatially map mussel assemblages

6. Experimental and comparative approaches to determine factors supporting or limiting submersed aquatic vegetation in the Illinois River and its backwaters

AND THE LIST GOES ON....
For more information, go to **www.umesc.usgs.gov/ltrmp.html** — perhaps the world's best source of ecological data on large rivers.

Congress declared the Upper Mississippi River System as a nationally significant ecosystem and a nationally significant commercial navigation system — the only river in the United States to receive this dual recognition. The Long Term Resource Monitoring Program was created over 20 years ago as part of the Environmental Management Program (EMP). The LTRMP consists of a comprehensive program of monitoring, research, and data management that provides critical information about the status and trends of key resources. The LTRMP information is used extensively by resource managers, planners, administrators, scientists, academics, legislators, and the general public for improved understanding, problem solving, and informed decision-making about issues important to the UMRS.

The LTRMP partnership:

USGS science for a changing world

This fact sheet is second in a series highlighting work done under the LTRMP. See: Leake, L., and Johnson, B., 2006, Taking the pulse of a river system: First 20 years: U.S. Geological Survey, Fact Sheet 2006-3098. http://pubs.usgs.gov/fs/2006/3098/pdf/FS2006-3098.pdf

For Program information contact Dr. Barry Johnson, USGS, LTRMP Science Director at 608-783-6451.