The Illinois River:
Working for Our State

Laurie McCarthy
Talkington

Illinois State
Water Survey

A Division of
the Department
of Energy and Natural
Resources

*Miscellaneous
Publication 128*

The Illinois State Water Survey (ISWS), a division of the Department of Energy and Natural Resources, was founded in 1895 and functions as the primary agency concerned with the water and weather of Illinois. Research and service programs address the assessment and evaluation of ground, surface, and atmospheric water resources as to quality, quantity, and use. Scientific research anticipates and reacts to the practical problems and needs of the people of Illinois.

Illinois State Water Survey
Richard G. Semonin, Chief
2204 Griffith Drive
Champaign, Illinois 61820-7495
Telephone (217) 333-2210
Telefax (217) 333-6540

Editors:
Eva Kingston and Gail Taylor, Office of Publications Services, ISWS; and Sheila Ryan, TextWright, Inc., Champaign, IL

Design:
Wheeler Arts, Champaign, IL

Graphics:
Linda Hascall, John Brother, and Dave Cox, Office of Publications Services, ISWS

Printed by:
Division of Printing Services, University of Illinois at Urbana-Champaign

On the cover:
Sunset over the river. Courtesy Illinois Department of Commerce and Community Affairs by Terry Farmer.

Funds for the production of this book were provided by the Office of the Director of the Illinois Department of Energy and Natural Resources.

Printed by authority of the state of Illinois.

3M—78344—8-91
3M—82734—4-93

Printed on
Mohawk 50/10,
a recycled paper,
using soy ink.

The Illinois River: Working for Our State

Laurie McCarthy Talkington

Illinois State Water Survey

Richard G. Semonin, Chief

2204 Griffith Drive
Champaign, Illinois
61820-7495

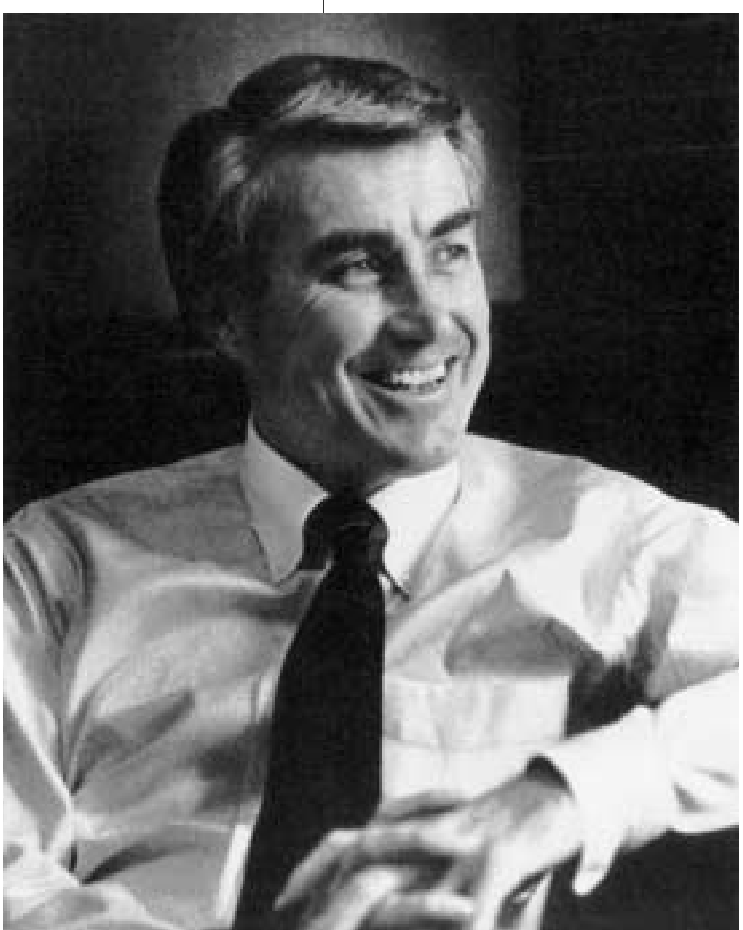
Governor

Greetings:

One of my most stunning realizations as a public official and an inveterate traveler throughout our state is the importance of the Illinois River to our lives and our work. We can see on a map how the Illinois flows through and by scores of cities and towns. But in fact it touches people and parts of our state from border to border. The Illinois River is wildlife habitats and fishing, family fun, scenic majesty, and a physical link to our history. But the river also works in partnership with Illinois industry as a source of hydroelectric power, cooling or cleaning water, or as a thoroughfare for barge transport of commodities from coal to corn. Almost one-tenth of all river barge shipments within the United States travel on the Illinois Waterway, making it a giant among intrastate commercial corridors.

While we have used the river through the years, we have also abused it. Recent decades have witnessed dramatic recoveries, but the river is a living entity, constantly vulnerable to new threats. For example, even as we seem to be winning the battle against pollution, the hazards of sedimentation and flooding threaten the river's delicately balanced ecosystems and in fact the very survival of the river and its backwaters. Today these issues hang in the balance, and our actions and decisions in the next few years will determine the future of the river.

As a result, the state of Illinois has redoubled its commitment to the well-being of the river and to preserving and expanding the role of the river as a working partner in Illinois. State agencies such as the Water Survey, the Natural History Survey, the EPA, and the Department of Transportation, as well as federal and private agencies and foundations are focusing a great deal of effort and attention on the river, all aimed toward keeping the Illinois River "on the job."

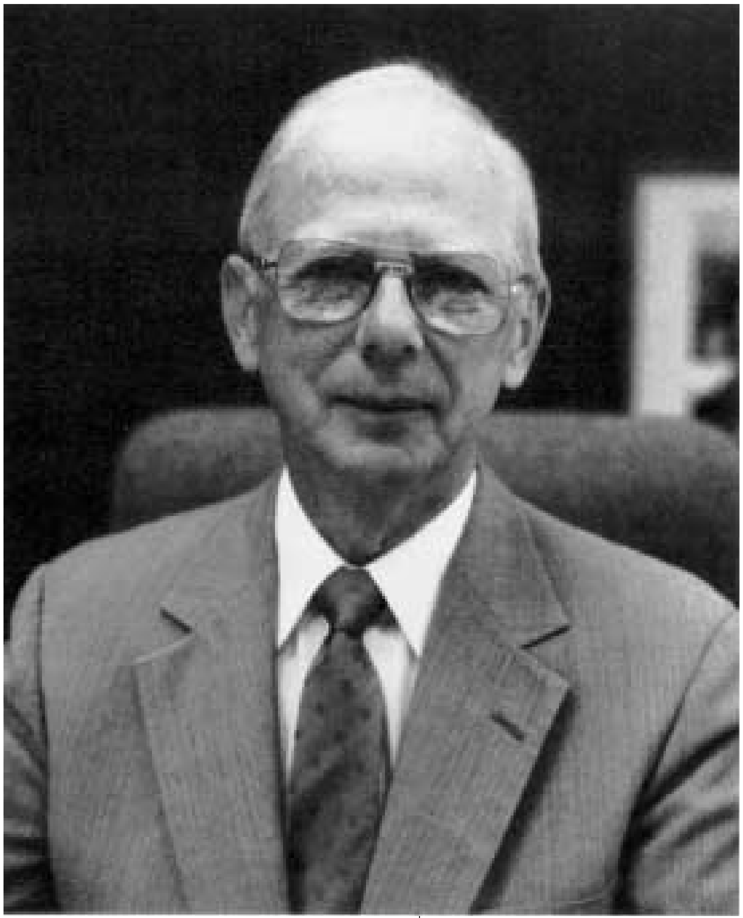


The challenges facing the Illinois River are vast in scope and could well be never-ending. But we can help meet them by taking the time to understand the river. This publication will help accomplish that. And with a broader understanding of the Illinois, we can all be more confident that it will continue to serve our state effectively and aesthetically, for many centuries to come.

Jim Edgar

The Hon. Jim Edgar, Governor
Springfield, Illinois
February 1991

Water Survey Chief



The complete story of the Illinois River cannot be contained in the pages of a book, regardless of their number. The work of the river, like its story, is far from finished. Even as you read this, dedicated men and women of the Illinois State Water Survey, our sister divisions in the Department of Energy and Natural Resources, and agencies throughout the state are working to expand our understanding of the river, to ensure its future health and well-being — and adding new pages to its story. The Water Survey has been involved with research on the Illinois River since our founding in 1895, earning the Illinois the distinction of being "the most studied river in the world." But the story began long before researchers or historians could record it, and it will continue long after these pages are forgotten.

Nevertheless, for more than a year, the Water Survey has worked to put this story together and present as broad a panorama of knowledge as possible about the Illinois River: the science and the history, the conflicts and the consensus. It is drawn from thousands of pages produced by Water Survey researchers and those from our sister surveys and other state, federal, local, and private agencies. Like the living river, the story is filled with contradictions and unresolved dilemmas.

This publication focuses intensively on the last 150 years, in truth only a moment in the long life of the river, but equally truly the most crucial moment in its entire history. That moment represents the time in which the Illinois River was converted from a naturally flowing stream to a channel formed by and subject to human manipulation. That moment is a turning point from which the future of the river will be determined. This publication is intended to elicit your support for that future.

We welcome your inquiries about any of the material in this publication, we welcome your interest in the work of saving the Illinois River, and we welcome your endorsement for the recommendations we propose in support of the river. Just as the Illinois has worked for millennia for the people who have inhabited its banks and backwaters, so too must we now all work together to be sure that the chapters yet to be written about the Illinois River are the best of them all.

Dick Semonin

Richard G. Semonin, Chief
Illinois State Water Survey
Champaign, Illinois
January 1991

Acknowledgments

First and foremost, I would like to thank Chief Richard G. Semonin of the Illinois State Water Survey for giving me the opportunity to work on this project and to develop an appreciation for the life and work of the Illinois River. We are very grateful to Karen A. Witter, outgoing director of the Department of Energy and Natural Resources, for her long-standing support and to incoming Director Jack Moore for his encouragement.

My very special thanks and acknowledgment to the scientists of the Illinois State Water Survey, from whose writings and research this publication was developed — especially to Krishan Singh, Nani Bhowmik, Misganaw Demissie, Raman K. Raman, Don Roseboom, Rodger Adams, Mike Terstriep, and Tom Butts; and from the Illinois Natural History Survey, Steve Havera.

This publication would not have been possible without the guidance and advice of the many people who reviewed the manuscript, supplied illustrations and other special materials, and took the time to respond to my requests for varied and sundry pieces of information or clarification. My sincere thanks to Linda Vogt of the Office of Research and Planning of the Department of Energy and Natural Resources; to Glen Sanderson, Richard Sparks, Michael Jeffords, and Dick Warner of the Illinois Natural History Survey; to Glenn Stout of the Water Resources Center of the University of Illinois at Urbana-Champaign; to Jim Brim of the Division of Natural Resources, Illinois Department of Agriculture; to Donald Vonnahme and Bruce Barker of the Division of Water Resources, Illinois Department of Transportation; to Bernard Killian, Jim Park, and Joel Cross of the Illinois Environmental Protection Agency; to Jerry Skalak of the Rock Island District of the U.S. Army Corps of Engineers; to Craig Colten of the Illinois State Museum; to Steve McClure, Wally Bierman, and Terry Farmer of the Illinois Department of Commerce and Community Affairs; to Mark Frech, Jim Hart, and Bob Bluett of the Illinois Department of Conservation; and to Tracey Conrad-Katz, WILL-TV, Urbana.

L.M.T.
Illinois State Water Survey
Champaign, Illinois
January 1991

Contents

1.
Introduction to the Illinois River Valley

The Illinois River is at a crossroads. All the events in its history, both natural and those accomplished through human intervention, are now poised to change the river in ways that may render it unrecognizable in our own lifetimes. This publication is intended to introduce you to the Illinois River and the issues that will shortly determine its very survival.

The Illinois River has been the focus of intensive study for more than a century. Yet it is neither the largest, the longest, nor the oldest of waters. Rather it is a working river. From the dawn of human memory, it has served the people of the vast basin known as the Illinois River Valley. Its life-giving waters have shaped the history, geography, ecology, and economy of our state.

Today the Illinois River is an important working partner in our state, essential to the industry and agriculture that power the Illinois economy. And the future of our economy is inextricably tied to the river — to the health of its waters, to the balance of the complex ecologies along its banks and backwaters, and to the harmony of life and work for the people of our state.

From the river we have our very name — Illinois. It touches us all, and its future is our own. Come with us now and meet the Illinois River — while time is with us.

Illinois Department of Commerce and Community Affairs by Terry Farmer.

Geography

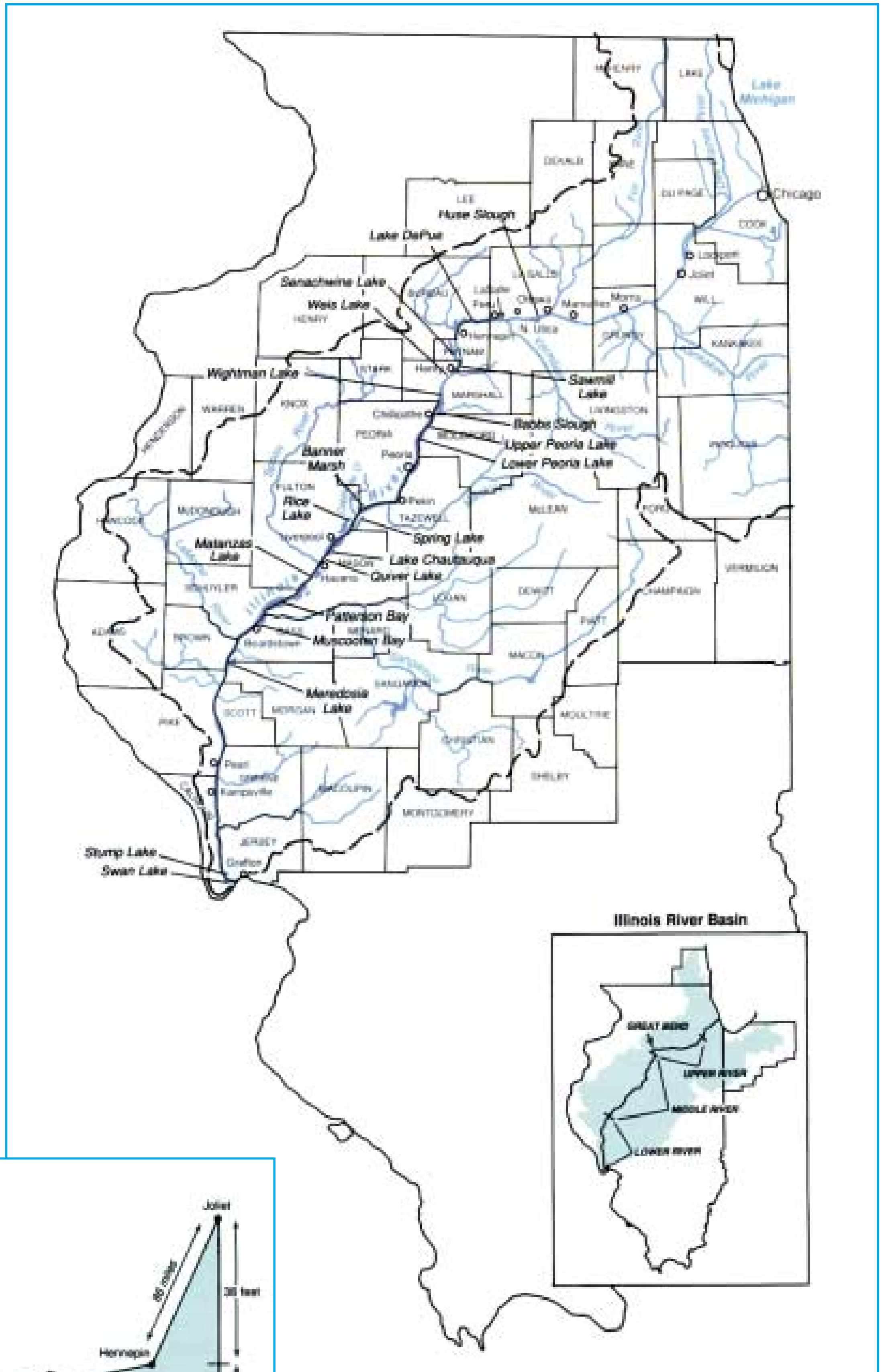
The Illinois River is either 270 or 327 miles long, and it may or may not be considered to lie entirely within the boundaries of our state. These discrepancies arise because the river has had several incarnations. Geographically, it begins at the point where the DesPlaines, DuPage, and Kankakee Rivers converge near the Will and Grundy County lines; that river flows for a distance of 270 miles, ultimately entering the Mississippi at Grafton, about 40 miles north of St. Louis.

But the Illinois is a working river with a working title, the "Illinois Waterway." In that form it extends all the way to Lake Michigan through the DesPlaines and Chicago Rivers. With this added length, the Illinois Waterway spans 327 miles from Lake Michigan to its confluence with the Mississippi.

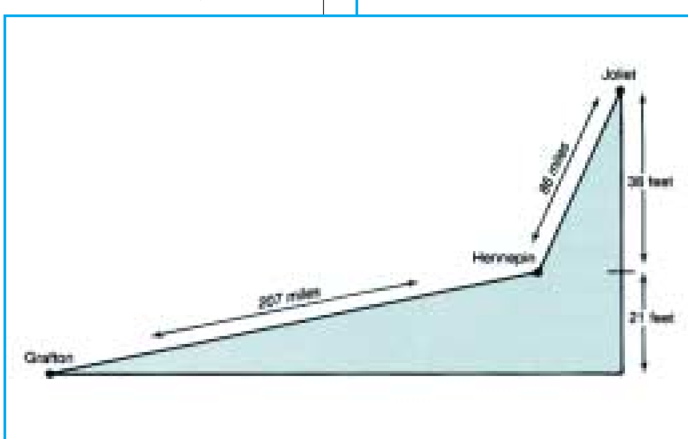
From its headwaters, whether they are considered to be at Lake Michigan or farther inland, the Illinois River winds southwest through northern Illinois. Along this stretch, known as the "upper Illinois," currents are swift because the river flows down a fairly steep incline through a narrow, young valley that was once occupied by the Mississippi River.

The upper river flows to Hennepin in Putnam County, where it encounters the "Great Bend." This point marks the beginning of the middle river. Here the Illinois turns southward and flows past Peoria to Beardstown in a gentle

The Illinois River Basin and the gradients of the Illinois River. The decline from Joliet to Hennepin (a) ranges from 1.14 to 2 feet per mile, while the gradient from Hennepin to Grafton (b) ranges from 0.12 to 0.2 foot per mile.



Ilinois State Water Survey.



gradient through a broad, shallow valley three to six miles wide.

The banks along this stretch of the Illinois are lined with dozens of lakes and backwaters that were originally carved out of the land by sediments contained in the river waters. When the river overflowed, its sediment-laden waters cut crevices through the riverbanks. As the waters escaped through these crevices, they created side channels, sloughs, swamps, and other backwater wetlands, so that the river valley resembled a boundless marsh. When dams were built in the river in the nineteenth century, many of these backwaters and wetlands were filled and formed as many as 300 long, narrow backwater or bottomland lakes.

In our century, the natural sedimentation processes that formed the backwater wetlands have been altered and accelerated by human activities such as agriculture, levee building, and urbanization. These activities have set the stage for the very extinction of the wetlands and lakes along the middle river, which are now being filled with sediment. As of 1975, sedimentation had reduced their average depth to only 2 feet.

The lower river, extending from Beardstown to Grafton, was once rich with backwaters, but levees erected early in our century destroyed almost all of the lakes and wetlands along this stretch. Thus only about 53 backwater lakes now survive along the full length of the river, and the floodplain of the Illinois River is now little more than 200,000 acres, about half its size 100 years ago. Although the Illinois River Valley was once almost entirely wetlands, actual water surfaces now account for only 60 to 100 square miles (40,000 to 70,000 acres).

The Illinois River Valley (which is also known as a “basin” or “watershed” or “drainage area”) encompasses some 30,000 square miles, covering 44 percent of the land area of the state and including more than a dozen tributaries of the main river. About 1,000 square miles of the watershed extend into Wisconsin with the upper portions of the Fox and DesPlaines Rivers, and another 3,200 square miles extend into Indiana with the Kankakee and Iroquois Rivers. The Illinois River Basin includes 46 percent of the state’s agricultural land, 28 percent of its forests, 37 percent of its surface waters and streams, and 95 percent of its urban areas.

The Illinois River north of Chillicothe, illustrating the natural levees formed by sedimentation and the backwaters that developed behind them. The river channel is shown meandering between Babbs Slough, Sawyer Slough, and Big Meadow, Wightman, and Sparland Lakes.
Illinois Natural History Survey.

Flora and Fauna

The Illinois River and its backwater lakes, wetlands, and bottomland forests include habitats that provide nesting, food, and cover for fish, waterfowl, and wildlife. The prehistoric river valley was once a paradise where plant and animal life flourished. Today’s flora and fauna are but a remnant of these, but they still include some of the richest habitat in the Midwest, even some unique in North America.

Wetland Vegetation

Basic to the ecology of the river valley is the vegetation that grows in, alongside, and upland from the waters. The plant life of the Illinois valley is best understood according to its physical relationships to the river and its backwaters: aquatic vegetation grows in the waters, moist-soil vegetation occurs alongside, and upland vegetation, mainly forest, occurs on the bottomlands away from the river. The life cycle of each is tied to the waters.

Aquatic vegetation may live entirely beneath the water, it may emerge from the water, or it may float on the surface, such as the foliage of lotus or water lily. Different varieties of aquatic vegetation thrive at different depths. Those varieties requiring total submersion must have deeper water, while those that must be able to emerge above the waterline require shallow depths.

Aquatic plants are basic to the ecology of the Illinois River Valley and serve many

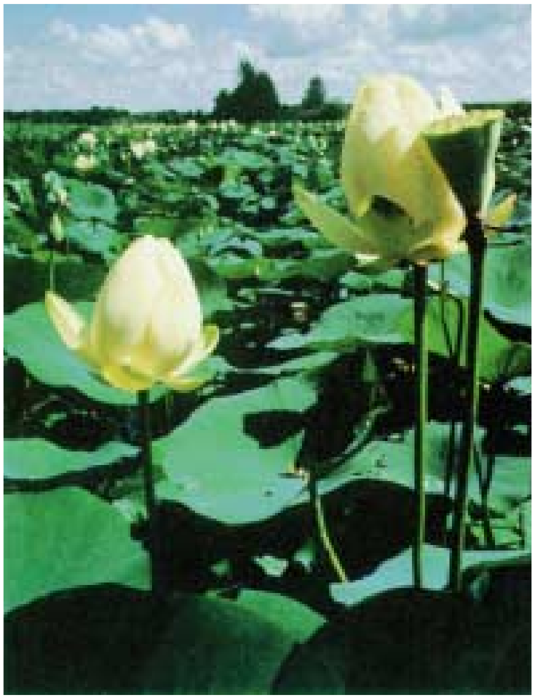
We have seen nothing like this river . . . as regards to its fertility of soil, its prairies and woods; its cattle, elk, deer, wildcats, bustards, swans, ducks, parroquets, and even beaver. There are many small lakes and rivers.
Father Jacques Marquette, 1673

functions. Their leaves and fruit provide food for waterfowl and habitat for plankton and small invertebrates — insect larvae, mollusks, crustaceans, and worms — on which fish and ducks feed. The leaves also provide protective shelter for spawning and young fish. In addition, the plants help cleanse the water of certain toxins, such as ammonia.

A century ago, the waters of the Illinois River Valley teemed with aquatic plants, but today only the most hardy varieties are generally found, such as river bulrush, marsh smartweed, pondweed, wild celery, coontail, and American lotus. These species are tolerant enough to adapt to fluctuating water levels, pollution, and turbidity.

River bulrush, the most common emergent aquatic plant in the Illinois valley, provides nesting habitat for some species of ducks, as well as food and den materials for muskrats. Marsh smartweed, also an emergent variety, provides cover for migrating waterfowl and seeds to feed them. It is the preferred brood habitat for wood ducks and mallards, and it provides some food and housing for muskrats.

Sago pondweed, once the most important waterfowl food plant on the continent, is now relatively rare. It was killed off almost entirely by temporary high water levels in the 1950s and 1960s, although it has recently been found in isolated locations along the river. Curlyleaf pondweed, an underwater plant, was abundant in nearly all the backwater lakes as late as the 1950s. But like so many other varieties of aquatic vegetation, today it is found only in isolated beds. Wild celery, the preferred food of canvasback and ring-necked ducks, also nearly disappeared from the river valley in the 1950s and 1960s, and only remnants survive today.



Lotus.
Illinois Natural History Survey by Michael Jeffords.

Like all plants, aquatic varieties require clean, healthy water; sunlight for photosynthesis; and relatively undisturbed environments. The disappearance of most of the aquatic vegetation from the waters of the Illinois River Valley seems to be linked to pollution and fluctuating water levels, which stunt the growth of some varieties and force others to struggle to reach the water's surface. But just as important to the disappearance of aquatic vegetation is the turbidity caused by sedimentation, which inhibits photosynthesis. Moreover, suspended sediments settle only loosely to the lakebeds, creating soft bottoms in which aquatic plants cannot take root.

Moist-soil vegetation grows on mudflats that occur naturally around the shores of backwater lakes. These plants, the most abundant form of vegetation in the Illinois River Valley, occupy some 31,000 acres of mudflats. Their seeds are the primary food source for as many as 35 different species of waterfowl, which either pluck them directly from the plants or pick them from the mud or shallow waters after the plants have dropped them. The seeds most favored are produced by arrowleaf, cocklebur, several species of millet and smartweed, nutgrasses, rice cutgrass, Spanish needles, teal grass, and water hemp.

The health and seed productivity of these moist-soil plants depend on a year-round cycle of specific water levels. The cycle begins in the spring when waterfowl eat the seeds left on the mudflats around the lakes. With plentiful spring rains, the river overflows and the lakes rise and cover their muddy banks. Light summer rain and low water levels from July to October cause the lakes to recede. As the mudflats dry in the sun, the seeds remaining in the mud germinate and grow. With the coming of early fall rains, the plants produce seed once again, the river makes the lake waters rise, and the mudflats are immersed under a shallow cover of water. This is the environment in which dabbling ducks feed during fall migrations.

Thus water levels in the Illinois River and in the bottomland lakes determine the availability of both aquatic vegetation and moist-soil plant foods for ducks. If water levels are low in the fall and mudflats are exposed, moist-soil plants cannot produce adequate seeds for the waterfowl. And if the levels are too high in the fall and mudflats are too deeply submerged, the dabbling ducks will be unable to reach the seeds.

High water levels not only threaten the ability of dabbling ducks to glean seeds from the mudflats — they also threaten the mudflats. If they are immersed under too much water in the fall, the most water-tolerant trees of the bottomland forest will encroach on them, thus eradicating the moist-soil vegetation and ultimately the mudflats.

Upland vegetation. The forests of the Illinois valley occupy low-lying areas along the river known as "bottomlands," and the trees are classified according to their physical relationship to the river and its floodwaters. Thus different species appear at different elevations and distances from the water and thrive in soils with varying moisture content.

Although the Illinois River Valley was once rich with verdant forests, today's bottomland forest consists of little more than narrow strips along the edges of the riverbanks and the mudflats surrounding the bottomland lakes. The most densely forested areas today are located around LaSalle and Starved Rock, and in the Alton Pool, the river's southernmost section.

Black willows, cottonwoods, and soft maples are the most water-loving species of the bottomland forest. They can grow right up to the water's edge, overcoming smaller, more delicate moist-soil vegetation normally at home on the mudflats. Although they provide habitat for some forms of wildlife, these trees do not support a biologically diverse ecology. And because so few species thrive in this near-aquatic environment, they are at constant risk of eradication from a single disease, pest, or climatological change, including severe flooding or drought.

Farther upland from the river and the lakes, the forest is dominated by mixed softwoods. The most prevalent species is silver maple, but American elm, swamp privet, red mulberry, box elder, green ash, sycamore, and river birch are also present, creating a diverse and biologically active forest ecology.

Still higher up on the floodplains, the community of species becomes even more diverse. In addition to mixed softwoods are sugarberry, hackberry, hawthorn, honey locust, bur oak, persimmon, and dogwood. And finally, on higher lands at some distance from the river and the lakes, the forest is characterized by a genuinely diverse mix of softwoods and hardwoods. The upland forests of the Illinois River Valley include many species of oak and hickory, red and sugar maples, and black walnuts.

A marsh drying in the summer sun. The pool at the center is surrounded by smartweed and then by blooming hibiscus. Ash and birch trees encircle the mudflat farthest from the water.

Illinois Natural History Survey by John Taft.

Wildlife, Fish, and Waterfowl

Wildlife. The forests, wetlands, and scrub-shrub environments of the Illinois River Valley are inhabited by about 50 different types of mammals, including many species of opossums, shrews, weasels, moles, bats, rabbits, squirrels, beavers, raccoons, muskrats, minks, red and gray foxes, coyotes, and deer. Their habitats include subterranean dens burrowed at the water's edge, in the upland forest floor, or beneath hollowed trees. Some mammals nest in any of the valley's thick scrub-shrub environments not encroached upon by humans.

Although fewer species of mammals inhabit the forests and wetlands of the Illinois River Valley today than 100 years ago, wildlife populations in general are stable and healthy. Some species, such as raccoons and beavers, are as plentiful now as at any time in recent memory. Even white-tailed deer, which were hunted to extinction in the Illinois River Valley in the early part of this century, have thrived since their reintroduction in the 1930s.

Where specific populations are declining slightly, as is the case with cottontail rabbits and minks, weather extremes or loss of habitat

Water hemp and cocklebur on a dried mudflat in autumn.
Illinois Natural History Survey by K.R. Robertson.

to agricultural expansion are typically to blame. Bobcats and river otters are among the larger species now considered by the state to be "threatened," while white-tailed jackrabbits and some species of rats and bats are listed as "endangered."

Fish. The Illinois was once among the most biologically productive rivers in the nation. In 1682 Henri de Tonty, a French explorer and companion to LaSalle, wrote in his travel log that one catfish caught in the Illinois River served as supper for 22 men. As recently as the 1950s, the waters of the Illinois River Valley were counted among the great inland commercial and sport fisheries. Although this is no longer the case, the state as a whole remains one of the nation's top ten producers of freshwater fish.

Gray fox.
Illinois Natural History Survey by Charles and Elizabeth Schwartz.

The Illinois River is home to more than 100 fish species, and its side channels and backwater lakes serve as nurseries and spawning areas. Carp and carp-goldfish hybrids are most abundant, but other species common to the Illinois include gizzard shad, white bass, largemouth bass, bluegill, and black crappie. Channel catfish, buffalo, bullhead, sauger, and many other warm-water species also inhabit the river.

Around Chicago, in the upper reaches of the Illinois Waterway, most species diversity can be attributed to the accidental entrance of Lake Michigan fish into the waterway through the Chicago River. Because water quality is less than ideal between Chicago and the Great Bend, and because that stretch includes few backwaters for breeding and spawning, only the hardiest species can be found. Thus carp are most plentiful throughout the upper river, except around Starved Rock, which offers more diverse habitats.

Although many fish in the upper river suffer from poor water quality, improving conditions since the 1970s have resulted in increased populations of largemouth bass and black bullheads and in the appearance of substantial numbers of white bass, especially around Starved Rock.

The middle river has historically been the most productive because of the excellent habitat in the backwater lakes and wetlands along its banks. But as the lakes fill with sediment and as aquatic vegetation is killed off, fish-food resources are diminished. Thus rough species such as carp predominate here also.

Fish populations are most successful in the backwaters if 1) the lake is closely connected to the river, ensuring adequate depth; 2) inflow to the lake comes from sources other than the river, ensuring good water quality; 3) the lake bottom is sufficiently stable, ensuring clear water in which fish can feed, breed, and build nests by sight, and in which aquatic vegetation can grow; and 4) food and aquatic vegetation are indeed available.

The lower river, from Beardstown to Grafton, features about the same mix of fish species as the middle river, but populations are smaller. Even though water quality is better than in the middle river, fish populations are constrained because the lower river is channelized behind levees, and very few backwater habitats are accessible for breeding.

Mallards.

Illinois State Water Survey by Tom Rice.

Waterfowl. The Illinois valley is also temporary home to hundreds of thousands of waterfowl who rest and feed among the backwaters during their spring and fall migrations. The Illinois River Valley is part of the Mississippi Flyway, the route followed by migratory waterfowl between Canada and the Gulf Coast. As of 1983, about half of the floodplain of the Illinois River was appropriate for waterfowl habitat.

The backwater habitats of the Illinois valley support approximately 20 species of waterfowl, about 95 percent ducks and 5 percent geese. Mallards are by far the most plentiful, accounting for more than three-quarters of the populations. The valley represents a special haven for wood ducks, which breed more abundantly among the backwater lakes of the Illinois River than anywhere else in the state or the entire nation.

Migrating waterfowl typically visit the Illinois River backwaters from 16 to 28 days each spring and fall, with an average stay of 21 days. Food resources are more plentiful in the fall, so populations are higher; mallards in particular feed until mid-December. The availability of food is the primary factor affecting the number of ducks and the length of their stay. For example, the surprising appearance of canvasback and ring-necked ducks at Peoria Lake from 1949 to 1953 seems to have coincided with the appearance of wild celery, one of their favorite foods. But if waterfowl do not find food soon after they arrive in the backwaters, they leave the area within one day and continue their migrations.

Mallards, pintails, green-winged teals, and some wigeons are known as "dabbling ducks" because they feed on the seeds of moist-soil plants in the shallow waters of inundated mudflats around the backwater lakes. Mallards supplement this diet with corn gleaned from harvested fields, while Canada geese and snow geese feed almost entirely in fields. Although these food sources have made it possible for hundreds of thousands of mallards to overwinter in the valley, the forage supply is declining steadily as more efficient harvesting techniques and equipment make less grain available. Fall plowing also stymies forage opportunities for waterfowl, and new corn varieties are being developed for even cleaner harvest. Thus mallards now rely more on the seeds of moist-soil plants that grow on mudflats.

"Diving ducks" find their food sources below water. Wigeons and coots depend on a variety of aquatic plants, including coontail, American lotus, river bulrush, marsh smartweed, duck potato, sago and longleaf pondweed, and various species of duckweed. (Coots, not technically waterfowl, are classified as such because of their feeding behavior.) To supplement their diets of aquatic vegetation,

Fingernail clams (shown about life-size) were an important food source for many fish and birds.

Illinois Natural History Survey.

ring-necked, canvasback, and ruddy ducks eat the small invertebrates, such as fingernail clams, insect larvae, snails, and worms, that inhabit the vegetation and the lake bottoms. Lesser scaup ducks depend almost exclusively on these underwater organisms for sustenance.

Because diving ducks pluck their food from deep waters, their numbers are not as severely affected by water-level fluctuations as are dabbling duck populations. But diving ducks have been affected by the unexplained disappearance of fingernail clams from the Illinois River Valley in the 1950s. This catastrophe resulted in a dramatic decline in the numbers of diving ducks in the Illinois River backwaters and in the duration of their visits. Efforts to reintroduce fingernail clams since the 1950s have been unsuccessful, and today these tiny mollusks are virtually nonexistent in the Illinois River Valley above Beardstown. Consequently, populations of lesser scaups and canvasbacks have dwindled, and their stays are now shorter. It is not uncommon to see birds arrive on the backwater lakes one night and depart the next.

Waterfowl populations declined even further in the 1960s when temporary high water levels eradicated much of the aquatic and moist-soil vegetation of the river valley. Overall duck populations using the Illinois River backwaters in 1982 were only 28 percent of 1948 numbers.

With the demise of their habitats and food resources in the last 40 years, many migratory waterfowl have abandoned the waters and backwaters of the Illinois. As a result, mallards now make up as much as 85 percent of the duck flight over the Illinois River Basin, probably because their feeding habits are so flexible. They select from acorns and pecans plucked from flooded bottomlands, seeds from moist-soil and aquatic plants, and grain foraged from harvested fields.

To develop alternative food sources, private duck clubs and state and federal agencies are establishing holding ponds and refuges with controlled water levels. These artificial impoundments offer deep waters with aquatic vegetation for diving ducks, as well as controlled waters and regularly occurring mudflats on which moist-soil plants are cultivated for dabbling ducks. Given the increasing shortages of natural food resources, these controlled water impoundments are becoming essential to maintaining populations of migratory waterfowl, and each year additional acreage is being brought under some degree of water-level control.

Shorebirds. The backwaters of the Illinois also serve as habitat for 20 to 30 species of shorebirds and 15 species of gulls and terns. The cottonwoods and black willows along the middle and lower river and its wetlands are host to various types of herons, egrets, plovers, sandpipers, and other migrating wading shorebirds, as well as gulls and terns.

Wading shorebirds represent the farthest ranging visitors to the Illinois River Valley, traveling between the Arctic and Chile and Argentina yearly. And the river valley provides virtually the only appropriate environment for them in the entire Midwest. Their behaviors are diverse: they wade in the wetlands and feed on invertebrates and small fish in the shallow waters and marshes, as well as on insects in adjacent woods and fields. Only two species stay to nest in the forests.

Although their numbers appear to be stable or even improving slightly, wading shorebird populations have never been large. For this reason, egrets, herons, cormorants, ospreys, eagles, hawks, falcons, and terns have been listed by the state as "endangered." An overall nationwide population decline in our century has been attributed to timber cutting and other loss of habitat, illegal hunting, pollution, and human disturbance.

Gull tern.

Illinois Natural History Survey by Michael Jeffords.

2.

The Many Roles of the Working River

For thousands of years the Illinois River Basin has been a center of human habitation and industry, and the Illinois River itself has long worked in support of human goals. Native American cultures flourished along the river as much as 12,000 years ago. Early cultures were nomadic family groups dependent on hunting, fishing, and gathering plant foods. Later cultural groups evolved into agricultural societies settled in permanent towns with hundreds of residents. Traces of their activities and their environments are preserved today in the sediments of the valley.

From bits of bone, carbonized plant remains, stone tools, and pieces of pottery gleaned from sites along the river, archaeologists have assembled pictures of the daily lives and environments of the earliest Illinoisans. Some sites were temporary settlements, perhaps hunting camps used during the fall when large flocks of ducks were present. Others appear to have been villages that were occupied for thousands of years.

The Illinois River was the major throughway for Native Americans moving across the continent to trade, hunt, fish, migrate, or conduct diplomacy. From east of the Great Lakes, they could pass through Illinois to the Mississippi and on westward almost entirely by river. From the shores of Lake Michigan, their canoes followed the Chicago River. At its westernmost point, they were obliged to leave the water and carry their canoes a few short miles across the ridge known as the "Chicago Portage" to reach the DesPlaines River and ultimately the Illinois River.

The Illinois River continued as the backbone of Illinois commerce and industry into recent centuries. Father Louis Hennepin, one of the early Jesuit explorers of the Mississippi valley, reported the discovery of coal along the river in 1679. The French trappers and explorers considered it a strategic corridor between their missions and forts in the Illinois wilderness and their bustling colonial settlements in New Orleans and Quebec. The French hunted along the river and traded pelts from muskrats, minks, beavers, raccoons, and other fur-bearing animals. But they grew disappointed with the quality of the beaver fur they found along the Illinois, so they abandoned their trading post near Peoria in 1702.

The Illinois River working its way south of Pekin.
Illinois Natural History Survey.

The European settlers of the eighteenth and nineteenth centuries also put the Illinois to work for them. They hunted small wildlife for food and fur, continued a limited trade in pelts, and looked to the river for fish and household water. The river was also the settlers' primary

The *Fred Swain* photographed just north of Peoria in July 1903.

From Report of the Submerged and Shore Lands Committee, *Illinois State Historical Library.*

inroad to the Illinois section of the Northwest Territories. They came downstream from the Great Lakes and upstream from St. Louis with their household goods and commercial wares loaded on flatboats and keelboats. By 1828, only ten years after Illinois was admitted to the Union, paddle-wheel steamboats plied the river, and by the 1840s the Illinois was a major highway through the burgeoning interior.

Although the lives and work of the first explorers were closely associated with the river, the permanent settlers looked inland to the fertile prairies to make their living from the land. Those who continued to work the river — whether for transport of people or goods, for ice cutting, fishing, mussel gathering, or trapping — became part of a vast, inland, river-oriented culture linked inextricably to the waters.

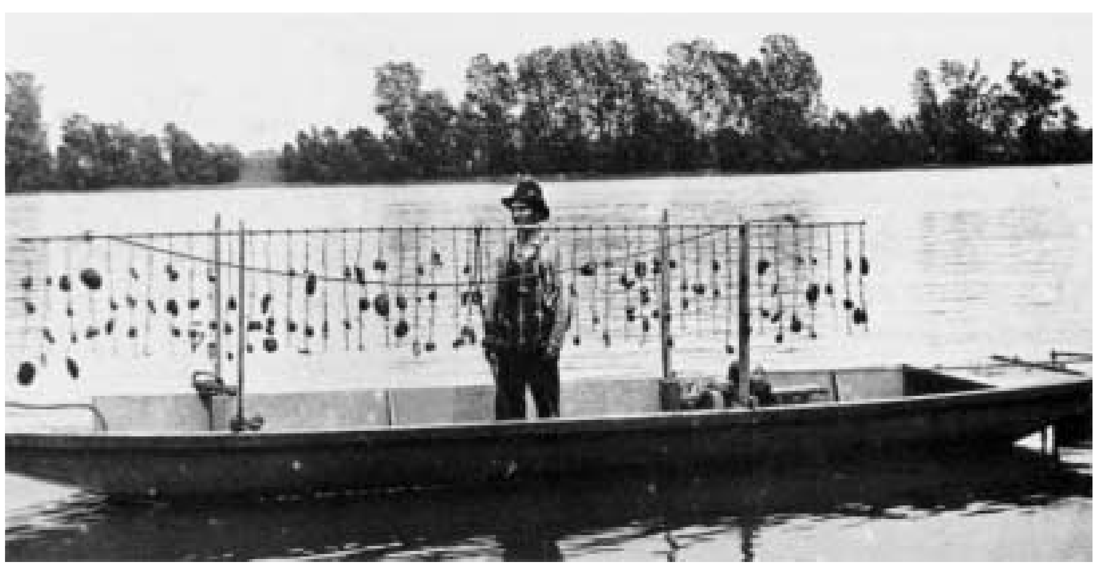
People of the river culture kept apart from townspeople. Many lived in cabinboats, moving up and down the Illinois with the seasons. When commercial fishing and mussel gathering became profitable in the late nineteenth century, farmers and townspeople swelled their ranks. But as these industries declined in the twentieth century, young river people gradually abandoned the old ways, and the culture has largely faded into legend.

Mussels and Button Making

By the beginning of the twentieth century the Illinois River supported a major commercial industry based on mussels. Native Americans had eaten the meat of these freshwater mollusks and used the sharp-edged shells as eating and cutting utensils, hoes, and scraper tools. The mother-of-pearl that lines the shells, and the slug pearls sometimes found inside, were prized as ornamentation.

Late in the nineteenth century, mother-of-pearl became the basis of a major button-making industry. By 1891, a button factory was in operation in Muscatine, Iowa, processing the mussel harvest from the Mississippi. Its success encouraged large-scale deepwater mussel gathering on the Illinois River, turning entire families of river people into mussel gatherers.

By 1910 more than 2,600 mussel boats worked the Illinois, and by 1912 they supported fifteen button factories along the river. The towns of Pearl (in Pike County) and Beardstown had five factories each. The industry peaked in



Mussel gatherers worked out of flatboats that were usually equipped with two “crowfoot bars,” each carrying up to 150 four-inch hooks. The crowfoot bars were dragged across the vast mussel beds on the riverbottom. As the hooks touched the mussels, they closed their shells around them.

Marshall County Historical Society and the Illinois State Museum.

1916, when midwestern manufacturers boasted a $12.5 million sales volume. But by 1929 the supply of mussels was depleted, and button sales dropped to $5.8 million. The last button factory on the Illinois River closed in 1948.

The mussel populations were mainly depleted by unlimited gathering of adult shells and breeding stock, but they also fell victim to pollution, which altered the typically white mother-of-pearl and reduced its market value. Then, just as the mussel supply became exhausted, the button industry turned to plastic as its primary material.

While 49 species of mussels once flourished in the Illinois River, only 25 species still survive. Virtually no mussels remain in the Illinois River above Peoria Lake, and efforts to restore them have been frustrating. Isolated beds are occasionally discovered in the middle and lower river, but they are quickly depleted.

By 1907 mussel gathering was a widespread, lucrative occupation along the Illinois, considered by some to be the most productive mussel stream in the United States. In 1909 a single gatherer is credited with hauling in 500 pounds of shells in one day. Mussel gatherers typically searched first for pearls, saved the shells for buttons, and discarded the meat.

Courtesy E.E. VanFossen and the Illinois State Museum.

Commercial Navigation

As early as 1673, French explorers Louis Jolliet and Father Jacques Marquette noted that the Great Lakes and the Illinois River could be linked by cutting a short canal through the low ridge of the Chicago Portage. This would create a direct route to the Mississippi and ultimately to the Gulf of Mexico. Their observation became reality two centuries later with the Illinois & Michigan (I&M) Canal. Named for the two bodies of water it connected, the canal spanned the Chicago Portage and connected Lake Michigan to the Illinois River via the Chicago River.

The canal began at the Chicago Portage (near the Chicago city limits and the Cook County communities of Summit and Justice), where the South Branch of the Chicago River originally came to within five miles of the DesPlaines River. From that point, the canal generally paralleled the route of the DesPlaines and Illinois Rivers until merging with the Illinois at LaSalle-Peru.

The canal's 96-mile length bypassed the DesPlaines River entirely because its steep gradient, rough bottom, and difficult banks prevented navigation by canal boats, which were pulled by mules that walked the towpaths on either side. The original canal design called for a 60-foot width at the water surface and a 6-foot depth. Water levels were regulated for navigation by a series of fifteen locks.

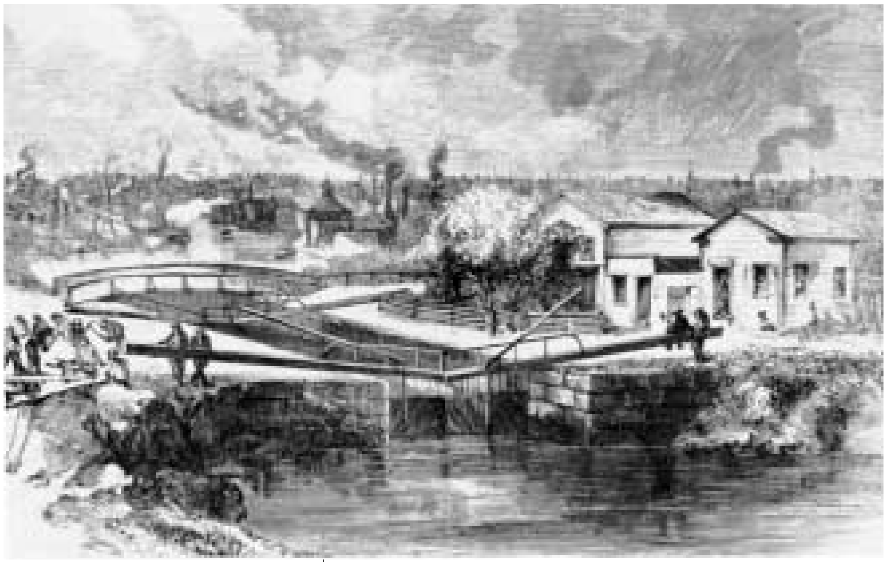
The concept of the I&M Canal began with the first Illinois Canal Commission, which was established by the state in 1823. The commission's plans generated such rapid settlement along the upper river that whole towns were laid out by the 1830s, even before canal construction began in 1836. When the canal officially opened in 1848, its impact was immense and immediate. The Illinois River Valley had been barely populated in 1840, but by 1850 the population was one-half million people. By 1870 it was 1.6 million, and by 1900 it was 3.3 million.

Dozens of new communities were established along the canal and the upper Illinois River. Lockport, Joliet, LaSalle, Marseilles, North Utica, Morris, Seneca, and Ottawa were all incorporated between 1837 and 1869. With access to the canal, manufacturing, trade, and agriculture boomed. As towns and commerce developed along the Illinois, the river was put to work. It provided water for homes, industries, and agriculture; it served as a navigation channel, a source of food, a source of power for mills and factories, and as a dumping site.

During those dynamic years a continual flow of people and materials moved between St. Louis and Chicago. By linking the Great Lakes and the Gulf of Mexico, the I&M Canal introduced international trade opportunities to the continent's interior and helped transform Chicago into the nation's major inland commercial hub. In 1854 the population of Chicago already numbered 74,000. Within four years — a decade after the opening of the canal — the population had increased by 600 percent.

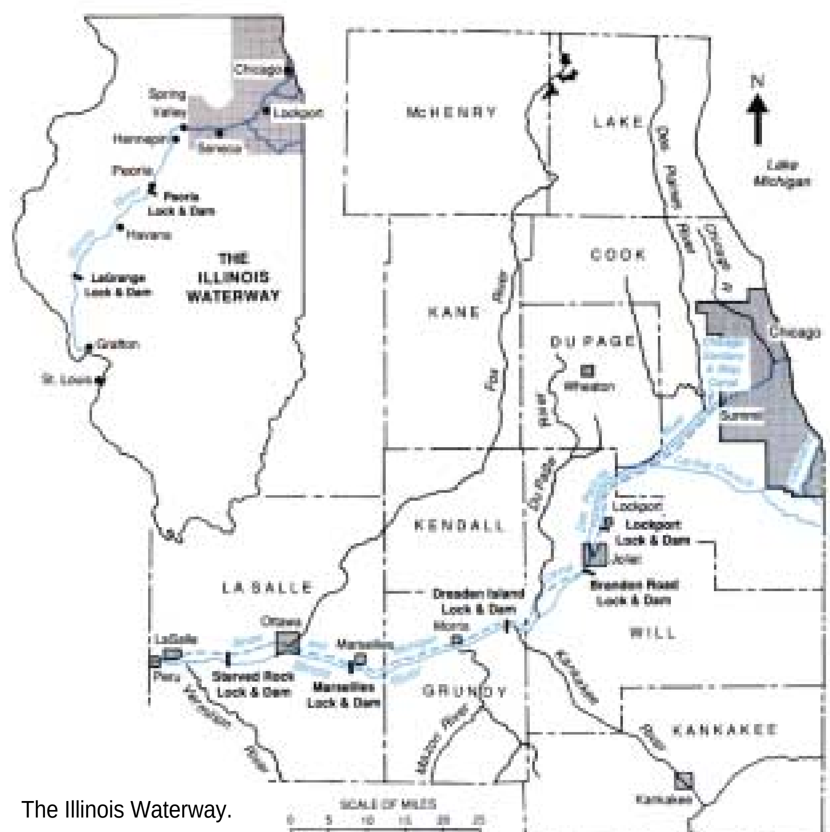
The Illinois is a fine river, clear, gentle, and without rapids; insomuch that it is navigable for batteaux to its source.

Thomas Jefferson, 1787



Operation of a lock on the I&M Canal as shown in *Harper's Weekly*, July 22, 1871.
Lewis University Canal Archives.

Commerce on the I&M Canal grew from 1848 to the 1880s, but competition from the railroads had been fierce almost from the beginning. In response, mule-drawn canal barges soon gave way to larger steamboats so that costs could be contained and rates could be competitive. The canal required several alterations to make water levels deep enough for navigation by the larger boats. In 1871 the highest point of the canal, over the Chicago Portage, was dredged and lowered to allow gravity diversion of water from Lake Michigan. Pumps were installed in 1884 to increase diversion to about 500 cubic feet per second.



The Illinois Waterway.
Illinois State Water Survey.

As part of the same effort, dams were erected at critical locations along the middle and lower Illinois River to raise water levels and maintain sufficient depth for navigation. Dams were constructed at Henry (Marshall County) in 1872; at Copperas Creek (Fulton County) in 1877; at LaGrange (Brown County) in 1883; and at Kampsville (Calhoun County) in 1893. These low dams created a 7-foot-deep navigation channel in the river for large steamboats moving between the Mississippi and the I&M Canal at LaSalle-Peru.

The construction of dams placed artificial controls on the river's low flows and made the river deeper and wider at various points. These changes represent the first attempts to manipulate the Illinois, which had existed under near-natural conditions until this time, virtually unaffected by humans.

The ultimate transformation of the Illinois River began with the twentieth century. The Chicago Sanitary & Ship (CS&S) Canal was opened in 1900, bringing with it several thousand cubic feet per second of diverted Lake Michigan water. The new canal was cut into the channels of the South Branch of the Chicago River and the I&M Canal through the Chicago Portage area. At that point, it becomes a separate third channel parallel to the DesPlaines River and the old I&M Canal. After about 40 miles, it enters the DesPlaines River between Lockport and Joliet.

In 1919 the state began constructing the Illinois Waterway. This ambitious project carved a new and even larger channel through the Chicago River, the CS&S Canal, the DesPlaines River, and the Illinois River, shaping them into a continuous navigation route 9 feet deep and at least 300 feet wide all the way from Lake Michigan to the Mississippi. The state did much of the work on the upper river, and the U.S. Army Corps of Engineers completed construction on the middle and lower river.

The waterway project required the construction of seven major locks and a new set of very high dams in the 1930s. A 40-foot-high dam is located on the DesPlaines River just south of Lockport and another, just south of Joliet at Brandon Road, is 34 feet high. At

Dresden Island, about two miles downstream from the confluence of the Kankakee and DesPlaines Rivers (where the Illinois River begins) the dam is 22 feet high. A 24-foot-high dam is located at Marseilles, and the dam at Starved Rock is 19 feet high. Lower locks and dams were constructed on the gentler slopes downriver: the Peoria Dam is only 11 feet high, and the dam at LaGrange in Brown County is 10 feet high.

All of the navigation locks and dams on the Illinois Waterway are now more than 50 years old. As the structures and equipment reach the end of their projected lives, breakdowns and equipment failures have become more frequent and expensive, resulting in delays and loss of revenue to commercial shippers. The U.S. Army Corps of Engineers has been conducting maintenance and major rehabilitation work since 1975, and these efforts are expected to continue on every lock on the Illinois Waterway through the 1990s.

Commodities Transport

With the establishment of the Illinois Waterway, the nation's heartland became a strong competitor in national and international markets, and midwestern agriculture and industry took on global perspectives. Today, approximately 50 percent of all the commercial traffic on the Mississippi River above St. Louis comes from the Illinois Waterway, making it as economically important to the state and to the Midwest as the interstate highways.

The waterway carries almost 60 percent of the state's annual commodities tonnage and 9 percent of the total barge shipments transported on our nation's inland and intracoastal waterways. This amounts to 23 percent of the grain, 5 percent of the petroleum products, and 7 percent of the coal transported in the entire United States.

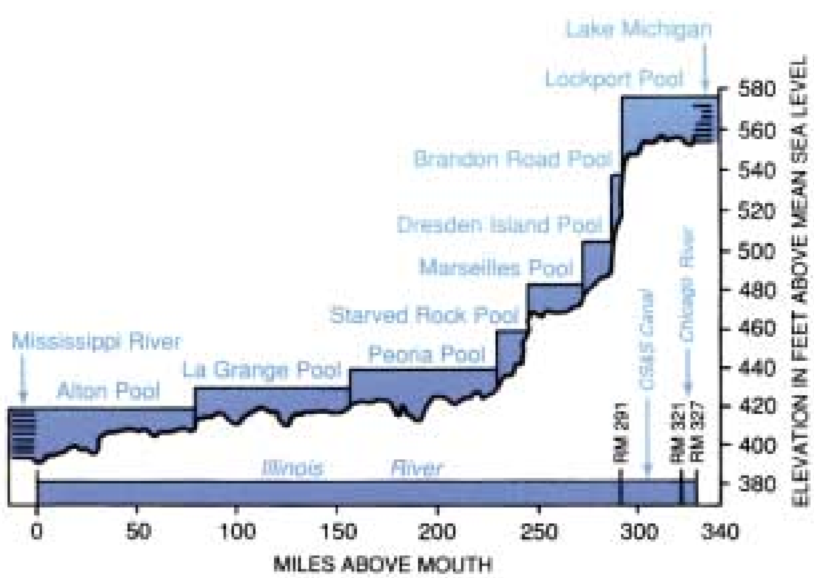
Total tonnage on the waterway increased at an annual rate of 6 percent between 1940 and 1977 and then generally leveled from the mid-1970s through the mid-1980s. In 1983 the Illinois Waterway carried 16.1 million tons of grain, 6.6 million tons of petroleum products, and 9.3 million tons of coal. The Illinois Waterway also carries sand, gravel, rock, crude petroleum, chemicals, fertilizers, pulp, paper, and many other commodities. Record highs were achieved in 1986 with a total volume of more than 59 million tons.

Two hundred fifteen terminals are situated along the banks of the Illinois Waterway to process, load, and unload commodities and products. More than half are located along the upper river, most near Chicago. They primarily handle chemicals, iron, coal, petroleum products, and steel, while grain is the main commodity at the terminals below Starved Rock.

Farm products represent the most sizable commodity on the waterway; in 1986 they made up 37 percent of total shipments. And they are the most significant factor in projections of future transport volumes. By the year 2000, movements of farm products may well exceed 25 million tons per year. Overall,

The Dresden Island Dam near Morris.

Courtesy Marcia Dundore Wolter.



With the completion of the last of the locks and dams in 1939, the Illinois River was transformed into a series of navigation pools, each named for the dam immediately downstream.

Data from the U.S. Army Corps of Engineers, Chicago District.

Covered hoppers being loaded at a terminal.
Illinois Department of Commerce and Community Affairs by Terry Farmer.

waterway transport is expected to increase at an annual rate of about 2 percent through the year 2000.

Shipping between Marseilles and Lake Michigan alone accounts for about half of all the shipments on the waterway. About 80 percent of these cargoes are considered to be potentially hazardous materials according to federal guidelines. Between 1986 and 1988, approximately 200 accidental spills were reported on the waterway. Most of them involved petroleum, and 70 percent occurred between Joliet and Lake Michigan.

Major accidents involving hazardous materials include a disastrous 1984 spill that dumped 600 gallons of crude oil into the river at Chillicothe (Peoria County), and a ruptured pipeline that dumped a half-million gallons of ammonia-based fertilizer into the river near Seneca (LaSalle County) in early 1988. To date, the adverse effects and the extent of spills have been limited. The implications would be much more serious and far-reaching if spills were to occur near water intakes, wildlife refuges or other sensitive biological habitats, or recreational areas used for swimming or boating.

Although most of the hazardous materials accidents along the Illinois Waterway have involved minor quantities of pollutants, the cumulative implications are very serious. The state as yet has no comprehensive plan for managing major accidents involving hazardous materials.

A full barge tow of fifteen vessels. Tows typically move at speeds of 3.5 to 11 miles an hour.
Illinois Department of Commerce and Community Affairs by Terry Farmer.

Barge Traffic

Commodities travel on the Illinois Waterway in massive barges, each about 35 feet wide and 195 feet long, with a cargo capacity of around 1,500 tons. Typically the barges travel in configurations or tows of fifteen vessels, three across and five long, pushed by one 5,000-horsepower towboat. Altogether a typical fifteen-barge tow equals the area of about two football fields, and the submerged volume amounts to nearly one million cubic feet.

The sheer size of the barge tows causes traffic delays at locks and dams. When the locks and dams were originally constructed in the 1930s, barge tow dimensions were never expected to exceed 100 feet by 700 feet, and cargo averaged 10,000 tons per tow. Today’s tows are typically 105 feet wide by as much as 1,200 feet long, and capacities exceed 22,000 tons. In 1988, the locks at Peoria and LaGrange processed more than 3,000 tows each. These locks are the busiest and most congested on the waterway, and tows are delayed an average of 101 minutes before entering either one. Continued commercial growth on the waterway could cause increased congestion and delays, which translate into increased shipping costs.

Although most barges share the same general dimensions, various types have been designed to transport different commodities. Bulk solid commodities such as coal travel in open hoppers, which account for about half of the barges on the waterway. Covered-hopper barges account for another 25 percent. Commodities such as petroleum and chemical products are transported in specialty tank barges, which vary in size and design. They may be compartmentalized, pressurized, or temperature-controlled. The hulls of barges are shaped to reduce drag and thereby improve economy. Indeed, no other method of shipping is as convenient for massive volumes of commodities as is waterway transport. The cargo capacity of one barge is equal to that of 58 semitrailers or 15 jumbo-hopper railroad cars.

Majestic but ponderous, barge tows take their toll on the Illinois River. They displace a large section of the channel, and as a typical tow progresses, it affects the hydraulics of the river, the riverbottom sediments, and the shorelines.

Bottom sediments were unaffected by the earliest large craft on the river, the Great Northern canoe, which had a draft (depth below water) of only 3 inches. The paddlewheel steamboats and other steam-powered craft of the nineteenth century had drafts of up to 6 feet, but these also appear to have had little significant impact on the riverbottom sediments. The bottoms of today's loaded barges typically sit 9 feet below water level, however, and the towboats that propel them have drafts of 8 to 9 feet.

The Illinois Waterway navigation channel was designed to accommodate 9-foot drafts, but barge tow traffic disturbs the flows of the river, temporarily alters the velocity of the waters, changes pressure distributions and the direction of flow, and creates waves and drawdown. With the slightest disturbance or decrease in water levels, barge tows can upset the riverbed, resuspending sediments, increasing the water's turbidity, and accelerating shoreline erosion. The biological implications of these physical effects may include disruption of normal behavior patterns and loss of habitat for aquatic or bank-dwelling species of plants and animals, and ultimately loss of biological productivity, diversity, and abundance in and along the river. Of special concern along the lower Illinois is the considerable risk of damage to riverside archaeological sites.

The effects of barge traffic are also felt in the backwater lakes and wetlands along the river. As the river waters are roiled by the barges, sediments overflow the banks and drop into the adjacent wetlands and backwaters. This process contributes to a severe sedimentation problem in the lakes, many of which are being filled at an alarming rate.

Barges wait to enter a lock.
Illinois Department of Commerce and Community Affairs by Terry Farmer.

Water Supply Source

In addition to serving the economic and commercial needs of the state, the Illinois River also serves as a source of water for public supplies and industry. The Chicago-area Commonwealth Edison Company uses 30 to 50 cubic feet per second for cooling purposes, and the city of Peoria draws some 7 million gallons per day from the Illinois.

Many other communities draw their public water supplies from tributaries of the Illinois: Elgin from the Fox River, Kankakee from the Kankakee River, and Pontiac and Streator from the Vermilion River. Decatur uses water from

Covered hoppers and open barges loaded with coal.
Illinois Department of Commerce and Community Affairs by Terry Farmer.

At the turn of the century, almost every community along the river supported local fish markets like these at Havana. Floating markets operated from riverboats tied up at piers. The Havana fish markets handled about 13,000 pounds of largemouth bass in 1897, but between 1899 and 1908, the volume increased by 322 percent.
Illinois State Museum.

the Sangamon River, Taylorville from the South Fork, and Springfield from Sugar Lick Creek. Bloomington draws its public water supply from Evergreen Lake, which was created by damming tributaries of the Mackinaw River. And Jacksonville and Canton maintain reservoirs on area streams that are also tributaries of the Illinois.

Commercial Fishing Industry

Once a major industry on the Illinois River, commercial fishing first became lucrative in the mid-nineteenth century when the railroads developed refrigerated boxcars. They eliminated the risk of spoilage, thereby making it possible to ship live fish from the Midwest to the East Coast.

The Woodruff brothers display their catch on Peoria Lake, c. 1927.
Courtesy Donald Woodruff and the Illinois State Museum.

Fish were so abundant in the Illinois River that large-scale commercial operations relied almost exclusively on nets — trammel nets, hoop nets, and seine nets. Commercial fishing peaked in 1908 when more than 2,000 commercial fishermen along the Illinois River harvested nearly 25 million pounds of fish — equal to 178 pounds per acre — with a commercial value of more than $1 million. That same year, the 207-mile stretch of the river between Hennepin and Grafton produced 10 percent of the nation's total catch of freshwater fish.

The terrific increase in the commercial fishery from the turn of the twentieth century until 1908 was apparently the result of two factors. First was the opening of the Chicago Sanitary & Ship Canal in 1900, which carried several thousand cubic feet per second of diverted water from Lake Michigan. This raised water levels along the entire length of the river, and these waters in turn spilled into the backwater lakes, increasing the areas available for fish habitat. Thompson Lake (near Havana), for instance, tripled in size from 1,943 acres to 5,972 acres.

The second factor in the commercial fishing boom was the introduction of carp into the Illinois River in the 1880s. Their behaviors were well suited to the sediment-filled waters, and after 1900 they adapted quickly to the pollutants that invaded the river via the CS&S Canal, which contained elements that served as nutrients for fish-food organisms. Carp populations exploded, accounting for two-thirds of the peak catch in 1908.

But a new market was ready to absorb the supply: Catholic and Jewish immigrants from eastern Europe, recently settled in Chicago, Pittsburgh, and large East Coast cities, exerted great demands for fish. Their religious dietary laws and cultural traditions were well served by Illinois River carp, whether as Friday evening supper for Catholics or as the basis of gefilte fish for Jews.

But carp flourished and multiplied in the Illinois at the expense of other less hardy fish, which diminished the overall diversity of species in the river. After 1908, commercial fishing declined steadily. By 1913, only five years after the peak, the catch had dropped to 11.5 million pounds, and market value was halved to $500,000. By 1931, the commercial harvest on the Illinois was only 6.8 million pounds. But even in the 1940s the industry was still profitable and fish were still relatively plentiful. Carp and buffalo fish remained a major source of income along the middle and lower river, although fishermen had to bait basket traps to catch more desirable species such as catfish. As adult fish populations declined, gatherers took in ever smaller and younger specimens, until finally the breeding stocks were virtually exhausted.

After 1950, commercial fishing on the Illinois River dropped more dramatically than on any other body of water in the state. That year the Illinois River accounted for almost two-thirds of the state's total commercial harvest; but since 1971 it has provided less than one-quarter of the state's total. Fish populations declined to all-time lows in the 1970s, and the annual harvest dropped to barely 4 pounds per acre. By 1976 only two full-time commercial fishermen worked the Illinois.

The fish of the Illinois River fell victim to contaminated waters and loss of habitat. Initially, the Lake Michigan diversion introduced through the CS&S Canal in 1900 had enlarged the backwater lakes and expanded spawning grounds, while the contaminants in those waters contained nutrients that apparently encouraged fish. But after 1900 and through the 1920s, pollution became more severe, and levees constructed in response to the increased flows destroyed many backwater spawning grounds, particularly along the lower river. Then in the 1930s, the U.S. Supreme Court ordered a reduction in the amount of water that could be diverted from Lake Michigan. As a result, lakes along the entire length of the river receded and became smaller and more shallow.

Sedimentation has also contributed to the reduction of the backwater fish habitats. A natural occurrence in the Illinois River, sediment is now filling the backwater lakes and interfering even more seriously with the remaining breeding stock. Coupled with pollution and fluctuating water levels, sedimentation has damaged and in many cases eliminated aquatic vegetation. With it have gone the most important fish-food resources: the organisms known as "benthic species" and the aquatic invertebrates such as the clams, insects, snails, and worms that inhabit the plant beds and the bottoms of the river and the lakes.

The scarcity of commercial-size carp in the middle river also led to the decline in the commercial fish harvest. While small specimens are present, many die before reaching commercial size and weight. Although they have adapted well to polluted waters, carp are often undersized, diseased, or otherwise unsuitable for commercial use.

Smallmouth buffalo and channel catfish were also once important to the commercial fishing industry, but they too have declined. The populations of both species were initially reduced early in the century in competition with carp. But for smallmouth buffalo, the most rapid declines occurred between 1950 and the mid-1960s: the commercial catch in 1964 was half that of 1950. Their demise has been attributed to the loss of breeding areas in the backwater lakes. While the commercial harvest of channel catfish was 241,000 pounds in 1899, it was only 98,000 pounds in 1964. Although catfish had largely succumbed to pollution, some are now taken from the lower river.

With improvements in water quality since 1970 and fewer pollution-related fish kills in recent years, several fish species have returned to the Illinois. Nevertheless, the species most likely to prosper are those that can spawn in turbid waters, withstand low oxygen levels in warm water, and feed according to their sense of smell (since waters are now generally too turbid for fish to rely on sight).

Since 1980 the commercial fish harvest has improved somewhat, and the 1983 catch was close to pre-1970 levels. About one million pounds of carp, buffalo, catfish, drum, and other commercial fish are now taken from the river each year, with a wholesale market value of more than $250,000.

Commercial Fur Trade

The Illinois River Valley supports a commercial trade in furs and pelts. Fur-bearing animals such as muskrats, minks, raccoons, red and gray foxes, coyotes, and opossums inhabit the marshes, scrub-shrub, and bottomland forests, especially those flanking the LaGrange and Peoria Pools of the middle and lower river. Raccoons and muskrats constitute most of the annual harvest, and their pelts are valued at about $4 and $1, respectively.

Mink is also an economically important species, and pelts are valued at about $18 each. Total value of the pelts harvested along the middle and lower river from 1979 through 1981 averaged $1.5 million per year, although individual pelt prices have declined since then. In 1989-90 about 5,000 licensed trappers harvested about 60,000 animals. According to the Illinois Department of Conservation, wildlife populations are plentiful enough to accommodate commercial trapping, since most species are either stable or actually increasing in numbers.

Raccoon.
Illinois Department of Conservation.

A day on the river: father, son, and largemouth bass.
Illinois Department of Commerce and Community Affairs by Terry Farmer.

The Illinois River — Just for Fun

Illinoisans count bicycling, swimming, fishing, and ball playing among their favorite recreational activities, and the Illinois River and its banks and backwaters are host to all of them. With publicly owned facilities including seven state parks, nine conservation areas, four waterfowl management areas, and two federal refuges, the river valley offers excellent opportunities for hunting, boating, camping, picnicking, bird watching, and hiking.

Illinoisans spent more than $6.3 billion on recreation in 1985, which generated about $1.8 billion in tax revenues. The Recreation Technical Section of the Upper Mississippi River Conservation Committee estimated that every recreation dollar spent resulted in a benefit of $1.50 to the local economies.

Natural and Historic Attractions

Camping and the pleasures of observing, photographing, and feeding wildlife draw thousands of visitors to the banks of the Illinois each year. The Illinois River Valley offers ample opportunity for all of these activities in state parks and natural areas that include savannas, prairies, forests, wetlands, and fish and wildlife areas.

Among the many natural and historic attractions along the Illinois River is the I&M Canal National Heritage Corridor, which was established by Congress in 1984. Spanning the length of the old Illinois & Michigan Canal, the corridor is dedicated to preserving the region's historic, natural, recreational, and economic resources. It features special attractions and events year-round and includes some of the most diversely forested areas in Illinois and one of the largest expanses of tallgrass prairie remaining in the Midwest.

Boating

The number of recreational craft on the Illinois Waterway has increased each year since the late 1970s, and in 1988 a record 18,000 pleasure boats passed through its locks. The busiest locks were on the upper river at Dresden Island, Marseilles, and Starved Rock.

Sport Fishing

Sport fishing is now increasingly attractive along the Illinois, and the state supports it with three major fish hatcheries: Jake Wolf Memorial in Mason County, Little Grassy in Williamson County, and Spring Grove in McHenry County. Together they supply more than 50 million sport fish per year to the state's rivers, lakes, and streams, including the Illinois and its backwaters.

In the Starved Rock area, sport fish populations have increased substantially. A recent creel survey conducted below Starved Rock projected an annual white bass harvest of 61,000 pounds. Recent annual harvests of sport fish around Starved Rock have included 12,500 pounds of channel catfish, 5,200 pounds of sauger, and 2,200 pounds of walleye.

The Illinois now provides the best river fishery for white bass in the state, and its sauger fishery has attracted national tournaments. In a 1987 meet at Spring Valley, just west of Starved Rock, 1,571 sauger were caught, and the first-place fisherman credited the river with "some of the best sauger fishing in the world."

Black bullheads are still abundant in the river, particularly in the middle and upper reaches. Together with carp, they account for most of the catch for pole-and-line fishing from Morris downstream. Crappie populations seem to have remained constant in the lower river since the 1940s, although their numbers have declined in the middle river, probably because of inadequate oxygen supplies and reduced water levels due to sedimentation.

Fishing is regaining popularity along the length of the river, and populations are increasingly viable. An annual fishing derby has even been established in downtown Chicago's waterways. Rainbow trout, stocked especially for the event, do not normally inhabit the urban waters, but they can survive in them temporarily.

About 2 million angling days per year are spent on the Illinois River and its backwater lakes and streams. With an average of $12 spent for each angling day, the economic value of sport fishing on the Illinois River now amounts to about $25 million a year.

Small Game and Waterfowl Hunting

Small game. The bottomlands of the Illinois River are rich in wildlife pursued for sport hunting. Statewide in 1980, more than 400,000 hunters spent more than 8 million hunting days and about $37 million pursuing game, according to the U.S. Fish and Wildlife Service. In the bottomland forests of the Illinois River, about 90 percent

Early-morning mist shrouds fishermen on the Illinois.

Illinois Department of Commerce and Community Affairs by Terry Farmer.

White-tailed deer.

Illinois Department of Conservation.

of them hunted small game such as rabbits, squirrels, or bobwhite, although deer hunting is also popular. In all cases, successful harvests depend on the quality of the habitat available to support animal populations.

Surveys conducted in 1976-77 found that slightly more hunters sought small game than waterfowl in the Illinois River Valley. Cottontail rabbits, the most heavily hunted small game species in Illinois, are plentiful in the river valley. Squirrels are also in demand, and an average of 30,000 per year were bagged between 1956 and 1969. Other small game prized for meat and pelts include raccoons, muskrats, red and gray foxes, opossums, minks, beavers, skunks, weasels, and coyotes. Marked declines in mink populations have been observed since the late 1970s, typically due to weather extremes and loss of wetland habitat.

Overhunting virtually eliminated white-tailed deer from the Illinois River Valley early in this century. But they were reintroduced in the 1930s, and populations made such a successful comeback that the state Department of Conservation allowed hunting to begin again in 1957. About 3,500 deer are killed in the Illinois River Valley each year by an estimated 16,000 hunters. Because deer populations are carefully monitored and hunting licenses are strictly regulated, these “official state animals” are thriving. White-tailed deer seem to be most plentiful in Pike, Brown, and Schuyler Counties, along the southernmost pools of the river, and in Bureau County, just north of the Great Bend.

Waterfowl. Until the 1930s, the Illinois River was one of North America’s richest waterfowl hunting areas. The decline in hunting reflects overall waterfowl population declines on the continent and consequently lower populations along the Illinois River. But part of the decline must also be attributed to declining waterfowl food resources in Illinois.

Although duck populations are still below the numbers tallied in the early 1960s, the river valley remains a key area for international migration on the Mississippi Flyway, attracting more ducks than the stretch of the Mississippi that borders the state. In 1981, Illinois waterfowl hunters caught about 100,000 birds along the Illinois River and its backwaters. The average expenditure per bird has been estimated at about $54. Because private duck clubs provide managed habitat specifically for certain species of waterfowl, harvests are higher on private lands than on unmanaged lands.

In fact, public and private duck clubs and waterfowl areas are helping to attract and maintain populations. About 20 percent of all publicly owned lands in the valley include controlled water impoundments for waterfowl. And in the middle river alone, about 300 private duck clubs manage almost 60,000 acres. About one-third of those acres are subject to controlled water conditions for the cultivation of moist-soil plants, primarily Japanese millet, which serves as food for dabbling ducks.

Mallard.

Illinois Department of Commerce and Community Affairs by Terry Farmer.

3.
The Waters of the Illinois River

Walter Hatton of Havana was born in 1903, and in 1986 he reminisced about standing neck-deep in the Illinois River and seeing his toes, five feet eight inches below. He also remembered seeing more than 100,000 ducks overhead at one time. And he remembered backwater lakes that no longer exist and white water lilies stretching over them as far as he could see.

Times have changed along the Illinois. The crystal-clear waters are murky now with sediment. And most of the ducks are gone, too, having lost food and refuge in the backwater lakes. “We had a lot of good times around the river when I was young, and the Illinois was really beautiful then, clean enough to drink from,” Hatton recalled. “People nowadays don’t realize what they’ve missed.”

The Chicago River at the turn of the century: looking east from the south end of the Rush Street bridge.

From Report of the Submerged and Shore Lands Committee, *Illinois State Historical Library.*

Degradation of the Waters

As one of its most important jobs, the Illinois River has served as the primary channel for the transport and disposal of much of our state’s human, animal, industrial, and agricultural wastes. From Lake Michigan to the Mississippi, the river has absorbed the wastes of our homes, industries, farms, and stockyards for more than a century.

Chicago as a Source of Pollution

The major waste contributor to the Illinois River has always been Chicago. With the city’s rapid growth in the nineteenth century came the problems that normally accompany progress. Manufacturers, processors, slaughterhouses, and families all dumped their wastes into the small, sluggish streams along the Lake Michigan shore, including the Chicago River. The foul waters of those streams and ditches posed serious threats of disease. And they all eventually flowed into the lake, which was the city’s source of water supply. As these polluted waters entered the lake, it too became contaminated and threatened the health of the entire city‘s population.

As early as the 1840s, Chicago acknowledged a waste pollution and disposal problem, and after the new Illinois & Michigan (I&M) Canal opened in 1848, the city anticipated a solution. Although the canal was primarily intended for navigation and commerce between Chicago and the Mississippi, its usefulness was short-lived: by 1854 the railroads promised cheaper, faster transportation of goods and passengers. As traffic and income declined on the canal, Chicago looked to it increasingly as a disposal channel through which the city’s largely untreated wastes could be dumped into the Illinois River.

In 1859-60 pumps were installed at the junction of the I&M Canal and the Chicago River to speed the flow of navigation water. But their impact on water quality in the Chicago River was immediately observed: they “effected an occasional flushing and notable purification of the Chicago River," according to Bulletin 2 of the State Water Survey. By 1865 the pumps were dedicated largely to the purification of the river and were activated as needed to relieve its "offensiveness." Although they provided significant relief, the pumps were never completely adequate.

The city's first sewage commission recommended enlarging the canal for waste disposal, which involved leveling its summit, the old Chicago Portage, to speed gravity flow from the Chicago River to the canal. The job was completed between 1867 and 1871. As garbage was more efficiently removed from the city, Chicago's water quality improved and the annual death rate declined from 24 per thousand in 1860 to 18.5 per thousand in 1870. But the pumping system and the enlargement of the canal proved to be only temporary solutions. While they dissipated some of the foulness of the Chicago River, much contaminated water still reached the lake when rainfall made flows heavy. This water continued to pollute the water drawn into the city's supply mains.

In the 1870s, as population and industry continued to grow, an old lock on the Chicago River at Lake Michigan was re-established, and in 1884 an elaborate system of pumps was installed at the beginning of the canal. These actions finally succeeded in reversing the flows of the Chicago River. Thus sewage and wastes flowed westward, away from the lake and into the I&M Canal, ultimately to the Illinois River.

Nevertheless, untreated sewage still backflowed into Lake Michigan during heavy rains, Chicago's population continued to grow, and its sanitary situation rapidly declined. By 1886 it became necessary to establish a second special commission to address Chicago's water supply and sewage problems. This commission recommended an entirely new waste conduit to replace the old I&M Canal. It would become known as the Chicago Sanitary & Ship (CS&S) Canal. Unfortunately, the CS&S Canal did not open until 1900 — too late to relieve the beleaguered city from the filth and pollution that contributed to a series of deadly epidemics in 1895. One of them killed 90,000 Chicagoans.

The twentieth century marked the beginning of the darkest era of the Illinois River. On January 17, 1900, the river received the first of Chicago's wastewater through the CS&S Canal. The new canal was bigger, deeper, and more hydraulically efficient than the I&M Canal, and it opened the door to the massive degradation of the Illinois River, the destruction of waterfowl and wildlife habitats, and significant reductions in the value of the traditional river industries of ice cutting, fishing, and mussel gathering.

That very day, January 17, 1900, the state of Missouri filed suit against the state of Illinois and the Chicago Sanitary District in the U.S. Supreme Court, seeking to close the canal. Eminent scientists from around the nation testified on both sides of the question. The plaintiffs contended that the canal would "divert all the sewage of the city from the lake into the DesPlaines River," asserting that the velocity of the new canal would be strong enough to dislodge the sewage accumulated along the banks of the Chicago River and Lake Michigan. They estimated that 1,500 tons of sewage would be sent into the Illinois River daily, enough to "poison the waters of the Mississippi."

The opinion of the court was delivered by Justice Oliver Wendell Holmes in 1906. It includes the following passage:

> *It is a question of the first magnitude whether the destiny of the great rivers is to be the sewers of the cities along their banks or to be protected against everything which threatens their purity. To decide the whole matter at one blow by an irrevocable fiat would be at least premature. If we are to judge by what the plaintiff itself permits, the discharge of sewage. . . by cities and towns is to be expected. We believe that the practice of discharging into the river is general along its banks. . . . The argument for the plaintiff asserts it to be proper within certain limits. . . . [In this instance] there is nothing which can be detected by the unassisted senses — no visible increase of filth, no new smell.*

The Supreme Court determined that the CS&S Canal would pollute neither the Illinois River nor the Mississippi. Others closer at hand, however, did not agree. Said one witness: "Masses of sludge floated by so dense that dogs could run across the river; [it] had a mingled fish and privy odor, and the color of the water was an unnatural gray." But the pollution of the Illinois was a successful answer to Chicago's waste disposal problem. All the untreated wastes from a densely populated area of about 673 square miles were now channeled into the Illinois River through the CS&S Canal.

Along with the wastewater came as much as 10,000 cubic feet of water per second that was pumped from Lake Michigan to diffuse the vile odors, dilute the sewage, and speed the flows. But the diverted lake water also raised the levels of the river and thus improved navigation from Lake Michigan to the Mississippi. Average water levels rose 2.8 feet at Havana, and during summers the river was as much as 3.6 feet higher than before the diversion began. As the waters overflowed the banks of the Illinois River downstream, they swelled the size of the backwater lakes, which improved the fisheries and contributed to the phenomenal success of commercial fishing in the first decade of the twentieth century.

But increased velocities and volumes of flow also brought problems, including flooding and accelerated sedimentation rates. While the higher water levels enlarged backwater fish breeding areas, they did so at the expense of the surrounding mudflats, marshes, and forests. The waters permanently inundated thousands of acres of bottomland forests and moist-soil vegetation surrounding bottomland lakes, upsetting feeding grounds and habitats for waterfowl and wildlife.

The immediate goal of the diversion was sewage disposal, however, and this it did effectively. The diversion speeded the wastes downstream, but it could not hasten the decomposition of the untreated sewage that now traveled the Illinois. This sewage was so potent that water quality suffered throughout the length of the river. This had not been the case with the old I&M Canal. The harmful nitrogen materials in the sewage carried in the earlier canal were less concentrated and thus largely neutralized before the canal waters entered the Illinois River.

But the transport capabilities of the new canal were much more efficient. By 1915 the river was seriously polluted as far south as Pekin, and by 1925 it was polluted at Havana. Between 1915 and 1920 the pollution moved southward at the rate of 16 miles a year. By 1922 the upper river was so polluted that it was essentially dead.

Other Sources of Pollution

Chicago was not solely responsible for the pollution of the Illinois River. Professor John H. Long, a Northwestern University sanitarian and chemist, was retained by the Illinois Board of Health to study the waste assimilation capacity of the Illinois from Chicago to Grafton. His report notes a steady, gradual improvement in water quality at increasing distances from Chicago. But at Peoria "the river was again heavily contaminated by the discharge of wastes from cattle and distilleries. Peoria cattleshed filth, not Chicago sewage, was the main factor in the animal pollution of the lower river."

Peoria's stockyards, where 40,000 to 50,000 cattle were fed on distillery slops, dumped vast quantities of untreated biological wastes into the river. A Peoria distillery manager described the dismal situation in 1901: "[Slop and excrement] would accumulate along the bank for indefinite periods until high water washed it away, when it would flow down the stream in large islands, one of which was too large to pass between the piers of the Pekin bridge."

Another observer in the same era considered the river so offensive that he suggested damming it below Pekin, thus creating a huge septic tank. He suggested that this strategy might allow the lower reaches of the river to recover some of their original purity.

Urbanization and industrialization in the late nineteenth century also contributed to the degradation of the Illinois River. Peoria's population at the turn of the century had reached 25,000, and Pekin's was 10,000. In addition to the human and feedlot wastes then being generated in both cities, glucose and strawboard factories dumped more than 200 tons of organic waste into the river each day.

The situation was so serious that the Illinois state government established the "Submerged and Shore Lands Legislative Investigating Committee" to look into the problems. Their 1911 report to the governor notes the build-up of "accretions" along the riverbanks of industrial communities, such as Marseilles, Ottawa,

The CS&S Canal at Romeoville early in the century. The flows of both the Chicago River and the Calumet Sag Channel were reversed to flow directly into the canal.

From Report of the Submerged and Shore Lands Committee, *Illinois State Historical Library.*

At Morris. . . the water. . . was grayish and sloppy, with foul, privy odors distinguishable in hot weather. . . . Putrescent masses of soft, grayish or blackish, slimy matter. . . were floating down the stream; and chunks of this material, from the size of a walnut to that of a milk pan, occasionally rose to the surface. . . .

Stephen A. Forbes, 1911

Pekin in July 1902, where the legislative investigating committee found that "the railroads and . . . the distilleries have been dumping refuse and material into the river and in this way projected their lands beyond the natural line of mean high water."
From Report of the Submerged and Shore Lands Committee, *Illinois State Historical Library.*

The riverbank of the Illinois just below the Morris highway bridge in 1904, showing the spoil bank created by the Morris Tannery Company.
From Report of the Submerged and Shore Lands Committee, *Illinois State Historical Library.*

Peoria, and Pekin. Paper mills, lumberyards, manufacturing industries, icehouses, railroad yards, distilleries, and construction companies had located on the riverbanks to take advantage of water as a means of transportation, as a raw material, and as a power source for steam-run machinery. But they also used the river as a dumping ground.

The investigating committee reported that hundreds of acres of riverfront land were filled in and built up with industrial debris. At Ottawa the Pioneer Fireproof Construction Company had a "switchtrack running from its plant out to the edge of the Illinois River, and dump cars bearing . . . broken tile and other refuse are run out on the track and dumped into the Illinois River. In this way a considerable fill has been made, to a height of 12 or 15 feet and for a distance of over 500 feet along the Illinois River." At Peoria, the riverfront had been filled in at many locations, and industries then proceeded to build on it "with little documented title right to the lands." In fact, the committee cited hundreds of companies and noted many instances along the Peoria shores "where the rights of the people have been jeopardized by a lack of vigilance on the part of public officials."

By 1919, researchers had identified a broad spectrum of pollution from other sources as well. From rural areas came runoff and erosion from farm fields, animal feedlots, and streambanks. And from urban areas, industrial refuse and wastewater from street washing and the flushing of sewers after heavy rains all sent highly organically contaminated discharges into the river.

Degradation of Life Forms

The biology and the microbiology of the Illinois River Basin today bear little resemblance to those of a century ago. Predictably, the greatest alterations have occurred to the least visible but most vulnerable species at the base of the food chain. But the impact of their degradation affects all life forms in the river basin.

Benthic Species

Basic to most life forms in and along the Illinois River are the benthic species, the microscopic, invertebrate animals that inhabit the bottom sediments and aquatic vegetation of the river and the backwater lakes. Many different clean-water species of insect larvae and tiny mollusks serve as food for higher animals such as fish and ducks and thus form an important part of the food chain. Other benthic species, such as leeches and moss animals, are important to the health of the waters because they filter algae, bacteria, and organic matter.

A very desirable mix of clean-water species once dominated the benthic life forms in the river, according to studies conducted between 1913 and 1915. But much of the diversity of the benthic species in the Illinois River has been diminished, so that only the most hardy species — not necessarily the most valuable — still survive. Studies of the river between LaSalle and Beardstown in 1964 and 1965 showed that the most prevalent bottom fauna were pollution worms of the family Tubificidae, which are poor food for fish and ducks. Where 4.4 pollution worms were collected per square yard in 1915 at Lake Matanzas, below Havana, more than 11,000 worms were found per square yard in 1953.

Fingernail clams have been the most important benthic species to disappear. This primary food source for bottom-feeding fish and diving ducks was plentiful throughout the river and its bottomland lakes until 1954. Then the clams abruptly disappeared, and today only isolated populations can be found in tributaries and backwater lakes. Many attempts have been made to recolonize the river, but none have proved successful. Researchers are still trying to identify the toxic substance that is discouraging fingernail clams in the middle and lower river and actually preventing them from repopulating the upper river.

In Quiver Lake above Havana, a small snail known as "Cincinnati emarginata" disappeared along with the fingernail clams. Snail populations fell from almost 11 grams per square foot in 1952 to 6 grams in 1954 and finally to zero in 1964. Burrowing mayflies completely disappeared from the river above Havana by 1915, although some were collected in 1964 from the river below Beardstown and in the Alton Pool. Many of these drastic changes in the benthic populations of the Illinois River have been attributed to an unknown toxin in the bottom sediments or to the cumulative effects of pollution.

Aquatic and Wetland Vegetation

Many invertebrate species live among the leaves of aquatic plants, and the foliage itself is an important food source for waterfowl. But aquatic vegetation has also suffered. In Peoria Lake, degraded water quality during the early years of our century killed off extensive beds of pondweed, wild celery, and coontail between 1910 and 1914. By 1920 they were gone entirely. Although coontail and bushy, sago, and longleaf pondweeds made a dramatic comeback during the 1940s, they soon declined once again. Since the early 1950s Peoria Lake has been bare of all vegetation except remnants of sago pondweed and arrowhead.

Elsewhere along the middle river, pondweed and other large aquatic plants vanished between 1915 and 1920, and only isolated growths could be found from the 1930s to the 1950s. Even these have now disappeared almost completely.

Water lilies rise above the surface of a lake, which is visible in the foreground.
Illinois Natural History Survey by John Taft.

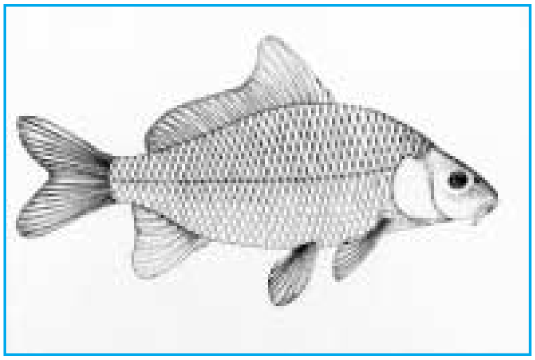
Aquatic vegetation has not fared well along the upper Illinois either. The last coontail, longleaf and sago pondweeds, and wild celery disappeared from the Starved Rock Pool in the 1940s.

A voluminous catalog would be required to document the plant life lost from every backwater lake and every river mile from Chicago to Grafton. Despite clearer waters along many stretches of the river, efforts to rejuvenate various species are as yet isolated. While the reasons for the eradication of aquatic vegetation in and along the Illinois River are not yet fully understood, the origins can be traced to the pollution and high water levels introduced by the CS&S Canal. Subsequent plant losses may be attributed to various combinations of pollution and water level fluctuations, resulting in sedimentation, contaminated sediments, and turbidity.

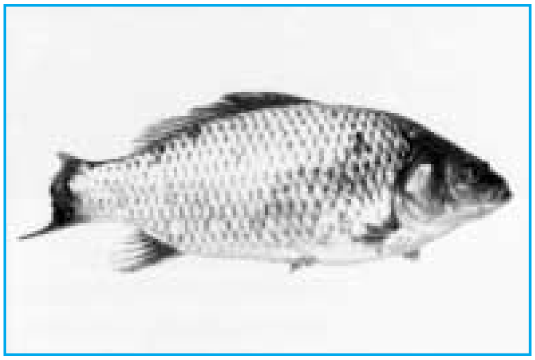
Fish Losses

As plant life has disappeared throughout the Illinois River Valley, so too have the fish that spawned amid the vegetation and fed on the microinvertebrates that inhabited the plant beds. Elderly Havana residents can recall the special excursion trains that used to bring Springfield anglers for a day's outing in the foliage-filled waters. They also recall the carloads of live fish that were once shipped from Havana to New York. But those days are gone, along with many of the fish and their habitats.

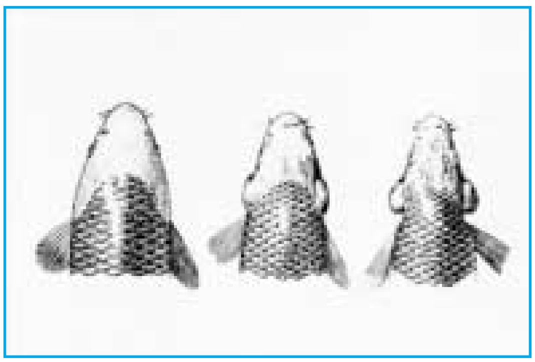
As could be expected, the upper river has been more drastically affected than the lower river. Between 1912 and 1917, pollution



A healthy carp.
Illinois Natural History Survey by C. Ronto.



A carp-goldfish hybrid with eroded tail and fins, collected from the polluted upper Illinois River.
Illinois Natural History Survey.



Stages of development of the "knothead" condition: left, normal; center, moderate knothead condition; right, extreme knothead condition.
Illinois Natural History Survey.

completely wiped out the fish life above LaSalle-Peru. Observations around Morris in the late summer of 1912 indicated that the river was virtually devoid of fish. The few bullheads present were "fungused" or otherwise unhealthy. The only mollusks to be found were dead.

Conditions were similar at Marseilles. In August 1912 researchers exploded dynamite in an effort to locate fish — dead or alive — in the main channel of the river. There were none. Shortly thereafter, a flood washed fish from some tributary creeks into the main channel. Once in the polluted waters, they appeared to become sick. A decade later, in the summer of 1923, the Illinois River was found to be practically devoid of oxygen as far south as Chillicothe. Conditions virtually prevented the existence of fish or aquatic vegetation.

Fish populations have declined steadily since the peak of the commercial industry in 1908. Although sewage treatment facilities installed in the 1930s alleviated some of the river's pollution problems, approximately eighteen species of fish have been lost to the waters of the Illinois River Valley, and as many as two-thirds of all species have declined and are now much less abundant than they were at the turn of the century.

Even carp show the rigors of adaptation to modern conditions. Many appear to be malnourished due to inadequate oxygen supplies and a lack of appropriate foods such as fingernail clams. Many are victims of "knothead," an abnormality characterized by malformed heads and gill covers. This condition, most common today in the waters near Chicago, was first identified and associated with polluted river waters during and after World War I.

Fish populations continue to be a matter of concern, as knothead and other pollution-related conditions threaten species near Chicago and as oxygen shortages and pesticide-laden agricultural runoff threaten populations downriver. As recently as 1981, the Department of Conservation documented 73 fish kills in a single spring planting season.

Migrating Waterfowl

Just as the loss of the Illinois River Valley's aquatic vegetation and microinvertebrates has affected fish populations, so too has it affected migrating waterfowl populations. The crustaceans and aquatic insects that live among the plants, as well as the plants themselves, form the major part of the diets of several species of ducks.

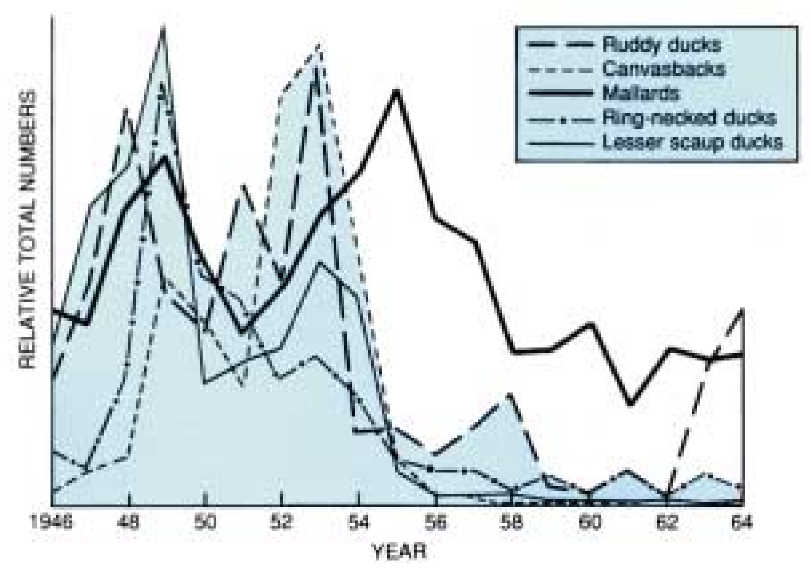
Diving ducks in particular have been drastically affected by the loss of food supplies, and increasingly fewer birds are using the river valley as a migratory stop. Peoria Lake, once the scene of the greatest autumnal concentration of diving ducks in Illinois, now attracts relatively few of them.

The loss of food supplies, particularly fingernail clams in the 1950s, caused major declines among lesser scaup, ring-necked, canvasback, and ruddy duck populations. The tiny mollusks had once constituted a significant portion of the diets of these diving ducks, while aquatic and moist-soil vegetation was used as a supplement. With the loss of both the fingernail clams and the aquatic vegetation, many diving duck species shifted their migration path to the Mississippi Valley. At the same time, high water levels that submerged mudflats along the middle river's backwaters during the 1940s and 1960s forced thousands of dabbling ducks and species such as wigeon and gadwall to leave the valley in search of moist-soil vegetation elsewhere.

Other less numerous species have also been affected by the loss of food resources. Double-crested cormorants were often seen in massive flights in the Illinois River Valley in the 1940s and early 1950s. The largest single flight ever observed numbered some 12,000 birds over Havana on October 7, 1940. By 1958 the greatest passage of cormorants was only 300 per day. And in 1965 the largest single passage numbered only 22 birds. The specific cause of the decline of cormorants is unknown.

General indications show that the numbers of great blue herons have also diminished along the Illinois River, and populations of American egrets appear to have decreased since 1962. Nesting populations of both species have fluctuated considerably following this decline, although tentative improvements in populations have been noted in recent years.

Resources for migratory waterfowl have been destroyed by a combination of problems: sedimentation; urban, industrial, agricultural, and domestic pollution; and water-level fluctuations. All these factors affect habitat, beginning with those organisms at the base of the food chain. Until these conditions are reversed substantially, it is unlikely that the Illinois River will attract significantly larger populations of migratory waterfowl or that the waters will be suitable for further development of fishing.



Relative population trends for diving ducks in the Illinois River Valley from 1946 to 1964, showing drastic declines in the 1950s with the disappearance of fingernail clams. The demise of aquatic vegetation at about the same time contributed to the severe reductions in ring-necked and canvasback duck populations. The ruddy ducks did not decline so drastically because their diets also include aquatic insect larvae, and mallards were less severely affected because of their diverse feeding habits.

Diving Duck Population Declines in the Illinois River Valley*

Species	Approximate population 1946–54	Approximate population 1955–64	Percent of reduction
Ruddy ducks	36,000	12,000	67
Canvasbacks	154,000	8,000	95
Mallards	400,000	300,000	25
Ring-necked ducks	310,000	50,000	84
Lesser scaup ducks	1,100,000	50,000	95

* Average number censused per year.

Data from the Illinois Natural History Survey.

Cormorants.

Illinois Natural History Survey by Michael Jeffords.

Mallards taking flight from the Chautauqua National Wildlife Refuge.
Illinois Natural History Survey.

Water Quality: The Long Road Back

After suffering massive degradation from the pollution introduced into the Illinois River in the first decades of the twentieth century, water quality finally took a turn for the better with two specific events in the 1930s. First and most significant was the establishment of improved waste treatment facilities and procedures in both Chicago and Peoria. These facilities provided one and sometimes two levels of treatment, and they affected substantial reductions in the river's organic waste loads.

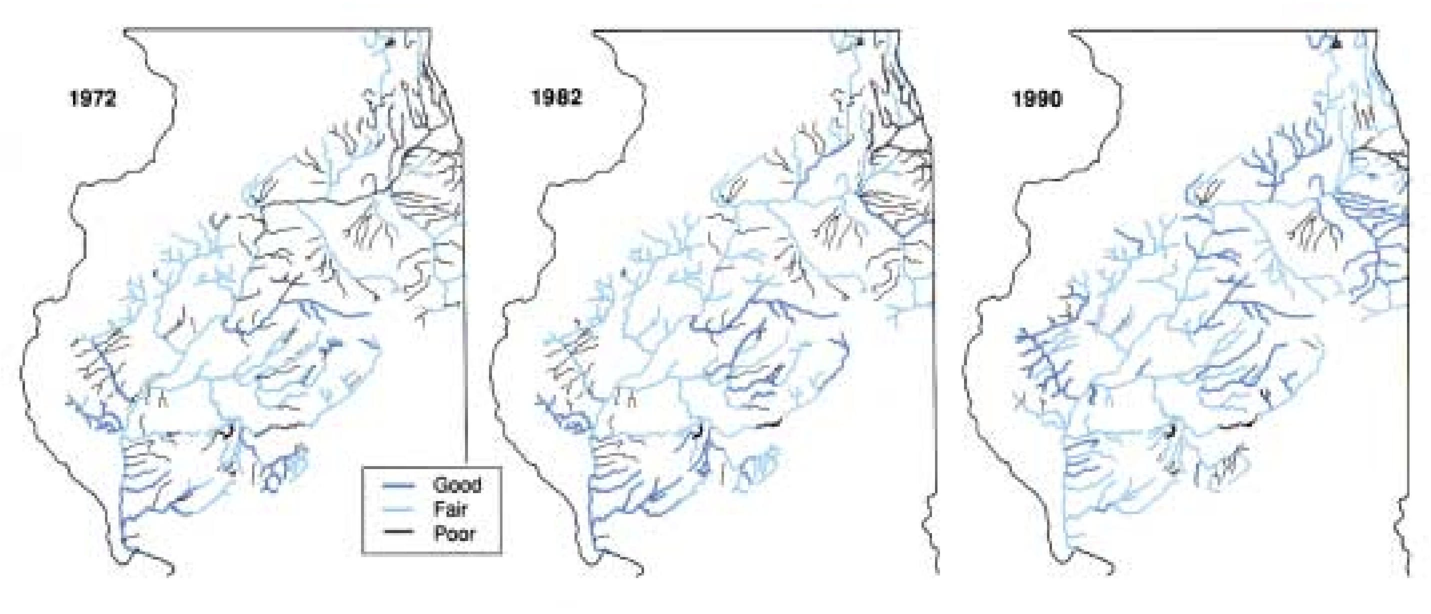
In 1922, perhaps its most dismal time, the Illinois carried wastes equivalent to the volume that would be produced by 6.2 million people. By 1962, that waste load had been reduced to 28 percent of the 1922 level. By 1971 volumes were cut to 13 percent. Another 32 percent reduction by 1982 brought the total waste load down to 9 percent of the original 1922 level — equivalent to the volume that would be produced by about half a million people. Results at Peoria have been even more impressive: organic wastes discharged into the Illinois River have been reduced to 3 percent of their 1925 levels.

The second event to help stem the pollution of the Illinois River was the U.S. Supreme Court decision that limited the amount of diversion water from Lake Michigan to only 1,500 cubic feet per second as of 1939. By then the Chicago Sanitary District had implemented improved wastewater treatment, so the reduced volumes of diversion water were sufficient to dilute the wastes.

Stringent water quality standards imposed in 1970 through the Illinois Environmental Protection Act produced even more marked improvements. More than 99 percent of the wastewater facilities in Illinois now provide two or even three levels of treatment. These have contributed to measurable improvements in many aspects of water quality, a subsequent return of many fish species, and a trend toward a larger commercial catch since 1980. The benefits are particularly visible in increased fish populations in the upper river and in the immediate Chicago area. Goldfish, carp, black bullheads, emerald shiners, and other less abundant species have recently been found in the upper reaches of the river, some after absences dating to 1908. Nevertheless, a fish advisory is still in effect, primarily for bottom-dwelling species such as carp.

Waterfowl populations have not responded as readily to water quality improvements, doubtless because of the continued lack of diversity of benthic species and limited success in reintroducing aquatic vegetation. Populations rose in the 1970s, but diving ducks never recovered to the numbers that traditionally fed in Illinois. Waterfowl populations in 1982 were not much greater than those measured in the mid-1960s.

But recent reports indicate progressively improving water quality, based on individual and cooperative monitoring efforts by state and local agencies such as the Illinois Environmental Protection Agency, the Metropolitan Water Reclamation District of Greater Chicago, the Illinois State Water Survey and Natural History Survey, and the Illinois Department of Conservation. Many of their efforts have concentrated on the troubled waters of the upper Illinois River. Reports concur that the waters of the Illinois, as well as the sediments, all showed considerable improvement between 1972 and 1979. Statewide, the percentages of waters ranked "poor" declined, while those ranked "good" increased. More extensive improvements were reported in 1982. And 1990 figures showed that only a small portion of the Illinois Waterway remains in "poor" condition. In fact, concentrations of total suspended solids and harmful substances such as dissolved barium, manganese, and boron all



Water quality of Illinois valley streams and rivers, 1972, 1982, and 1990, showing marked improvement in the quality of the Illinois River and its headwaters.

Data from Progress, *Illinois Environmental Protection Agency.*

declined on the upper Illinois and DesPlaines Rivers between 1977 and 1989.

Ammonia nitrogen, a product of some industrial and raw domestic wastes, also declined, apparently with reductions of the waste load in the river. Ammonia nitrogen is toxic to all aquatic life forms because it consumes oxygen and forces every other living thing to compete for available supplies. The higher the concentrations of ammonia nitrogen, the lower the supplies of available dissolved oxygen to all species.

Water treatment processes used before 1970 were largely ineffective against ammonia nitrogen. But new procedures instituted that year in compliance with the Illinois Environmental Protection Act, coupled with ongoing waste reduction through more effective wastewater treatments, have yielded excellent results. Ammonia nitrogen measured at Lockport in 1970 was as high as 118,000 pounds per day. By 1982, it was down to little more than 40,000 pounds per day, a reduction of more than 60 percent. At Peoria, average concentrations in 1986-87 were only 11 percent of 1971-72 levels. Overall water quality relative to organic pollutants is better now in the main stem of the river than at any time since the I&M Canal opened in the mid-nineteenth century.

The river's backwaters have not fared as well, however. Since the 1950s these shallow, serene waters have suffered from the mounting pressures of sedimentation, which seems to be introducing oxygen-consuming toxic sediments and organic contamination. As a result, backwater habitats continue to decline, and fish populations have not improved as markedly as they have in the main stem of the river.

Populations of backwater benthic species, however, have become somewhat more abundant and diverse in recent years, and marked improvements have been observed in Peoria Lake. Scientists suspect that as new, cleaner sediments from cleaner waters are deposited atop the old, they simply cover the more contaminated sediment layers. The cleaner top layers are apparently more amenable to clean-water benthic species and seem to insulate the microinvertebrates from the contaminants buried beneath. As a result, healthier benthic species, plankton, and invertebrates may be able to survive in the more shallow layers of sediment.

Water Quality: Current Issues

The waters of the Illinois River have been witness to 60 years of effort to improve their quality. Nonetheless, their health is still subject to the multitude of conditions that the river encounters on its route from Chicago to the Mississippi River.

Sedimentation

Paramount among the current issues surrounding the Illinois River is sedimentation. Much of the sediment load is the result of natural conditions such as the river's overall low slope, but much of it is also the result of human alterations to the lands and streams of the river basin. Nonetheless, sedimentation affects the navigability of the river and is filling the backwater lakes at a rate that threatens their very survival. By making waters turbid and murky, suspended sediments inhibit photosynthesis for aquatic vegetation. And as sediments settle out of suspension, they create a soft riverbed and lakebeds in which aquatic vegetation cannot take root.

Toxic Contamination of Sediments

The impact of waste toxins on sediments, plants, and animals is a major issue along the upper river. While all wastewaters are now treated before being discharged, specific toxins still enter the river from a number of sources and settle into the sediments that blanket the riverbed and the bottoms of the backwater lakes.

Agricultural pesticides are a significant source of toxins, especially along the middle and lower river. Today's organophosphate agrichemicals are relatively short-lived and do not pose a serious, long-term threat in the river waters. But the organochlorine insecticides used widely after World War II still persist. Considered a possible cause for the extinction of fingernail clams in the 1950s, these toxins are still found in sediments throughout the river basin. To varying degrees, they continue to threaten bottom-feeding fish, diving ducks, and the benthic species and plankton that form the basis of the food chain. Because these toxins consume oxygen, they deplete the resources available for all other species of life and contribute to "sediment oxygen demand," a new concern for the quality of the Illinois River waters.

Low Dissolved Oxygen Concentrations

Dissolved oxygen is one of the most basic indicators of the "health" of streamwater. Unfortunately, concentrations in the Illinois River have not increased commensurate with recent reductions in waste loads and ammonia nitrogen. Because of the physical damming, diking, draining, diverting, and deforming of the Illinois Waterway during this century, the river is now largely unable to cleanse itself and assimilate wastes. Thus any excess wastes that remain in the water produce ammonia nitrogen and consume oxygen.

Before 1800, the Illinois River carried enough oxygen to support diverse, healthy aquatic flora and fauna. The turning point came with the urbanization of Chicago and the Peoria-Pekin area and the construction of the CS&S Canal. With the introduction of this untreated sewage and domestic and industrial

The locks and dams constructed for the Illinois Waterway placed serious constraints upon the river's ability to assimilate organic, oxygen-consuming wastes. Water velocities were reduced, depth was increased, and sedimentation was promoted in the slower waters. All of these conditions are detrimental to natural waste assimilation processes.
Illinois Department of Commerce and Community Affairs by Terry Farmer.

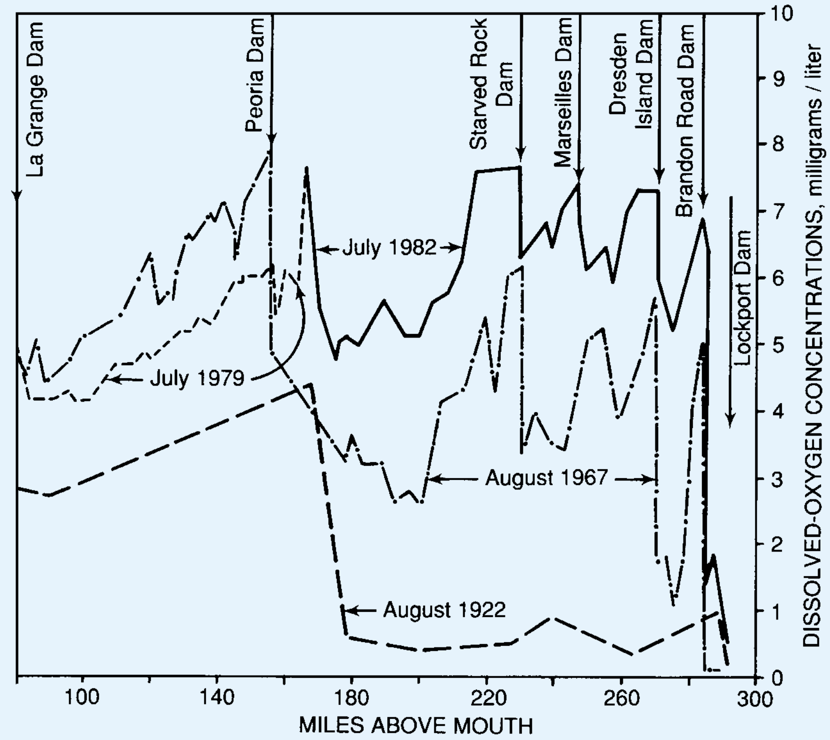
wastes, the concentrations of dissolved oxygen in the river regularly fell to as low as 0 milligrams per liter from 1900 to about 1930, especially during warm weather.

The current minimum standard for dissolved oxygen in the Illinois River outside of Chicago is 5.0 milligrams per liter, the minimum level at which many valuable fish can be maintained. Within the city limits, the minimum standard attainable is 4.0. Although this standard is routinely violated above the Interstate-55 dividing line and occasionally below it, recent years have witnessed significant improvements: annual average dissolved oxygen measured at Peoria rose from 3.3 milligrams per liter in 1964 to 7.6 in 1982. At Dresden Island in the upper river, levels increased from 3.3 to 6.2 milligrams per liter during the same period.

Despite these encouraging figures, inadequate oxygen still causes serious ecological imbalances in the upper river, where near-zero levels often occur above Lockport. Runoff from industrial and urban areas contributes enough nutrients, heavy metals, toxic substances, and organic materials to depress oxygen levels and kill off aquatic life — and to prevent its re-establishment, as in the case of mussels and fingernail clams.

Inadequate supplies of dissolved oxygen are not unique to the upper river. During extremely warm, low-flow periods, such as during the drought of 1988-89, dissolved oxygen levels in the lower river can fall to 2 milligrams per liter. Here the river must contend with the oxygen demands of contaminated bottom sediments and with organic wastes from agricultural runoff. The slow flows of the lower river and its consequent inability to assimilate wastes lead to seasonal shortages of dissolved oxygen. Therefore, water quality fluctuates with agricultural activities: it is worst during the spring planting season (when fertilizers and pesticides are applied) and the warm summer months; and it is best during the late fall and winter (when land lies fallow).

Oxygen levels are perhaps most endangered in the river's contiguous lakes and backwaters, and concentrations have actually declined since the 1950s. As the last resting place for the river's sediment-laden waters, the backwaters are also becoming the last resting place for the water quality problems associated with polluted sediments. In addition to reducing water volume and interfering with plant growth, sediments that contain oxygen-consuming pollutants also increase oxygen demand in the lakes. As a result, the diversity and abundance of all species in the lakes have declined in recent decades because they must compete with undesirable sediments and pollutants for available oxygen supplies.



Dissolved oxygen concentrations in the main channel of the Illinois Waterway, 1922-82. Elevated concentrations of oxygen at the dams illustrate the positive effects of aeration as water passes over them.

Illinois State Water Survey.

Algae Growth

Treatment of all wastewater discharged into the Illinois River has produced an 85 to 90 percent reduction in certain key pollutants. However, wastewater treatment does not completely remove phosphorus and nitrogen, two plant-growth nutrients that can sustain the growth of algae. Because phosphorus and nitrogen remain in treated wastewater, and because agricultural runoff is also rich in these nutrients, algae are becoming overabundant throughout the length of the Illinois.

Algae are a working part of the aquatic ecosystem: they serve as a foundation of the food chain for the benthic species; they produce oxygen through photosynthesis in the presence of light; and they respire in the absence of light,

Algae bloom in the Illinois River backwaters.
Illinois State Water Survey by Tom Rice.

which consumes oxygen. But the efficient operation of the ecosystem requires that all parts work in concert. If algae (particularly blue-green algae) become overabundant, they produce a scummy "bloom" on the surface of the water. As the bloom decomposes, it emits toxins and consumes oxygen. Therefore, an overabundance of algae can cause drastic fluctuations in the oxygen content of the water.

Before the mid-1970s algae were of almost no consequence to the quality of Illinois River water. But in the last ten years, algal growth has accelerated as far north as Marseilles, and algal blooms are becoming more frequent.

Recent Developments

Modern scientific and technological efforts are dedicated to improving the biological quality of the Illinois Waterway. They include instream and sidestream aeration projects, new wastewater treatment plant facilities and operations, and treatment and control of Chicago's combined sewer overflows.

Among the most ambitious new projects is the massive Chicago Tunnel and Reservoir Plan (TARP), which is scheduled for completion after the turn of the twenty-first century. During wet weather, Chicago's combined sanitary and storm sewers overflow and discharge into various Chicago-area waterways, ultimately destined for the Illinois River. TARP will control this excess runoff by storing the overflows and gradually passing them through wastewater treatment plants before they are discharged to the Illinois.

The development of new management methods for wastewater, runoff, and specific toxins is ongoing, carried out both in response to existing water quality problems and in attempts to forestall new ones. These efforts demonstrate the need for constant vigilance to protect the health of the waters of the Illinois River for future generations.

During the course of a century, the waters of the Illinois River have been changed drastically. For half of that century, they were abused and degraded. For the other half, state, federal, and local authorities have struggled to correct the abuses. While great strides have been made, the waters of the Illinois and the life forms that depend on them will hang in delicate balance as long as the river is required to serve in the diverse capacities that it does today.

4.
Flooding and Flow Levels

Through the ages, the flows in the Illinois River have fluctuated with natural events. Among those natural events are floods, and the Illinois River typically experiences a major spring flood and a minor fall flood each year.

Floodwaters originally spilled into the vast floodplains that extended beyond the backwater lakes. The system of tributaries, river, backwaters, and floodplains worked together: under flood conditions, waters naturally moved from one body of water to another. During low-water conditions, the various bodies of water were separate and more or less self-contained. But water levels rose as the river was altered in service to human needs, and natural processes were interrupted or replaced with artificial processes intended to manipulate its flows. Nevertheless, the cycle of ebb and flood along the length of the Illinois River still eludes human control.

A complicated arrangement of levees and dikes controls and manipulates the river and its overflows, draining some areas of the floodplain and impounding the overflows in others.

Illinois Department of Commerce and Community Affairs by Terry Farmer.

Human Alterations

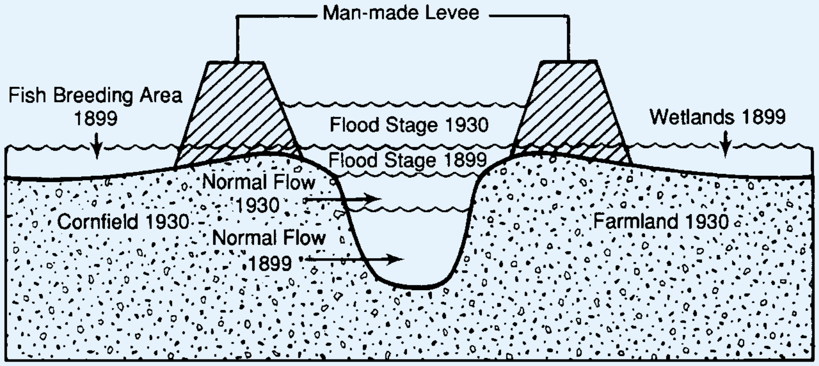
The Illinois flowed in near-natural and often changing patterns almost until the twentieth century. Although the river's flows undoubtedly changed in response to the construction of low dams in the late nineteenth century, water levels remained largely stable. Wildlife, waterfowl, and fish, as well as the human populations and enterprises lining the Illinois, lived and worked in tandem with its natural flows.

The opening of the Chicago Sanitary & Ship (CS&S) Canal in 1900 introduced major changes in the river's flows. Chicago's wastewater and the addition of up to 10,000 cubic feet per second (cfs) of water diverted from Lake Michigan represented significant new flows downstream. This influx raised the river's average level by 1.5 to 4 feet all the way to Grafton, increasing average flow levels and the frequency and severity of floods. In 1900, the streamflow at Lockport was measured at 2,900 cfs. But in 1907 flows rose to about 7,900 cfs and remained there until 1939, when the amount of water that could be diverted from Lake Michigan was finally reduced by an order of the U.S. Supreme Court.

The turn of the century also witnessed the coming of age for many riverside towns. The building and paving associated with urbanization created a new source of runoff, which also contributed to more frequent, severe flooding.

In the short term, waterfowl and fish benefited from the increased flows in the early twentieth century. Higher water levels in the river created enough overflow to double the surface areas of the backwater lakes, sloughs, and marshes. Waterfowl populations thrived, and the explosion in fish populations led to the greatest commercial harvest of all time in 1908.

But waterfowl and fish habitats were destroyed in short order by levees constructed along the river between 1900 and 1926 to protect riverside towns and industries from the encroaching, ever-rising waters and to expand



The levees raised river water levels and aggravated flooding outside of the levee and drainage districts.

Data from Illinois State Museum.

agricultural domains. In the middle and lower river, backwater lakes were drained or diverted, dikes were erected, and impoundments were created to control and direct the river's overflows. Downstream from Beardstown, the levees shaped the Illinois into a narrow channel with restricted spaces for overflows.

By 1930 the levees and drainage districts had effectively removed 200,000 acres from the floodplain, reducing it by half. While the levees expanded and protected farmlands, they also destroyed 40 to 50 percent of the backwater lakes and wetlands, some of which represented the state's richest fish spawning and migrating waterfowl areas. The reduction and disruption of these habitats were factors in the demise of the commercial fishing industry and forever altered the character of the river and its shorelines.

By constricting the river and its tributaries and backwaters, the levees prevent the sediment-laden overflows from reaching their natural floodplains, most of which have been cultivated to row crops. Instead, the overflows are either contained in the main river channel or routed to the remaining backwater lakes, which are filling with sediment at an alarming rate. But the levees have also contributed to increasingly severe flood problems outside of the drainage areas, where uncontainable waters have raised flood heights by up to 10 feet. In the levee districts, the floods that persist have been more severe than ever before.

At the height of the drainage period in the first quarter of the century, about 75 percent of the middle river and virtually all of the lower river were lined with levees. This wholesale reconfiguration was finally slowed during the 1920s when many of the dikes and levees proved insufficient to control the increased volumes of the river's flows. Flooding became so severe that many of the artificial impoundments and dikes gave way. The Partridge District across from Chillicothe failed before 1920; and the flood of 1926 made it necessary to abandon the large Chautauqua Levee District near Havana and the Big Prairie Levee District near Beardstown. These abandonments returned about 8,000 acres to fish and wildlife habitat. Nevertheless, as many as 35 levee or drainage districts still exist, accounting for about 325 square miles of cropland in twelve counties.

The problems associated with high water levels in the first decades of the century were finally addressed by the U.S. Supreme Court in 1930. A court decree established incremental limits for the amount of water that could be diverted from Lake Michigan: 6,500 cfs by July 1, 1930; 5,000 cfs by 1936; and 1,500 cfs by 1939, over and above domestic pumpage.

The wildly fluctuating water levels were also abated somewhat by the seven major locks and dams built in the 1930s as part of the Illinois Waterway. While their primary purpose was to facilitate navigation, the locks and dams also help stabilize water levels in the river by maintaining higher levels during low-flow periods and decreasing the velocities of flow.

Levee separates farmland from Illinois River wetlands.

Illinois State Water Survey by Tom Rice.

Natural Consequences

The streamflow levels of the Illinois River are relatively high as a result of natural conditions. Streamflow is a product of regional surface water and ground water. Surface waters enter the river from tributaries and surface runoff; ground water is discharged into the river when the local water table is higher than the level of the river. Thus, during dry periods with little or no surface runoff or in areas where few tributaries enter the river, streamflow is essentially made up of ground-water discharge.

In the Illinois River, streamflow increases continuously downstream from the upper to the lower river with the addition of ground-water discharge and surface water contributions from tributaries and runoff. The flow level at Lockport is normally about 3,500 cfs. But with the inflow from the CS&S Canal and the Kankakee and DuPage Rivers, flows rise to about 7,000 cfs below Lockport. At Peoria, flow levels are typically about 10,000 cfs, and at Beardstown about 12,000 cfs.

Despite the reduction in Lake Michigan diversion in the 1930s as a result of the Supreme Court decision at the beginning of the decade, current streamflow levels are still somewhat higher than they were before 1900, and flooding remains an ongoing concern, particularly downriver. In an effort to compare conditions before and after the levees were erected, flow measurements were taken in 1904 (at the height of diversion) and in 1943 (after diversion was reduced). Both years witnessed serious flooding. River elevations were found to be almost 10 feet higher in 1943 than in 1904. Since then, flood-level flows and flooding have been aggravated even further — not only with the construction of levees, but with the sedimentation of marshes, wetlands, and backwaters; and the channelization of tributary streams, both of which increase the flow of surface water to the river.

Since 1970 floods have become more frequent and more severe than ever. In the 27 years from 1943 to 1970, the National Weather Service recorded 27 floods along the Illinois River that equaled or exceeded designated flood stages — an average of one per year. In the 13 years from 1970 to 1983, however, 16 floods equaled or exceeded that level — an average of 1.2 per year, amounting to a 20 percent increase. And five of the ten highest

Drainage and levee districts established by 1924 between Peoria and the mouth of the Illinois River.

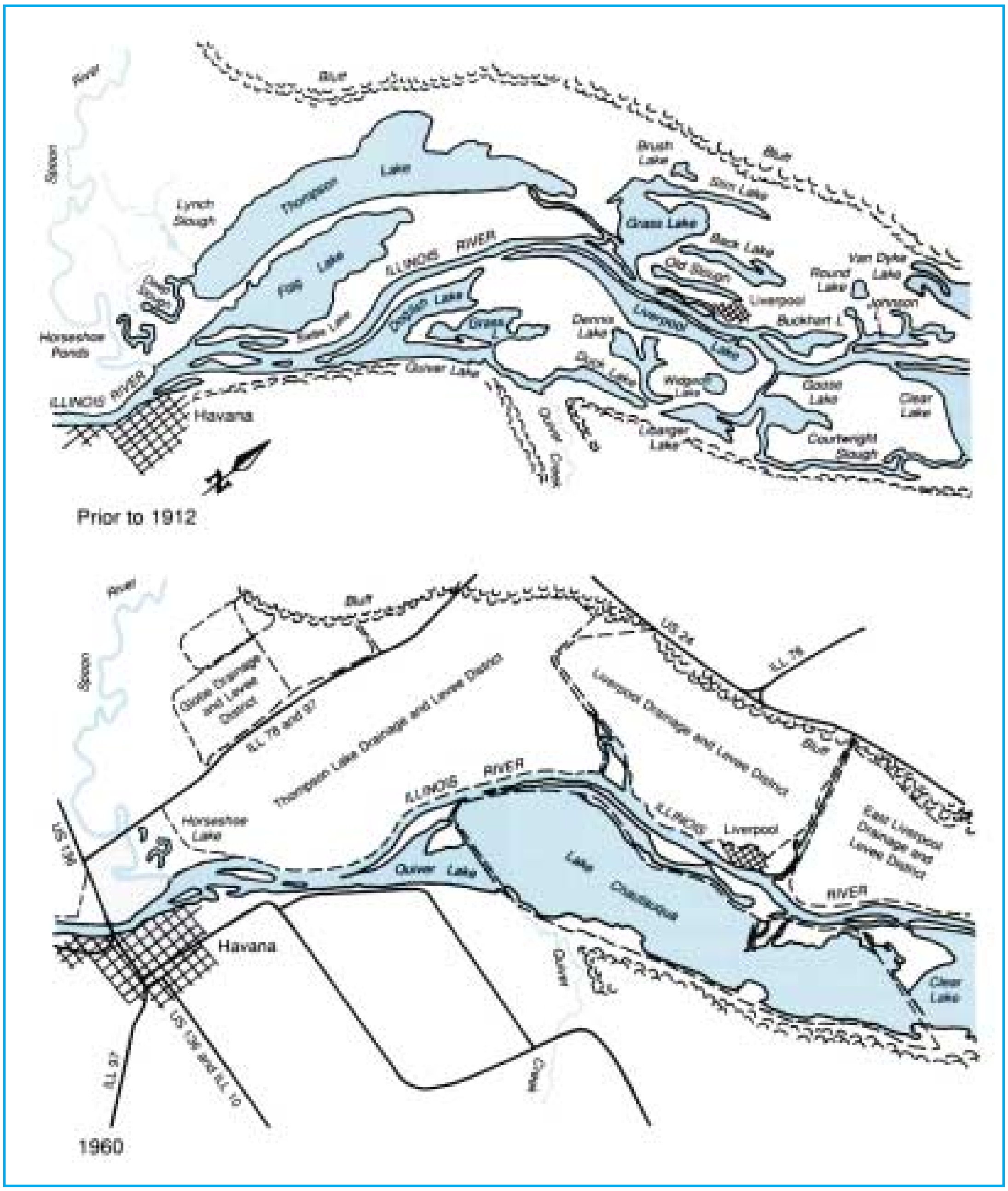
Data from J. Thompson, From Carp to Corn.

The Illinois River inundated a Liverpool subdivision in March 1985, while the Liverpool Levee protected agricultural lands in the adjacent drainage district.

Peoria Journal Star.

Before it was drained in 1921, Thompson Lake was considered among the river's most beautiful backwaters.

From Report of the Submerged and Shore Lands Committee, *Illinois State Historical Library.*



The Illinois River and its backwaters near Havana as they were before 1912 (a). By 1960 the lakes and wetlands had been transformed into a series of drainage and levee districts (b). Thompson, Flag, and Grass Lakes, along with many others, were drained entirely for agriculture. Lake Chautauqua was formed after a levee failed.

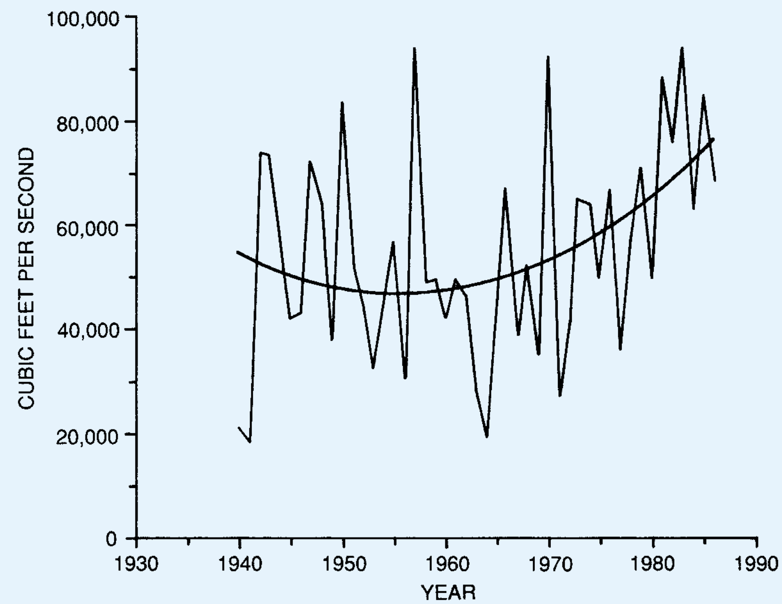
Data from Illinois Natural History Survey.

floods recorded since 1844 have occurred since 1970.

Flood frequency has increased dramatically in the Peoria area: of nine serious floods between 1943 and 1983, seven occurred after 1970, and four after 1978. The four most recent floods are also among the five most serious in the entire period since 1943.

Some of the increased flooding can be attributed to a trend toward increased precipitation. In the upper half of the Illinois River Basin, precipitation has been about 14 percent higher in the last 20 years than in the previous 60 years. Simultaneously, the mean annual flow of the Illinois River has increased by about 20 percent, while the peak annual flow has been at least 40 percent higher in the last 20 years than it was in the previous 25 years. Not only has the magnitude of high flows increased, but also their duration. The length of time that the river remains at high flow levels has been increasing substantially in the last 20 years and has virtually doubled in the last decade.

As a result, the Illinois River has experienced devastating floods at least once a year since 1978, and this trend is expected to continue. In 1983 the Illinois River Valley Association estimated that the cost of flood damage to



Annual floods of the Illinois River and flood trend measured at Marseilles, 1930-90.

Illinois State Water Survey.

Severe flooding forced the abandonment of the Lake Chautauqua Levee District in 1926. Since then the levee has blended into the wetlands.

Illinois State Water Survey by Tom Rice.

individuals, local governments, and the federal government amounted to more than $5 million per year in flood payments and reduced tax revenues, outside of lost recreation revenues.

But flood damages and losses due to high water levels are also measured in terms other than dollars. When water levels are too high and the foliage of emergent aquatic plants cannot reach the water's surface, it dies back. When sediments are stirred and waters become turbid, underwater plants cannot obtain enough light for photosynthesis, and they too expire. When wave action becomes too forceful in deep waters, vegetation is uprooted. With the aquatic plants go the life-giving oxygen they produce, the food resources they harbor and provide, and the diving ducks and fish that depend on them.

A disastrous period of high water levels and subsequent flooding in 1943-44 virtually eradicated all aquatic vegetation from the Lake Chautauqua area. The only survivor was sago pondweed. Although it prefers depths of less than 3 feet, it is tolerant of reduced light and turbidity occasioned by flood conditions.

Aquatic plants began to disappear from Rice Lake when water levels were raised artificially in the mid-1940s. By 1950, some 360 acres of river bulrush had dwindled to less than 100 acres; by 1956 only 20 acres remained. Coontail and white water lily followed: more than 600 acres were surveyed in 1950, but they were gone by 1960.

Similar losses occurred in Spring Lake when water levels were raised for recreational purposes. About 400 acres of coontail and river bulrush were entirely destroyed by wave action, which resuspended bottom sediments and prevented new plants from rooting.

Another period of temporary high water levels in the 1960s was particularly devastating to moist-soil habitats among the backwater lakes. When shoreline mudflats touch the edges of bottomland forests, the mudflat vegetation is especially vulnerable. If water levels are too high and mudflats are immersed under too much water in the fall, water-tolerant trees such as black willows, cottonwoods, and soft maples volunteer and overcome the smaller moist-soil plants, thus eradicating the mudflat vegetation and creating communities with low species diversity and little biological value. In only a few short years the mudflat habitat becomes bottomland forest, invariably lost to moist-soil plant growth and waterfowl feeding.

Other victims of high water levels have been pin oaks and pecan trees, once abundant in the valley below Peoria and an important food source for mallards and wood ducks. These trees are especially vulnerable to high water levels and have generally succumbed, further reducing the diversity of waterfowl food supplies. As the food sources found in aquatic, moist-soil, and upland vegetation are all threatened by floods and fluctuating water levels, waterfowl must rely increasingly on food and habitat in controlled environments provided by duck clubs and state and federal agencies.

Efforts to counter and control flooding have included the addition of reservoirs, detention basins, and channel improvements in the tributary basins when the river is at its peak. Nevertheless, nonstructural flood control measures appear to be more appropriate options for future management of the river's flow levels. These measures include improved management practices for agricultural lands; floodplain zoning; restoration of wetlands, riverbank habitats, and greenbelts along streams; and land-use regulations.

The forest encroaches on the moist-soil mudflat environment.
Illinois Natural History Survey by Michael Jeffords.

5.
Sedimentation and Erosion

The Illinois River existed in near-natural, but not necessarily original, conditions until the nineteenth century. Through the ages, nature has recast the river in many different forms. Glaciers moved, carved out the land, and melted. These waters created new avenues and distributed sediments that continuously altered the river's meandering path. Even in our own lifetime, sedimentation and erosion continue to reshape the Illinois and its valley.

The present-day Illinois River is the remnant of several others. The earliest — and probably the largest — was basically part of the Mississippi. But 200,000 to 300,000 years ago, the movement of the Illinoisan glacier isolated the Mississippi within its present channel and cut it off from the expansive lake that occupied the Illinois valley.

The birth of the Illinois River occurred about 13,000 years ago when the Wisconsinan Glacial Retreat opened the Illinois valley to Lake Michigan. This large, prehistoric river system was as vast as a lake. It carried much more water than does today's Illinois River, and its flows were greater and more rapid. The ancient river also covered a far greater portion of land and was bordered by more lakes and sloughs.

After the end of the glacial movements, the river continued to change in concert with natural processes of flooding, sedimentation, and erosion. Even before human intervention, the Illinois River could not accommodate the sediments from its tributary streams. As a result, the river was changing constantly — and naturally. The channel altered in shape, so the river moved and meandered in different courses; ridges of sediment were formed and breached; and backwaters were created and flowed into each other or became part of the river.

Illinois River shoreline erosion between Ottawa and Marseilles.

Illinois State Water Survey by Nani Bhowmik.

The Illinois River

By the nineteenth century, natural sedimentation processes had reduced the river's drainage area and constricted the flows of the upper river into a single, rather narrow channel. Below the Great Bend the river flowed slowly through gently rolling terrain. Broader and shallower than the upper river, it was lined with sidestreams, wetlands, and narrow lakes with vast, low floodplains beyond. Overflows were accommodated by the backwaters and side channels, and they in turn released their own sediment-filled overflows into the floodplains.

The Illinois River Valley is especially subject to sedimentation because the tributary streams flow downward into the river, descending many times faster than the river itself. The slope of the Spoon River, for instance, drops at the rate of 1 to 3 feet per mile, while the slope of the Illinois at the mouth of the Spoon River is only 0.12 to 2 feet per mile. As the fast-flowing, sediment-laden waters of the tributaries enter

An alluvial fan is formed at the mouth of a tributary stream as it meets the slower waters of the Illinois River and sediments drop out of suspension.
Illinois State Water Survey by Nani Bhowmik.

the slower flowing river, sediments drop out of suspension to form alluvial fans and deltas near the mouths of those tributaries. Swift flows then cut the narrow, shallow crevices that became side channels and ultimately the narrow backwater lakes.

While sedimentation is a problem along the full length of the Illinois, the swifter waters above the Big Bend help keep sediments suspended. But with the transition to a gentler slope in the middle and lower river, the waters flow more slowly, and velocities are not sufficient to keep sediments in suspension. Thus the middle and lower river, where most of the backwater lakes were originally concentrated, is more susceptible.

Natural processes and the gentle landscape of the middle and lower river have made it shallow and vulnerable to sedimentation, and the locks and dams have made its flows very sluggish. In effect, the pools between the dams are each separate, riverine lakes with slow currents and broad reaches — as vulnerable to sedimentation as any lake would be. Thus today's Illinois River is even less capable of accommodating the sediments delivered by its tributary streams.

Navigation traffic also affects sedimentation and erosion. The waves created by the barge tows work away at the banks and encourage shoreline erosion. And within the river, the passage of the barge tows stirs the waters and may scour the riverbottom, adding to the sedimentation of the waters. In some areas, such as in Peoria Lake, navigation activity has actually carved a channel in the riverbottom that would otherwise fill in with sediment. Without the channel, the barges could not navigate that section of the river. Without the barges, the channel would not exist.

The U.S. Army Corps of Engineers routinely dredges portions of the river to remove excess bottom sediments and keep the navigation channel open. Some sections are dredged yearly, others less frequently. Sections at the mouths of tributaries must be dredged very frequently, and continual dredging operations are necessary in the Chicago area to keep the waterways open.

Intensive agricultural development in the Illinois River Valley, particularly along the middle and lower river, has complicated the naturally occurring sedimentation by transforming the once rock-hard prairie floor into rich, loose soil. Since the 1920s, intensive row-crop agriculture, particularly soybean cultivation, has left the soil bare and vulnerable to erosion many months each year. Between 1945 and 1976, row-crop land in the Illinois River Basin increased by 67 percent, most of which was planted to soybeans. Sedimentation is further exacerbated by the practice of fall moldboard plowing after harvest.

The Illinois Environmental Protection Agency estimated in 1982 that more than 26 million tons of soil erode from the Illinois River Basin each year. Of these, about 11 million tons are transported to the Mississippi, leaving about 15 million tons that are typically washed or blown into tributary streams in the Illinois valley.

Most of the small tributary streams of Illinois have now been channelized and straightened to provide flood control, to accommodate roads and bridges, and to conform to agricultural land use. More than half of all the

Typical erosion pattern on Illinois valley farmland.
Office of Agricultural Communications and Education, University of Illinois.

streams in eight counties that line the Illinois River have been channelized. Moreover, the great marshes that once impeded the movement of streamwaters are now largely gone. Together these conditions accelerate streamflows, which in turn accelerate the rate of farmland runoff. Faster farmland runoff increases streamwater velocities, and these in turn encourage streambank erosion. All these conditions have dramatically increased sedimentation in the river and subsequently in the backwater lakes.

According to preliminary results of the 1987 Natural Resources Inventory conducted by the Illinois Department of Agriculture, approximately 52 percent of the state's croplands are in need of conservation practices to control erosion. The most common practices include reduced tillage, contour farming, terracing, grassed waterways, and streambank stabilization. Between 1982 and 1987 these techniques reduced soil erosion in Illinois from about 7 tons per acre per year to about 5 tons per acre, still well above desirable levels. Federal and state agencies are actively promoting several erosion reduction programs and practices in an effort to solve the problem.

But rural agrarian conditions are not alone in contributing to the sedimentation of the waters of the Illinois River Basin. Landscape wastes and sediment also originate in storm runoff from road construction sites, paved urban areas, and urban construction sites where vegetation has been stripped away.

Sedimentation and erosion are now recognized as the number-one problems facing our state's wetland resources. Without drastic control measures, the aquatic and wildlife ecology of the entire Illinois River system will decline irretrievably.

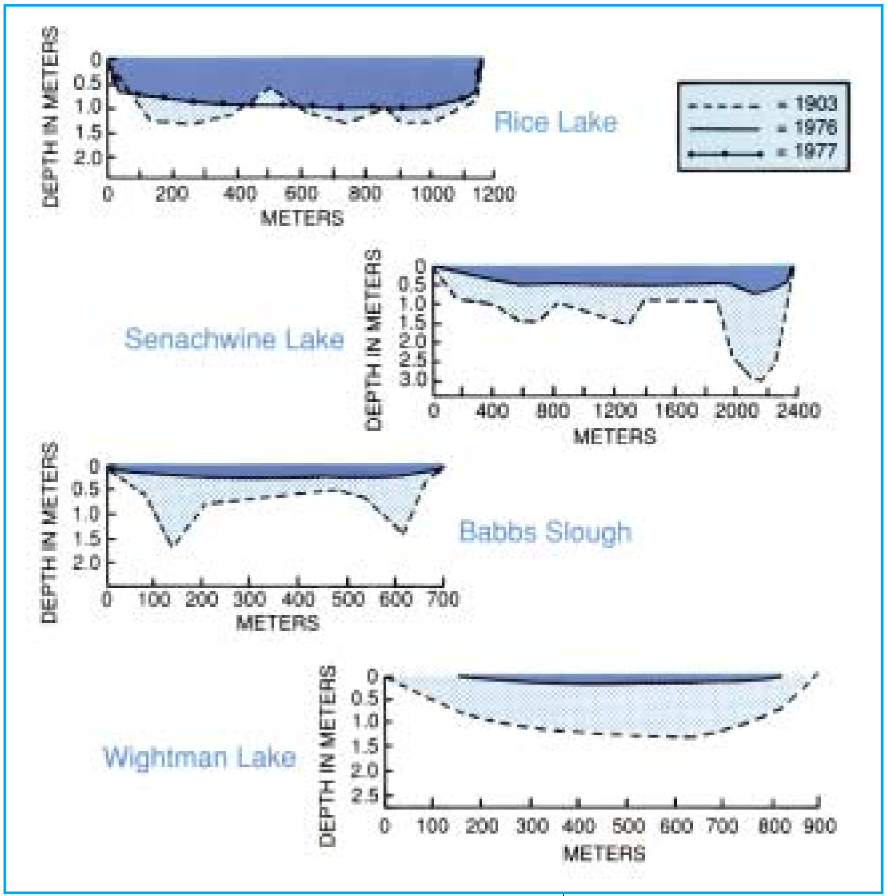
The Backwater Lakes

Most of the man-made lakes and reservoirs across the state of Illinois are now losing their capacities to sedimentation at the rate of about one-half percent per year. But the rates in the backwater and bottomland lakes of the Illinois River are substantially higher. As much as 15 million tons of sediment are deposited annually over the river valley, displacing the waters of the lakes, side channels, and sloughs. Since levees have turned floodplains into row-crop fields, sediment can no longer be deposited in its natural resting place. Now the backwater lakes are the receptacles for the sediment-laden overflows from both the river and its tributaries.

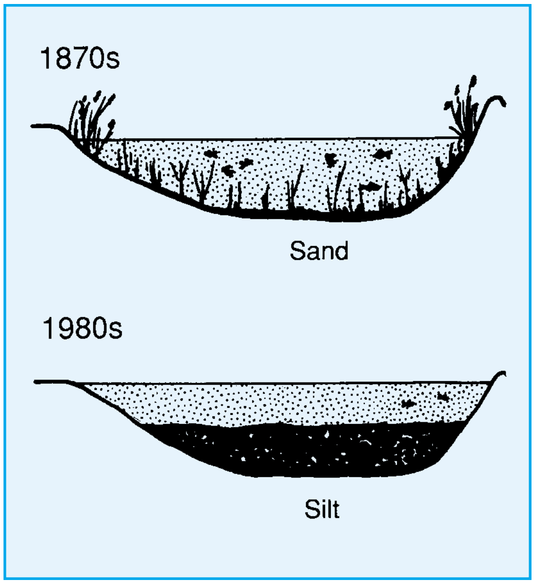
Early in this century, the backwater lakes of the Illinois River Valley had bottom profiles of very diverse shape and depth. But sediments tend to fill deeper areas first, settling in the pits and hollows of the lake bottoms and leveling the surfaces. By the mid-1970s the lake bottoms had been flattened into uniformly shallow, saucer-shaped basins. The lakes that were originally deepest have received the greatest amounts of sediment.

Theoretically then, as the lakes have become more shallow, sediment deposition should have abated. But yearly sedimentation rates have actually increased with intensified row-crop cultivation. Muscooten Bay, for example, filled with sediment at the rate of 1.13 inches per year between 1903 and 1960. But between 1960 and 1975, the lakebed rose by as much as 4.3 inches per year.

The degree to which the backwater lakes are separated from the river seems to govern sedimentation rates: those more distant from the river or better separated from it seem to suffer less. The backwater lakes in the Peoria



Bottom contours of backwater lakes along the middle river, 1903 and 1976-77.
Illinois State Water Survey.



The profile of Quiver Lake, 1870s and 1980s. Today the lake is devoid of aquatic vegetation and has been filled with 4 to 8 feet of silt, creating a soft, flocculent bottom in which vegetation cannot take root.

Data from Illinois Natural History Survey.

Pool, for example, are separated from the river by nothing more than low, narrow peninsulas of land. Thus they are independent of the river only at low-flow stages and are otherwise subject to high rates of riverborne sedimentation. By comparison the lakes in the LaGrange Pool are located farther from the main channel and have lower rates because they are subject to sedimentation only when the river is at high-flow stages or when it actually overflows. The few lakes remaining in the southernmost reaches of the river, in the lower LaGrange and Alton Pools, are largely separated from the river by levees, so their water levels are completely managed.

In an attempt to measure the capacity losses of some of the most seriously endangered backwater lakes, their 1985 capacities were compared to measurements taken early in the century. Muscooten Bay showed a 100 percent loss and has virtually disappeared. Patterson Bay had experienced a 90 percent loss, Sawmill Lake 93 percent, Huse Slough 91 percent, and Weis Lake 86 percent. Approximately 18 percent of the capacity of Lake Chautauqua was lost in a 24-year period.

Every backwater lake along the Illinois River has suffered a similar fate. Many have been reduced to shallow wetlands, and losses in water surface area now amount to more than 20,000 acres, leaving fewer than 70,000 acres of lake surface. According to studies conducted from 1976 through 1979, the average depth of bottomland lakes in the Illinois valley was only 2 feet. The lakes in the LaGrange Pool along the lower Illinois River averaged only 1.8 feet in depth. Many are so shallow that they are often completely devoid of oxygen in the summer and freeze solid in the winter, seriously threatening the viability of fish populations.

On the basis of sedimentation rates and loss of capacity, survival predictions have been developed for a number of the backwater lakes, including Lake Chautauqua (92-year life expectancy) and Meredosia Lake (90-year life expectancy). The deepest of the backwaters, Peoria Lake, will likely survive longer than any other body of water in the Illinois River Valley only because of the navigation channel chiseled through it.

While sediment fills the lakes, some benefit is accruing to the surrounding mudflats. As sediments raise the bottoms of the lakes, the shorelines also rise and become favorable for moist-soil vegetation, thereby creating habitats for dabbling ducks. Between 1933 and 1976, some 3,400 acres of lake surface became mudflats. Such changes amount to a natural cycle of creation and extinction of the lakes. Under natural conditions, however, extinction would have required hundreds of years, and the birth of new lakes would be part of the cycle. But intensive agricultural and urban land use has greatly accelerated that process and prevents the formation of new lakes.

Protecting and Restoring the Backwater Lakes

Sediment deposition continues along the entire length of the river and its backwater lakes without significant interruption, threatening every life form. Aquatic vegetation is particularly vulnerable. Sediment consumes oxygen supplies and creates turbid waters that prevent photosynthesis and flocculent, loose lakebottoms in which plants cannot root. Thus the invertebrates at the base of the food chain lose their habitat, and fish and waterfowl lose food and habitat resources as well. Because delicate gills are physically abused by sediment, bottom-feeding carp and shad now tend to proliferate in the turbid waters, while more desirable species are eliminated, particularly those dependent on clear water for spawning and feeding.

Agricultural, engineering, and sanitary management practices are now beginning to address the problems of runoff and soil erosion; the expansion and re-establishment of floodplains; and the reclamation and stabilization of the backwaters, mudflats, and wetlands. Projects funded by individual, county, state, and federal efforts and funds offer hope of solutions and the possibility that some portions of the backwaters can be saved, along with their natural habitats and recreational value.

Lake DePue Restoration

Efforts to save some backwater lakes have focused on dredging to create deepwater areas. Dredging has been recommended for Peoria Lake and has been carried out in several smaller lakes in Illinois, including Lake DePue in Bureau County. Lake DePue was once celebrated for its boat races and regattas, but sedimentation forced an end to these activities for a number of years. Between 1903 and 1975, about 75 percent of the lake's capacity was lost at an average rate of 0.6 inch per year. Average depth was reduced to 1.6 feet, and in 1976 the lake was given a 33-year life expectancy.

Realizing the impossibility of dredging the entire 500-acre lake, engineers and planners decided to dredge a circuit within Lake DePue that could be rededicated to the boat races. Dredging began in 1979 and was completed in December 1982 at a cost of $1.23 million. In the process 457,000 cubic yards of sediment were removed, which is equal to the area of a football field stacked 26 stories high. By summer 1983, however, only six months after completion, one foot of silt had already returned. Boat races were held that summer and each summer since, but continuing sedimentation makes it necessary to keep the lake under constant scrutiny.

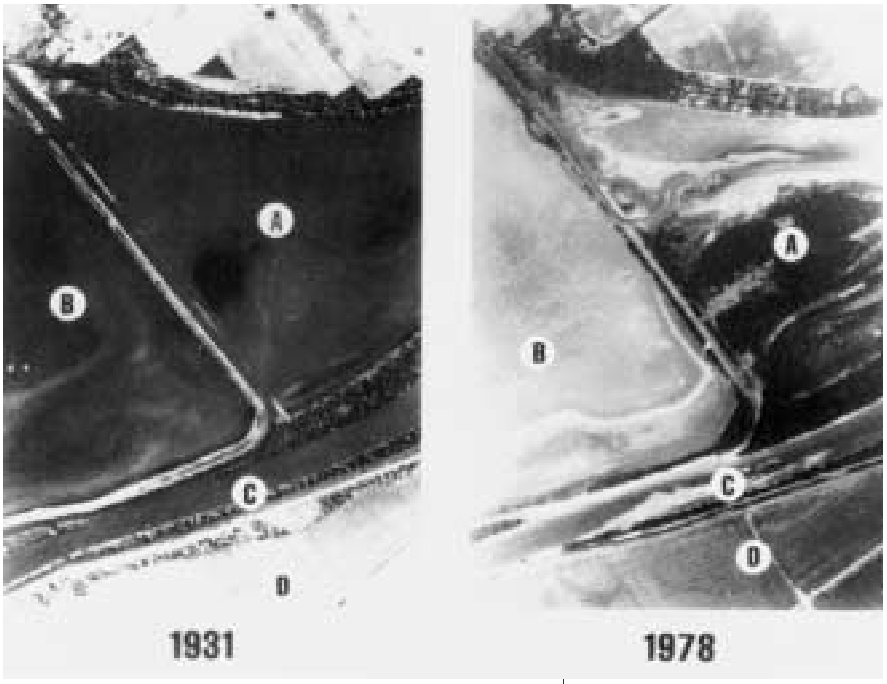
Peoria Lake Restoration

Peoria Lake lies within the main stem of the Illinois River. With more than 13,000 surface acres, it is among the largest bodies of water in Illinois, as well as the largest, deepest bottomland lake in the Illinois River Valley. But Peoria Lake is filling with sediment at the rate of 1.2 inches per year. Other than isolated areas, the only remaining deepwater portion is the incised navigation channel through which the river flows. Barge tow traffic scours the bottom and suspends sediments, generating enough water movement to inhibit deposition of sediment.

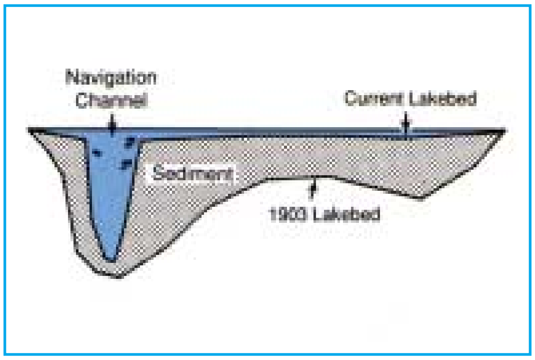
Since 1903, Peoria Lake has lost 68 percent of its capacity, and its average depth has been reduced from 8 to 2.6 feet. If the navigation channel is excluded, the lost capacity is close to 78 percent of the 1903 volume. Moreover, the rate of loss has increased substantially since 1965.

Sedimentation appears to be most severe near Chillicothe where the river enters the north end of the lake. There the river currents are slowed by about one-third. As a result of their reduced velocity, the waters deposit their sediment load in the placid lake waters. Without immediate, drastic measures, scientists now predict that the upper portion of Peoria Lake will probably lose most of its capacity outside the navigation channel by the year 2000.

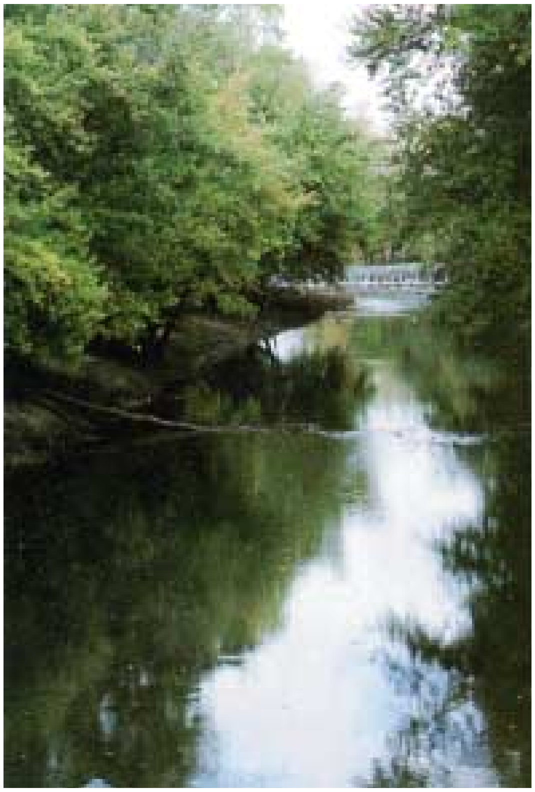
Dredging and Creation of Islands. Dredging proposals for Peoria Lake center on the creation of two islands, one in upper Peoria Lake and another in lower Peoria Lake. According to studies by the Illinois State Water Survey, the islands, created from dredge spoil, would reduce the wave action that resuspends bottom sediments. Increased flow velocities around the islands would help prevent sediment



Aerial views of the river valley just north of Havana, 1931 and 1978, showing Quiver Lake (a), Lake Chautauqua (b), the Illinois River (c), and Thompson Lake Drainage and Levee District (d).The light areas in the later photo indicate sedimentation. A 1951 study determined that an average of 85,000 tons of sediment was deposited in Lake Chautauqua each year. *Illinois Natural History Survey.*



Typical Peoria Lake cross sections, 1903 and 1989. *Illinois State Water Survey.*



Backwaters around Lake Chautauqua.
Illinois Natural History Survey by Molly Hardin Scott.

deposition. The resulting reduction in turbidity and improved water quality would increase chances for the survival of aquatic vegetation and invertebrate food resources for fish and waterfowl, and would also enhance recreational opportunities.

Revegetation. Aquatic vegetation was buried under sediment and disappeared from Peoria Lake in the 1950s. Its re-establishment appears to be the key to stabilizing the backwater environments. Since 1985, Peoria Lake has been the site of Water Survey efforts to re-establish fish and waterfowl habitats by restoring aquatic vegetation. The low-cost procedures are based on planting tubers deep beneath the sediment strata in protected environments.

To safeguard the planting area from the damaging waves that can uproot young plants, a breakwater was constructed of old tires. Arrowhead and sago pondweed planted near it have thrived and become unusually dense and robust. The breakwater has come to function as an underwater reef, helping to stabilize the lakebed.

Game fish are also thriving in the test area: the new vegetation acts as a nursery for bluegill, channel catfish, and bass. The number of fish species in the area doubled in two years, and the actual numbers of fish have quadrupled since testing began. The area has also attracted wildlife and waterfowl.

The Peoria Lake project has demonstrated that aquatic vegetation can be re-established in the soft, shallow lakebeds of the Illinois River Basin. The plantings promise excellent habitat for desirable game fish and wildlife populations if the invertebrate food base can be regenerated through identification and control of toxic contaminants in the bottom sediments.

Given the severe loss of depth in so many backwater lakes, the expense of dredging, and the high return rates of sedimentation, it may be economically feasible to re-create deepwater environments only in selected areas. Revegetation, however, could create desirable, less costly habitats on a much broader scale.

Upper Mississippi River System Environmental Management Program

The Environmental Management Program (EMP) was established by Congress to protect the resources of the Upper Mississippi River System, which includes the Mississippi River from the southernmost point of Illinois north into Minnesota. The Illinois Waterway is considered part of the system. The program is intended to balance present and future navigation activity with environmental, recreational, and economic considerations. Basic to that balance are environmental projects to improve habitat for fish, waterfowl, and wildlife; to monitor and analyze the river's physical, chemical, and biological features; and to expand recreational opportunities. As part of the EMP, important restoration and reclamation projects will be implemented among the backwaters of the Illinois River by the St. Louis and Rock Island Districts of the U.S. Army Corps of Engineers.

This small 1985 pilot planting of arrowhead in lower Peoria Lake immediately attracted shorebirds.
Illinois State Water Survey by Don Roseboom.

Most EMP projects are scheduled for the 1990s through combinations of federal, state, and local government funding. They include:

- Dredging selected backwaters, side channels, and the mouths of tributary streams that enter lakes to remove sediment buildup and create deepwater habitats.
- Constructing dikes, levees, and pumping stations to keep silt-laden waters out of prime habitat areas and to control water levels in moist-soil environments.
- Building islands to create habitat for aquatic plants and wildlife.
- Opening or closing side channels to maintain the flow of water to these channels and backwaters.
- Modifying wing and closing dams to restore main-channel habitat.
- Developing aeration and water control systems to improve habitat quality.

Lake Chautauqua Restoration. Comprising about 1,200 acres, Lake Chautauqua lies on the eastern shore of the river in Mason County. The lake is now extremely shallow, and waters have been degraded by flood overflows from the Illinois River. Consequently, habitat for migratory waterfowl, bald eagles, and peregrine falcons has also been degraded. Wave-induced sediments in the waters have created turbidity that prevents establishment of aquatic vegetation and invertebrate food resources. The EMP proposal calls for a pump station, repair of a dike, installation of a water control structure, possible dredging of tributary channels, and construction of islands within the lake.

These improvements will create a vegetated, moist-soil environment and a shallow-water habitat to attract waterfowl, shorebirds, and other wetland wildlife species. The deeper channels to be created by dredging will benefit the fishery.

Banner Marsh Restoration. Located in Fulton and Peoria Counties about 20 miles south of Peoria, Banner Marsh was once a bottomland lake. It was leveed for agriculture and mining and now consists of reclaimed strip-mining land, virtually devoid of natural habitats. The EMP proposes to restore the wetlands, using control structures and a pumping station to manipulate water levels. Habitat features will include fish spawning and rearing ponds; nesting islands for waterfowl, bald eagles, and blue herons; habitat for river otter; and renovated grasslands. The resulting moist-soil and shallow aquatic environments will attract dabbling ducks, while deepwater areas left from strip-mining activities will provide habitat for diving ducks and fish.

Peoria Lake Restoration. The EMP is charged to create an island within the lake from dredge spoil; to remove sedimentation plugs at tributary mouths and dredge an access channel; to develop a gravel bar habitat by constructing levees, water control structures, and a pump station; and to construct a forested wetland management unit with selective forest and grassland revegetation. Altogether, these measures should stimulate the development of aquatic vegetation, mussels, and other invertebrates; and encourage waterfowl, fish, and aquatic wildlife species.

Restoration of Rice Lake Complex. Located 25 miles south of Peoria, the Rice Lake Complex comprises 5,600 acres of backwaters. Increased flooding and accompanying sedimentation rates have diminished waterfowl and aquatic habitats and compromised the effectiveness of existing levees and water control structures.

The EMP includes plans for re-establishing a levee to function as a water control facility and construction of a pumping facility. Later phases will include channel excavation, upgrading of riverside access, construction of a new levee for flood and sediment control, and other earthworks to create moist-soil management areas. Islands will be constructed in the lakes, and mudflats will be extended. Most of the projects are intended to enhance waterfowl habitat and stabilize food supplies. Herons, egrets, eagles, cormorants, and other shorebirds will also benefit.

Breakwater constructed of old tires in Peoria Lake protects beds of sago pondweed, encourages game fish breeding, and serves as a haven for waterfowl and wildlife. Waterfowl dive from the breakwater to feed on aquatic plants and animals, and a muskrat den rises above the water in the foreground.
Illinois State Water Survey by Long Duong.

A flock of startled waterfowl leave their feeding grounds as we pass into the wide expanse of Flag Lake [just above Havana]. We push our way through lily pads and beds of lotus, past the submerged domes of muskrat houses built of last year's rushes, and thread our way, through devious channels, among the fresh green flags and rushes just emerging from the water.
C.A. Kofoid, 1903

By slowing wave action and catching sediment, wing dams reduce turbidity, provide shelter for young fish, and encourage the growth of aquatic vegetation.
Illinois State Water Survey by Tom Rice.

Swan Lake Restoration. Located along the southernmost stretch of the Illinois River in Calhoun County, Swan Lake has become shallow and turbid due to incoming floodwaters from the river and wind action across the lake. Between 1955 and 1985, waterfowl use-days declined from 20 million to 3 million. The fishery has also declined as the increasingly shallow waters have become warmer and dissolved oxygen concentrations drop during the summers.

The EMP will construct three low riprap dikes and pumping facilities to manipulate water levels for moist-soil waterfowl habitats and fisheries. Deep channels will be dredged to provide winter fish refuge, while wing dams extending from the shorelines into the lake will provide shelter for young fish, decrease wave action, and reduce turbidity, thus encouraging the growth of aquatic vegetation.

Stump Lake Restoration. Opposite the river from Swan Lake, Stump Lake lies in Jersey County. Over the years, silt deposited by Illinois River floods has impaired drainage systems, inhibited the growth of aquatic vegetation, and degraded waterfowl habitat.

The EMP will construct low levees to compartmentalize the backwaters, control water levels, and encourage aquatic vegetation. Ditches, drainage control structures, and pumping facilities will enhance habitat to attract waterfowl, fish, and wildlife.

Restoration of Alton Pool Side Channels. The southernmost 80 miles of the Illinois River feature several in-channel islands. The side channels around them afford protected riverine habitat conducive to fish feeding, spawning, and resting. But erosion and sediment deposition have altered the riverbanks and the unprotected shores of the islands, and have damaged fish habitat as well.

To protect the riverbanks and island shores, gabions (rock-filled baskets or cages), cribbing (timber framework), tree retards, stone dikes, and riprap will be installed. Stabilizing the banks and shores will reduce erosion, turbidity, and the resuspension of sediments, and will help restore fish habitat and increase species diversity.

Illinois River shoreline reinforced with riprap, a mix of rocks and concrete chunks.
Illinois State Water Survey by Nani Bhowmik.

Illinois State Water Survey by Tom Rice.

6.
Management of the Illinois River

The *Julia Belle Swain* plies the waters of the Illinois River today.

Illinois State Water Survey by Nani Bhowmik.

As a working river, the Illinois has been many different things to many different people and interests through the centuries. In the early days, the river served as a source of food and water and as a thoroughfare for travel. It was also a navigation channel and a waste disposal outlet. Its products formed the basis of important commercial industries, and the issues surrounding the river had to do with levees and locks and dams. In days past, human goals were to harness the river's resources for direct social and economic benefits, reflecting the concerns of the new industrial age.

Today the Illinois River is at a crossroads. Its resources have been harnessed to serve society's needs, and the task is no longer to engineer bigger, better systems. In fact, many of the works that turned the Illinois River from pastoral stream to modern waterway are now considered liabilities. New issues and needs are emerging, and the people of Illinois are now concerned with the environmental health and ecological balance of the river.

The well-being of fish and wildlife resources and the quality of the water itself are now considered legitimate values to be factored into a management plan. In our complex world, it has become clear that all rivers must be managed for the larger, long-term good of the environment, as well as for the many immediate purposes they serve. Illinois cannot afford to lose any element of the delicate ecological system that survives in the Illinois River Basin. And at the same time, Illinois cannot afford to lose any of the economic opportunities provided by such an extensive waterway system.

The Illinois River has been studied for more than a century, but much of the work has been fragmentary. Too many studies were initiated to provide immediate, "quick-fix" solutions to individual problems and isolated areas, rather than being part of a comprehensive long-range plan. National trends in large-river management now emphasize an integrated approach that views rivers as systems that are interconnected with other waterways and other natural systems. Illinois would do well to embrace these trends, to think and work according to a well-coordinated, efficient, and continuous management program for its river.

River Management Issues

The Illinois State Water Plan Task Force has identified sedimentation and erosion as the number-one problems facing the water resources of the state. Together they are adversely affecting the Illinois River and causing the demise of its backwater lakes and wetlands and the natural habitats they once provided.

A thorough management plan must include permanent, state-funded monitoring stations along the river, on its tributary streams, and on the backwater lakes. The stations should be concerned not only with measuring sedimentation rates, but also with identifying the nature, source, and toxicity of those sediments. Future management plans depend on accurate assessments of current capacities and thorough familiarity with the nature of the sediments themselves. Because agriculture and commercial navigation are central to the economy and culture of Illinois, state agricultural and transportation policies must be central to any management plan for the Illinois River.

Illinois Department of Commerce and Community Affairs by Terry Farmer.

Issues of water quality must also be addressed. Although great strides have been made in restoring the quality of the waters of the Illinois River, specific parameters and specific areas of the river remain problematic. Continuous monitoring stations for basic water quality parameters must be permanently established at critical points. Treatment plant effluents must be examined, and benthic species in the areas of treatment plants must be monitored as a measure of the river's organic health. This sampling and monitoring program will help determine the impact of waste discharges, assess long-term water quality trends, and identify sites where restoration efforts are needed or could be most effective.

Efforts to improve water quality should include development of computer and mathematical models for the entire length of the river and its tributaries. The models would assist in tracking and predicting the movement of hazardous materials and the development of water quality problems. This would enable the state to respond quickly and manage any crisis involving the quality of its most vital waterway.

With management of water quality and sedimentation, rehabilitation and restoration of wildlife habitats can be coordinated and accelerated. An overall management program must address the need for upgrading wetlands and greenbelts throughout the Illinois River Basin in concert with agriculture, industry, and local government interests.

The drought of 1988-89 made it possible for state field crews to survey archaeological, geological, and anthropological sites along the Illinois River that had been submerged since the Lake Michigan diversion began in 1900. Protection and management of these irreplaceable resources should begin with a comprehensive inventory and analysis of the cultural and paleobiological records left to us by the earliest peoples of Illinois.

Through the course of its diverse history, the Illinois River has been a working partner in the interests of urban sewage districts, transport and navigation, agriculture, recreation, industry, wildlife conservation, politics, and commerce. The Illinois River has played a role in each of these areas, and all of these interests must be represented in the development of future management plans. For the Illinois River works for us all; its future is also our own. Consider it now — while time is with us.

References and Reading

Association of State and Interstate Water Pollution Control Administrators. 1982. *America's Clean Water, The States' Evaluation of Progress 1972-1982* (Appendix). Washington, DC.

Bellrose, F.C., S.P. Havera, F.L. Paveglio, Jr., and D.W. Steffeck. 1983. *The Fate of Lakes in the Illinois River Valley*. Illinois Natural History Survey Biological Notes, No. 119. Champaign, IL.

Bellrose, F.C., F.L. Paveglio, Jr., and D.W. Steffeck. 1979. *Waterfowl Populations and the Changing Environment of the Illinois River Valley*. Illinois Natural History Survey Bulletin, Vol. 32, Article 1. Champaign, IL.

Bhowmik, N.G., and R.J. Schicht. 1980. *Bank Erosion of the Illinois River*. Illinois State Water Survey Report of Investigation 92. Champaign, IL.

Demissie, M., and N.G. Bhowmik. 1985. *Peoria Lake Sediment Investigation*. Illinois State Water Survey Contract Report 371. Champaign, IL.

Demissie, M., and N.G. Bhowmik. 1987. Long-Term Impacts of River Basin Development on Lake Sedimentation: The Case of Peoria Lake. *Water International*, Vol. 12, No. 1.

Demissie, M., and L.L. Keefer. 1991. *Preliminary Evaluation of the Risk of Accidental Spills of Hazardous Materials in Illinois Waterways*. Illinois Hazardous Waste Research and Information Center Contract Report. Champaign, IL.

Demissie, M., T.W. Soong, and N.G. Bhowmik. 1988. *Hydraulic Investigation of the Construction of Artificial Islands in Peoria Lake*. Illinois State Water Survey Contract Report 447. Champaign, IL.

Fritz, B. 1985. Illinois Mussel Men. *Outdoor Highlights*, Vol. 13, November: 12-14.

Furry, W. 1990. A Canal through Time. *The Nature of Illinois*, Vol. V, No. 1: 6-9.

Hallwas, J. 1984. Pearling in Illinois. *Illinois Magazine*, March-April: 34-36.

Hatton, W. 1986. The Old Man and the River. *Outdoor Highlights*, Vol. 14, January: 3-17.

Havera, S.P. 1983. *Proposed Effects of Lake Michigan Diversion on Terrestrial Habitats in the Illinois River Valley*. Final Report to the Illinois Department of Transportation, Division of Water Resources. Illinois Natural History Survey. Champaign, IL.

Havera, S.P. 1987. Life in and around the Illinois River. *Illinois Resources*, January: 4.

Havera, S.P., and F.C. Bellrose. 1985. The Illinois River: A Lesson to Be Learned. *Wetlands*, Vol. 4: 29-42.

Havera, S.P., F.C. Bellrose, H.K. Archer, F.L. Paveglio, Jr., D.W. Steffeck, K.S. Lubinski, R.E. Sparks, W.U. Brigham, L. Coutant, S. Waite, and D. McCormick. 1980. *Projected Effects of Increased Diversion of Lake Michigan Water on the Environment of the Illinois River Valley*. Report to the Chicago District, U.S. Army Corps of Engineers. Illinois Natural History Survey. Champaign, IL.

Hoffmeister, D.F. 1989. *Mammals of Illinois*. University of Illinois Press. Urbana, IL.

Illinois Environmental Protection Agency. 1984. Water Survey Shows Progress. *Progress*, Vol. IX, No. 1: 3-7.

Illinois Environmental Protection Agency. 1985. *Illinois Water Quality, Summary of Comparative Survey*. Report IEPA / WPC / 85-004. Springfield, IL.

Illinois Environmental Protection Agency. 1990. *Illinois Water Quality Report, 1988-1989*. Report IEPA / WPC / 90-160. Division of Water Pollution Control. Springfield, IL.

Illinois General Assembly. 1911. *Report of the Submerged and Shore Lands Legislative Investigating Committee*. Two volumes. Illinois State Journal Company. Springfield, IL.

Illinois State Museum. 1989. *Harvesting the River,* an exhibit aboard the *Belle Reynolds* on the Illinois River. August 27-November 22.

Illinois State Water Plan Task Force. 1987. *Illinois River Action Plan*. Special Report No. 11. Illinois Department of Transportation, Division of Water Resources. Springfield, IL.

Lee, M.T., and J.B. Stall. 1976. *Sediment Conditions in Backwater Lakes along the Illinois River*. Illinois State Water Survey Contract Report 176. Champaign, IL.

Lee, M.T., and J.B. Stall. 1977. *Sediment Conditions in Backwater Lakes along the Illinois River - Phase 2*. Illinois State Water Survey Contract Report 176. Champaign, IL.

Leighton, M.O. 1907. *Pollution of the Illinois and Mississippi Rivers by Chicago Sewage*. USGS Water Supply and Irrigation Paper No. 194.

Mills, H.B., W.C. Starrett, and F.C. Bellrose. 1966. *Man's Effect on the Fish and Wildlife of the Illinois River*. Illinois Natural History Survey Biological Notes 57. Urbana, IL.

Neely, R.D., and C.G. Heister, compilers. 1987. *The Natural Resources of Illinois: Introduction and Guide*. Special Publication No. 6. Illinois Natural History Survey. Champaign, IL.

Ramamurthy, G.S., K.P. Singh, and M.L. Terstriep. 1989. *Increased Durations of High Flows along the Illinois and Mississippi Rivers: Trends and Agricultural Impacts*. Illinois State Water Survey Contract Report 478. Champaign, IL.

Ross, P., and R.E. Sparks. 1989. *Identification of Toxic Substances in the Upper Illinois River*. Illinois Natural History Survey Reports, No. 283. Champaign, IL.

Singh, K.P., and G.S. Ramamurthy. 1990. *Climate Change and Resulting Hydrologic Response: Illinois River Basin*. Proceedings, ASCE Symposium on Watershed Planning and Analysis in Action.

Singh, K.P., G.S. Ramamurthy, and I.W. Seo. 1988a. *7-Day, 10-Year Low Flows of Streams in the Rock, Spoon, LaMoine, and Kaskaskia Regions*. Illinois State Water Survey Contract Report 440. Champaign, IL.

Singh, K.P., G.S. Ramamurthy, and I.W. Seo. 1988b. *7-Day, 10-Year Low Flows of Streams in the Kankakee, Sangamon, Embarras, Little Wabash, and Southern Regions*. Illinois State Water Survey Contract Report 441. Champaign, IL.

Stall, J.B., and S.W. Melsted. 1951. *The Silting of Lake Chautauqua, Havana, Illinois*. Illinois State Water Survey, in cooperation with the Illinois Agricultural Experiment Station, Report of Investigation 8. Champaign, IL.

Tetreault, F. 1989. Harvesting the River. *Outdoor Highlights*, Vol. 17, No. 16: 3-7.

Thompson, J. 1988. *From Carp to Corn: An Historical Geography of Land Drainage in the Lower Illinois Valley, 1890-1930*. Report to the Water Resources Center, University of Illinois at Urbana-Champaign.

Water Survey researchers collecting sediment samples on the Illinois in the 1920s.
Illinois State Water Survey.

Water Survey researchers injecting a test solution into the river for a water quality study, 1990.

Illinois State Water Survey by Ganapathi Ramamurthy.

Tonty, H. 1898. *Relation of Henri de Tonty Concerning the Explorations of LaSalle from 1678 to 1683.* The Caxton Club, Chicago, IL.

Tri-County Regional Planning Commission. 1983. *Peoria Lake: A Question of Survival*. East Peoria, IL.

U.S. Army Corps of Engineers, Rock Island District. 1989. *Plan of Study for the Upper Mississippi River and Illinois Waterway Navigation Studies.* Rock Island, IL.

U.S. Army Corps of Engineers, Rock Island District. 1989. *Report on the Upper Mississippi River and Illinois Waterway Navigation System*. Rock Island, IL.

Upper Mississippi River Basin Association. 1989. *The Upper Mississippi River System Environmental Management Program*. St. Paul, MN.

Waller, R. 1972. The Illinois Waterway from Conception to Completion, 1908-1933. *Journal of the Illinois State Historical Society,* 65: 125-141.

Warren, R.W. 1987. *The Impact of Bank Erosion on Prehistoric Cultural Resources in the Lower Illinois River Valley*. Illinois State Museum, Quaternary Studies Program. Technical Report No. 87-211-10. Springfield, IL.

Water Resources Center, University of Illinois at Urbana-Champaign. 1987. *Management of the Illinois River System: The 1990s and Beyond.* Proceedings of the First Conference. WRC Special Report No. 16. Urbana, IL. See especially the papers by M.L. Terstriep and T.A. Butts.

Water Resources Center, University of Illinois at Urbana-Champaign. 1989. *Management of the Illinois River System: The 1990s and Beyond.* Proceedings of the Second Conference. WRC Special Report No. 18. Urbana, IL. See especially the papers by T.A. Butts and D.B. Shackleford; M. Demissie; N.G. Bhowmik; D. Roseboom, R. Twait, and D. Sallee; G. Parker; G.E. Stout; and J.R. Brown.

Wiener, J.G., R.V. Anderson, and D.R. McConville, eds. 1984. *Contaminants in the Upper Mississippi River*. Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium. Butterworth Publishers. Boston.

WILL Television. 1987. *The Big River.* Urbana, IL.