United States
Environmental Protection
Agency

Region 5
77 West Jackson Boulevard
Chicago, IL 60604

EPA 905-R-02-007
September 2002

EPA State of the Waters 2002
Region 5

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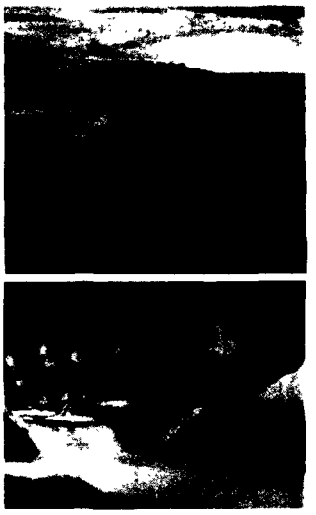
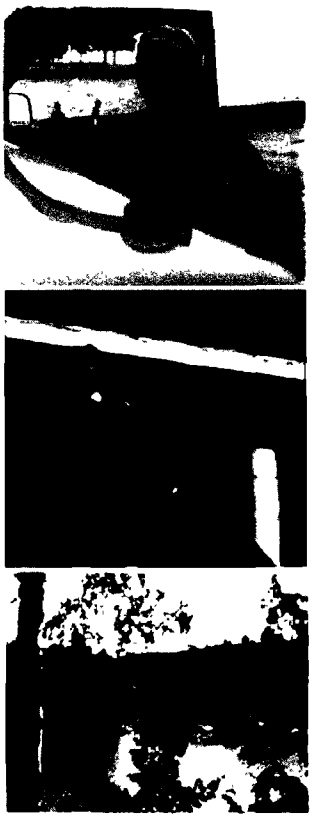
Foreword

Our Long-Term Goal: All people in Region 5 will have drinking water that is clean and safe to drink. The rivers, lakes, wetlands, aquifers, and coastal waters in Region 5 will sustain healthy fish, plants, and wildlife, as well as recreational, subsistence, and economic activities. Watersheds and their aquatic ecosystems will be restored and protected to improve human health, enhance water quality, reduce flooding, and provide habitat for wildlife.



This year marks the 30th anniversary of the Clean Water Act. We are pleased to celebrate this important milestone by presenting the first joint State of the Waters report – a report representing years of progress in improving the Region's water quality. EPA Region 5's Water Division and its partners have made great strides in our efforts to ensure clean and safe water. This report highlights the status of our waters and successes achieved for our shared water goals of healthy biological communities, aquatic habitats, fish populations, swimming waters, and drinking waters.



This report is intended to be the first in a series that, when taken together, will show trends in Region 5's water quality. Some of the data is already complete enough to report on water quality trends. For others, however, data improvements are needed before a baseline can be established. Over time, the report is intended not only to show the status of our waters but also the progress made in improving data.

We hope you find this and future reports useful in tracking the progress we have made to date and recognizing the challenges we face in our continuing commitment to improving water quality.

Thomas V. Skinner
Regional Administrator

We are fortunate to live in a Region abundant with water resources totaling over 350,000 miles of rivers and streams and 5,800,000 lake acres, and stretching across the incredibly beautiful and diverse Great Lakes, Upper Mississippi River, Ohio River, Missouri River, and Red River Basins. These unique resources provide us with water for drinking, recreation, commerce, and agricultural production. Region 5's protection and enhancement of water quality takes many forms and involves many partners, including collaboration with the States of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin, as well as 35 Federally recognized Tribes and other federal agencies. Most importantly, however, the key to improving our rivers, lakes and wetlands comes from the actions of individuals like you.

In 2002, our nation will celebrate the 30th anniversary of the Clean Water Act – the national statute which provides the authority for EPA and State surface water programs. While EPA and State agencies have accomplished much over the past three decades to ensure clean and safe water for the American public, there is more to be done to protect and improve the environment. The States and EPA are committed to building on these achievements through our strong federal/state partnerships and reporting on the progress we make. We are also committed to updating the citizens of Region 5 on our work to protect and improve the quality of water resources.

Over the past year, EPA's Region 5 Water Program and seven State Environmental and Public Health Agencies developed a set of five shared environmental goals to enhance our joint efforts to protect and restore our valuable water resources and measure accomplishments. These shared water goals are:

Goal 1: All waters in Region 5 will support healthy aquatic biological communities.

Goal 2: All waters in Region 5 will support fish populations with safe levels of contaminants.

Goal 3: Designated swimming waters in Region 5 will be swimmable.

Goal 4: All people in Region 5 served by public water supplies will have water that is consistently safe to drink.

Goal 5: The quantity and quality of critical aquatic habitat in Region 5, including wetlands, will be maintained or improved.

Our efforts to establish a framework for reporting on environmental improvements is continuing. This year, we will reach agreement on a set of shorter-term milestones that we will use to chart progress against the five goals. This first State of the Waters report presents environmental information organized around the five goals and documents what we know now about the overall quality of the waters in Region 5. In future reports, we will track progress against the specific targets and more specifically detail our efforts to achieve each goal.

In signing this report, the States and EPA are reaffirming our commitment to improving water quality and reporting on our efforts to the public. We hope you find the information in this report useful and insightful and that the successes described inspire you to take up the challenge of protecting and enhancing the environment with us.

Illinois Environmental Protection Agency

Minnesota Pollution Control Agency

Indiana Department of Environmental Management

Minnesota Department of Health

Michigan Department of Environmental Quality

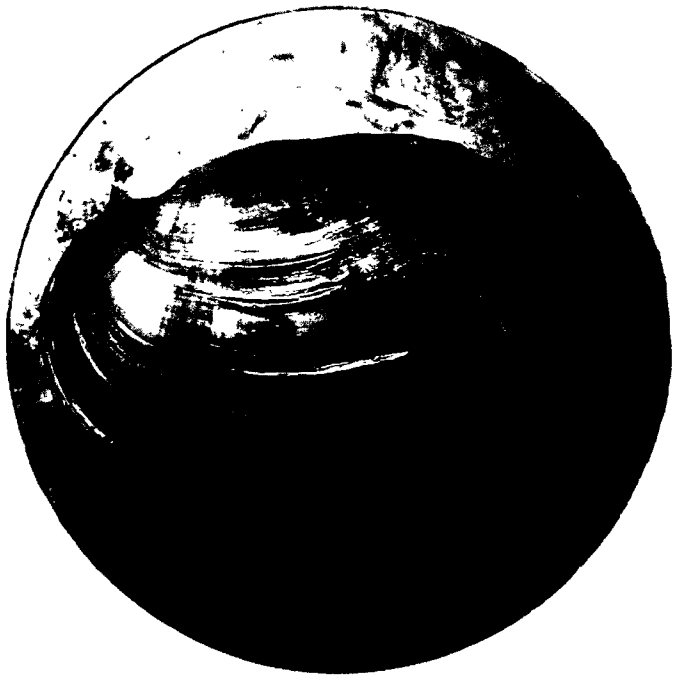
Ohio Environmental Protection Agency

Wisconsin Department of Natural Resources

U.S. EPA, Region 5, Water Division

U.S. EPA, Great Lakes National Program Office

Our Goal: All Waters in Region 5 Will Support Healthy Aquatic Biological Communities



In many ways, the portion of the Midwest that makes up Region 5 is defined by its water resources. These range from the major waters of the Great Lakes in the north to the great Ohio and Mississippi Rivers in the south. The region also includes the myriad of lakes, wetlands and trout streams of the northern forests and the prairie streams of the south. Thanks to this wide array of resources, Region 5 is host to a variety of plants and animals that reside in the water. The health of these organisms is an important indicator of the overall quality of the aquatic biological communities in the surface waters of the Midwest.

An "aquatic biological community" is the collection of plants and animals – microorganisms, algae, invertebrates, fish and other living things— that inhabit a body of water. Some, such as the region's many species of sport fish, are highly prized by anglers. Others, like wild rice, are culturally important as traditional staple foods. Still others, such as the different species of algae, aquatic insects and forage fish, are important links in both the water and land food webs. Taken as a whole, the plants and animals that live in our lakes, rivers and streams form the biological communities that we depend on for a multitude of uses, including food and recreation. Different components of the aquatic biological community respond in different ways to stressors such as the presence of pollutants, alteration of habitat or introduction of exotic species, resulting in changes in the community. Measuring aquatic community health provides direct information about the success of efforts to protect and restore the region's waters.

Water Quality Criteria and Standards

Water quality criteria are developed for specific chemicals to evaluate whether a water body is supporting aquatic life uses. Such criteria describe the minimum level of water quality necessary to allow a use to occur. EPA has developed water quality criteria for 157 pollutants to protect a variety of water body uses. States and tribes define the specific water body uses to be protected. A water body use and the water quality criterion developed to protect that use, together with an antidegradation policy, make up a water quality standard.

For more information on water quality standards and criteria, see http://www.epa.gov/waterscience/criteria or http://www.epa.gov/waterscience/standards.

How Is Aquatic Biological Community Health Assessed?

The health of aquatic biological communities can be assessed either directly by sampling plants and animals present in a water body or indirectly by measuring the chemical and physical quality of the water and comparing those measurements to established criteria. If the concentration of a pollutant in the water is greater than the corresponding water quality criterion, the health of the biological community may be adversely affected. Historically, chemical and physical measurements formed the basis for assessing aquatic community health. Recent development

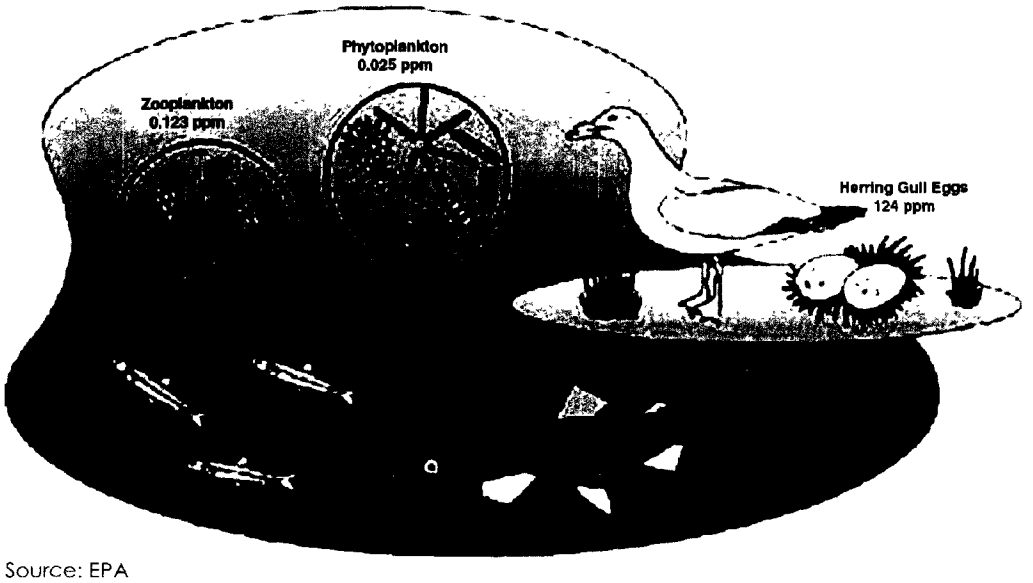
of direct measures of aquatic communities has allowed more accurate assessment of aquatic community health. Much of the information reported by the states on the status of their aquatic biological communities is now generated using these direct methods.

How Are Direct Measurements of Aquatic Biological Community Health Completed?

Direct measures of aquatic biological community health are based on assessments of how closely the biological community in a specific water body resembles the community that is expected to exist there in the absence of human-caused stressors.

The species of fish, invertebrates, algae and plants present as well as their condition and numbers provide direct information about the health of a water body and a means to efficiently assess the health of aquatic biological communities. The plants and animals therefore serve as biological indicators of community health. An indicator is a sign or signal about the status of a water body that can be used to assess the effects of a variety of stressors on that water body. A useful indicator is one that changes in a predictable way in response to biological, chemical or physical stressors in the water body.

Example Indicators of Biological Community Health



Source: EPA

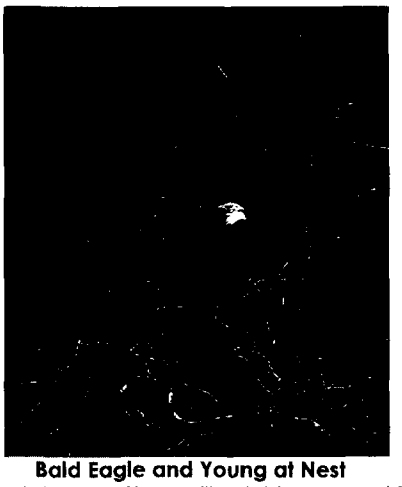
Levels of Toxic Contamination in Fish and Birds at the Top of the Food Chain

Certain human-made toxic chemicals present in a water body biologically accumulate (bioaccumulate) in organisms that live there. Even though these chemicals may be present at very low levels, through bioaccumulation, organisms such as phytoplankton can accumulate them at much higher concentrations than are found in the water. As the phytoplankton are eaten by zooplankton and small fish, the toxic chemicals are further concentrated in the bodies of the zooplankton and fish. This process is repeated at each step of the food chain and is known as biomagnification.

Shoreline Populations of Bald Eagles

Some pollutants and contaminants can be acutely toxic in relatively small amounts and can be harmful through long-term (chronic) exposure to minute concentrations. Aquatic and wildlife species have been intensively studied, and adverse effects such as crossbills and eggshell thinning in birds and tumors in fish are well documented. Evidence also suggests that polychlorinated biphenyls (PCB) and other contaminants may inhibit the reproduction of certain fish and wildlife species. For example, although they are greatly recovered from their decline in the 1960s, shoreline populations of bald eagles in the Great Lakes are having limited reproductive success compared to inland populations. These reproductive problems are likely caused by higher contaminant levels in the diet of the shoreline populations.

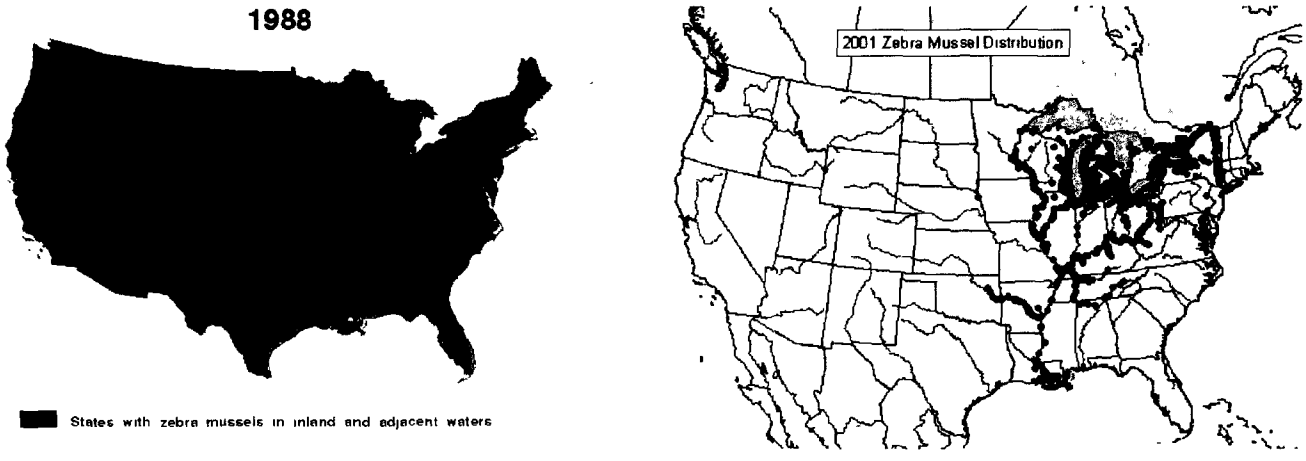
Source: EPA



Bald Eagle and Young at Nest
Photograph by Don Simonelli, Michigan Travel Bureau

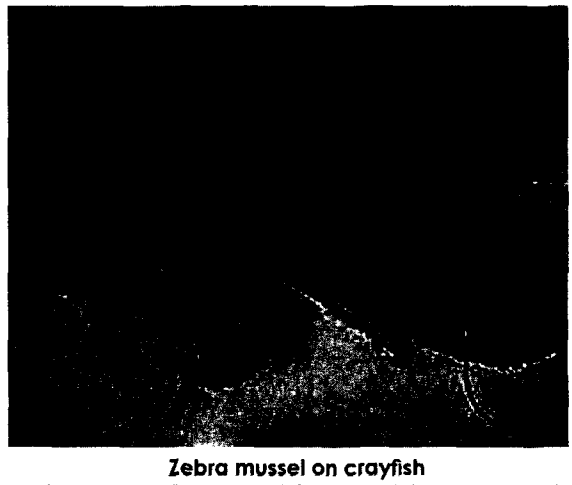
Aquatic Nuisance Species

Fish communities are the most visible indicators of water body health. To most people, they also represent one of the most important resources of the region's waters. Plankton communities (microscopic plants and animals) are the foundation of the food web and therefore are one of the most critical components of a water body's ecosystem. Changes to such communities may be occurring in the region as a result of the presence of contaminants and excessive nutrients in the water and sediment. In addition, exotic nuisance species such as the spiny water flea and zebra mussel are affecting aquatic ecosystems.



Source: U.S. Geological Survey

Zebra mussels were introduced to North America when they were discharged in the Great Lakes through a transatlantic ship's ballast discharge. The zebra mussel is now present in waterways throughout the eastern United States. Unlike native freshwater bivalves, which prefer to burrow into mud, the zebra mussel latches onto any hard surface it finds—rocks, pipes, boat hulls, other bivalves, and even sunken shopping carts. A million zebra mussels can cover 1 square meter. Their shells have impacted Great Lakes beaches. Great Lakes industrial facilities using surface water spent $120 million for zebra mussel monitoring and control between 1989 and 1994, according to the results of a 1995 survey by an Ohio Sea Grant researcher. Zebra mussels are also rearranging the ecosystems they invade. They filter vast amounts of water to consume microscopic phytoplankton. Although the filtering improves water clarity, it leaves less food for other organisms, with effects rippling through food webs. Native mollusks, for example, have disappeared from Lake St. Clair. Fishery populations in the Great Lakes are also being affected, although it will take years to sort out the specific impact of zebra mussels.



Zebra mussel on crayfish
Photograph Courtesy of Ontario Ministry of Natural Resources

Asian Carp
Photograph by Burr Fisher

More recently, an accidental release of the Asian carp in the Mississippi River has threatened the Mississippi River system and the Great Lakes. The Asian carp, which grow to 50 pounds, has no natural predators and competes for food with native fish. The carp has been seen 22 miles south of Lake Michigan in the Illinois River. The U.S. Army Corps of Engineers installed an experimental barrier in 2002 that many hope will prevent the Asian carp and other non-native species from spreading to the Great Lakes. It will also prevent migration of non-native species from Lake Michigan to the Mississippi River system.

What Does it Mean When an Aquatic Life Use Is Reported as Impaired or Not Attained?

Under the Clean Water Act, states and tribes designate uses for the surface waters within the states and reservations, respectively. The uses that states and tribes must consider in evaluating a particular water body include aquatic life, recreation, public water supplies, agricultural and industrial water supplies and navigation. An aquatic life use may be considered impaired if the aquatic community present at a site is significantly different from the expectations for the site or if the concentration of a particular pollutant or pollutants is greater than the criterion for that water body. The criteria are specific pollutant concentrations that protect specific uses. For example, if the concentration of copper is less than the aquatic life criterion, aquatic life in the water body should not be adversely affected by the copper.

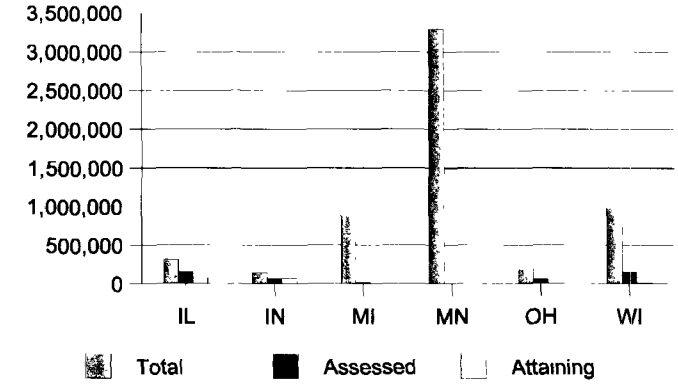
What Do Assessments Conducted by the States Show?

Every 2 years, the states report on the status of their water bodies. These reports are required under Section 305(b) of the Clean Water Act and are commonly referred to as "305(b) Reports." They are compiled into a National Water Quality Report to Congress. While the 305(b) Reports are not based solely on biological assessments (they include chemical and physical data assessments as well), they provide an overview of the status of aquatic biological communities.

Although 305(b) Reports provide a "snapshot" of water quality conditions, they do not reflect the status of all the water bodies within a state. As shown in Figures 1-1 and 1-2, states typically assess only a portion of the water bodies within their borders. For example, of the 87,110 miles of rivers and streams in Illinois, 15,304 miles were assessed for the 2002 305(b) Report, and 9,559 miles of the assessed streams were found to attain state water quality standards.

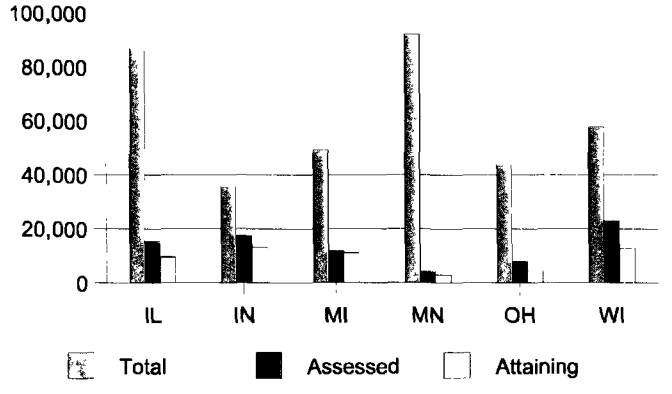
Of the 366,419 miles of rivers and streams in Region 5, 81,021 miles were assessed for the 2002 305(b) Reports (see Figure 1-3). A total of 54,982 of the miles assessed attained state water quality standards. This information compares favorably to data reported nationally, as Region 5 states both assess a greater percentage of river and stream miles than the national average and have a higher percentage of rivers and streams attaining water quality standards.

Figure 1-1
Inland Lakes (acres)



Source: 2002 State 305 (b) Reports

Figure 1-2
Rivers and Streams (miles)



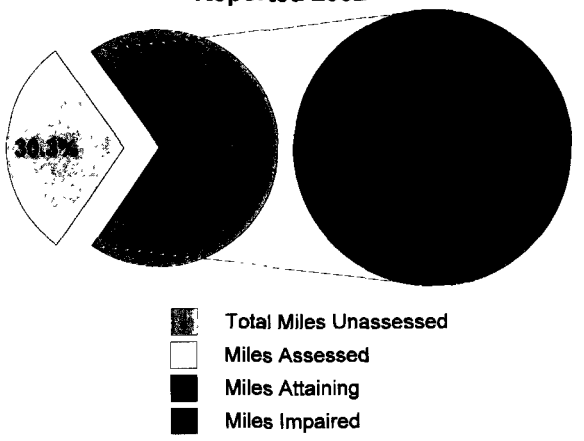
Source: 2002 State 305 (b) Reports

This type of summary provides useful information on the status of waters across the entire region as well as the capacity of state monitoring programs. Reporting the number of stream miles or lake acres assessed does not provide a measure of the distribution of sampling sites across a state or region, which is also important for accurately assessing water quality on a state or regional scale. For example, Ohio EPA visits each basin in the state once every 5 years. Each year, Ohio EPA staff visit 10 to 15 different study areas. Multiple sites in each study area are visited, bringing the total to 300 to 400 sampling sites per year. Biological, chemical and physical monitoring and assessment techniques are used at each site. Ohio EPA's approach for selecting sites ensures that the samples are representative of all the stream sizes within a watershed and that streams are covered across the state.

Figure 1-3

Aquatic Life Use: Rivers & Streams

Reported 2002

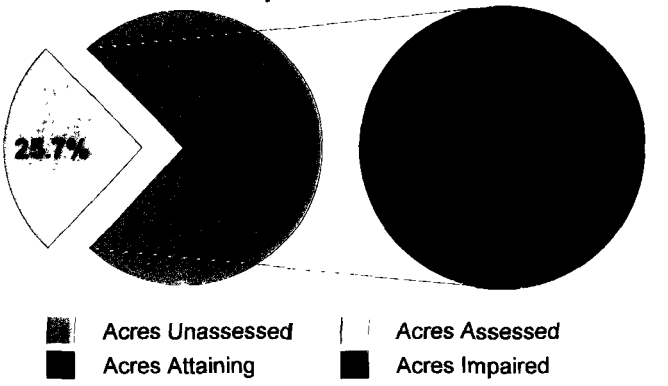


Source: 2002 State 305(b) Reports

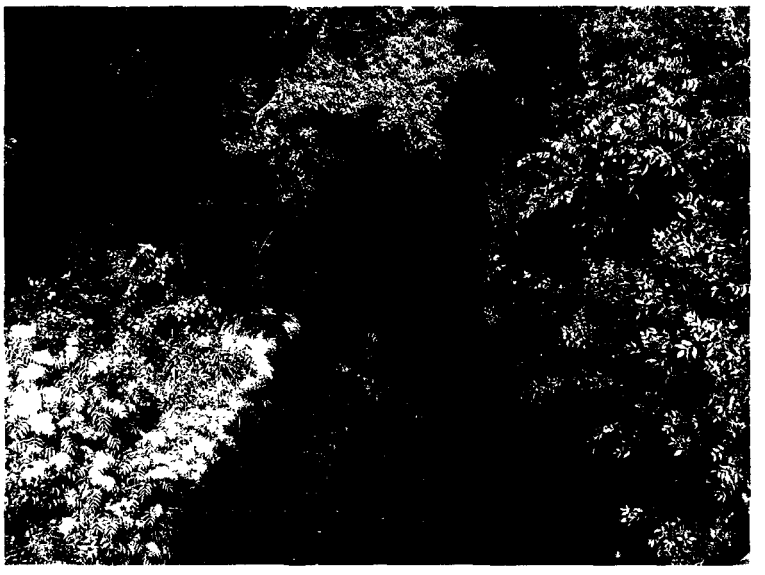
Figure 1-4

Aquatic Life Use: Inland Lakes in Region

Reported 2002



Source: 2002 State 305(b) Reports



An urban stream showing relatively few effects of urbanization. This stream has intact stream bank vegetation, natural banks and some natural variation in stream width, depth and habitat.

Photograph by Edward Hammer, EPA

The same stream on the same day undergoing channelization for flood control. Channelization eliminates aquatic habitat, destroys stream bank vegetation and changes flow regimes, all major causes of impaired aquatic communities in Region 5.

Photograph by Edward Hammer, EPA

Illinois River Success Story Runs from Carp to Trophy Bass

In the 1970s, the Illinois River could have served as the poster child for "Ugly Rivers." This important stream, which drains nearly a third of the state, was laden with trash, industrial waste and siltation. Nearly 30 years of point-source pollution control efforts since then have distinctly improved the river's water quality.

Thirty years ago, anglers' catches in the river were chiefly catfish and carp. As discharges received more effective treatment, the waters cleared, and sport fish as well as the macroinvertebrates they feed on returned. Today, anglers from throughout the Midwest are catching walleye, sauger, crappie and a variety of bass in the river. In 1995, Peoria was the site of a Professional Bass Masters Tournament, and there are many such tournaments along the river.

The focus for additional Illinois River improvements has shifted to nonpoint-source pollution. Several major plans have been developed to enlist landowner support for programs to reduce runoff and sedimentation. Under the Integrated Management Plan for the Illinois River, state government and leaders from agriculture, business and conservation are working in concert with the U.S. Department of Agriculture Natural Resource Conservation Service and its Conservation Reserve Enhancement Program (CREP), which was developed to enhance the Illinois River.

Illinois EPA has also channeled significant Clean Water Act Section 319 funding to CREP in order to implement conservation practices in environmentally sensitive areas.

Illinois EPA's success is indicated by the state's standing as the national leader in CREP enrollment. As of June 1, 2002, a total of 5,148 landowner agreements had been signed, with another 465 pending. So far, 122,370 acres have been enrolled in the program, which has a state goal of 132,000 acres.

CREP goals include reducing sedimentation and runoff; reducing phosphorus and nitrogen deposits in the river; increasing populations of waterfowl, shorebirds and state- and federally listed species; and increasing native fish and mussel stocks.

Region 5 states also provide information on the quality of their lakes. As with rivers and streams, states typically assess only a portion of their lakes. For example, of the 982,155 acres of inland lakes in Wisconsin, 146,479 acres were assessed for the 2002 305(b) Report, and 12,740 of the acres assessed attained state water quality standards.

Of the 5,801,970 acres of inland lakes in the region, 518,650 acres were assessed for the 2002 305(b) Reports (see Figure 1-4). A total of 348,320 of the acres assessed attained water quality standards. In contrast to the stream and river assessments, Region 5 states assess a lower percentage of lake acreage than the national average. This is due in part to the abundance of lakes in Region 5. On average, each EPA region has approximately 4,159,375 acres of lakes and reservoirs. With 5,801,970 acres, Region 5 has more than 1.5 million (39 percent) more lake acres than the regional average. Region 5 states report a greater percentage of lake acres attaining water quality standards as compared with national data.

Causes and Sources of Aquatic Life Use Impairments

In their 305(b) Reports, the states provide information about the causes of water body impairments and the sources of the pollutants responsible for the impairments. Figure 1-5 shows the causes of impairments for rivers and streams in Region 5, and Figure 1-6 shows the causes of impairments for inland lakes and reservoirs. These causes are ranked in descending order from those most frequently cited to those least frequently cited in the states' 2002 305(b) Reports.

Metals are most frequently cited as the cause of impairment of rivers and streams but not aquatic life impairment. Fish consumption advisories resulting from mercury contamination of fish account for most of the reported impairments. Toxic effects associated with metals, however, are actually responsible for only a small proportion of the reported impairments of aquatic community health. Based on the data gathered by the states, habitat alteration, siltation, nutrients, organic enrichment and low dissolved oxygen are the primary causes of adverse impacts on aquatic life. Pathogens, the primary cause of impairment of recreational uses, was a cause of impairment of 7 percent of the river and stream miles assessed.

The causes of aquatic life use impairments for lakes and reservoirs follow a similar pattern. Fish consumption advisories for mercury are the leading cause of impairment overall (greater than 100 percent because

Wisconsin lists all its surface waters as impaired as a result of fish tissue contamination with mercury). PCBs are the second most important cause of impairment because of fish consumption advisories (11 percent of impaired waters). The top causes of impaired aquatic communities in lakes and reservoirs (in order from most to least significant) are nutrients (18 percent), siltation (11 percent), excessive algal growth (10 percent), organic enrichment and low dissolved oxygen (8 percent), exotic species (8 percent), suspended solids (6 percent), noxious plants (4 percent) and turbidity (4 percent).

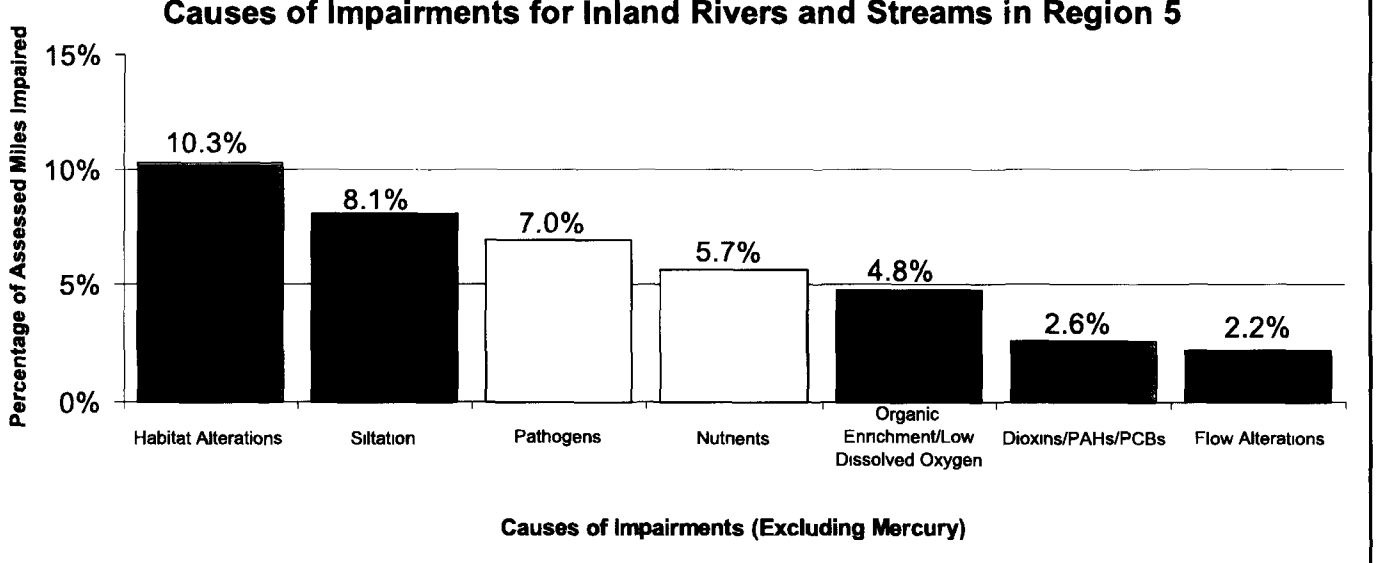
The states also report on the sources of the pollutants responsible for the reported causes of impairment. The primary source of impairments for rivers and streams is atmospheric deposition of pollutants (see Figure 1-7), which leads to such problems as high levels of mercury and other metals in these water bodies. Agriculture is also a major source of impairments because it causes such problems as high nutrient loads, contamination with pathogens, low dissolved oxygen levels, habitat alterations and siltation. Habitat modifications and hydromodifications (such as channelizing a river) are also major sources of impairment.

The sources of impairment for inland lakes and reservoirs are similar to those for rivers and streams. Figure 1-8 shows the sources of impairment and the percentages of the total assessed acres of inland

Improved Water Quality Through the Clean Michigan Initiative

Under Section 303(d) of the Clean Water Act, states are to list water bodies that are not in compliance with water quality standards. Michigan is working to remove water bodies from its impaired waters list (delisting) by controlling a variety of pollutant sources. As part of the Clean Michigan Initiative passed in 1998, specific funds were allocated to address nonpoint-source pollutant loadings. The nonpoint-source activities resulted in delisting of 10 water bodies, primarily because of actions that addressed sedimentation and animal access to water bodies. Michigan also delisted seven water bodies as a result of actions taken to correct point-source discharges. The water bodies now meet water quality standards, as has been shown by follow-up monitoring. In addition, seven water bodies included on the 2000 Section 303(d) list because of contaminated sediments have been delisted because the sediments have been remediated or are under order or contract to be remediated. These water bodies include the South Branch of the Black River, Manistique River, Pine River, Rouge River (Newburgh Lake), Saginaw River, Unnamed Tributary to Wolf Creek and Willow Run Creek.

Figure 1-5

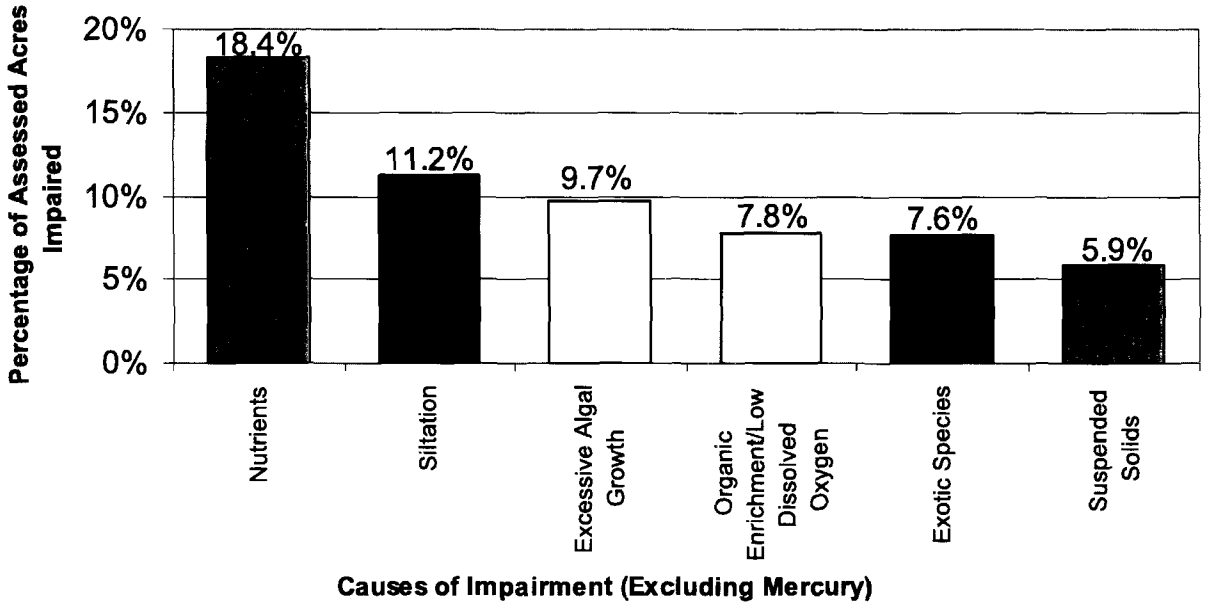


Note: PAH = Polynuclear aromatic hydrocarbon

Source: 2002 State 305(b) Reports

Figure 1-6

Causes of Impairments for Inland Lakes and Reservoirs in Region 5



Source: 2002 State 305(b) Reports

lakes and reservoirs impaired by the sources based on 2002 data reported by the states. As with rivers and streams, atmospheric deposition is the most significant source of impairment, accounting for 77 percent of the lake and reservoir acres assessed as impaired. Atmospheric deposition is primarily responsible for the input of mercury into inland lakes and reservoirs, resulting in fish consumption advisories because of unacceptably high levels of mercury in fish tissue, but is not a significant cause of impaired aquatic communities. Other significant sources of impairment of lakes and reservoirs are agriculture (13 percent); habitat modifications (10 percent); forest, grassland and parkland (5 percent); hydromodifications (5 percent); and recreational activities (5 percent).

What Are We Doing to Address the Problems?

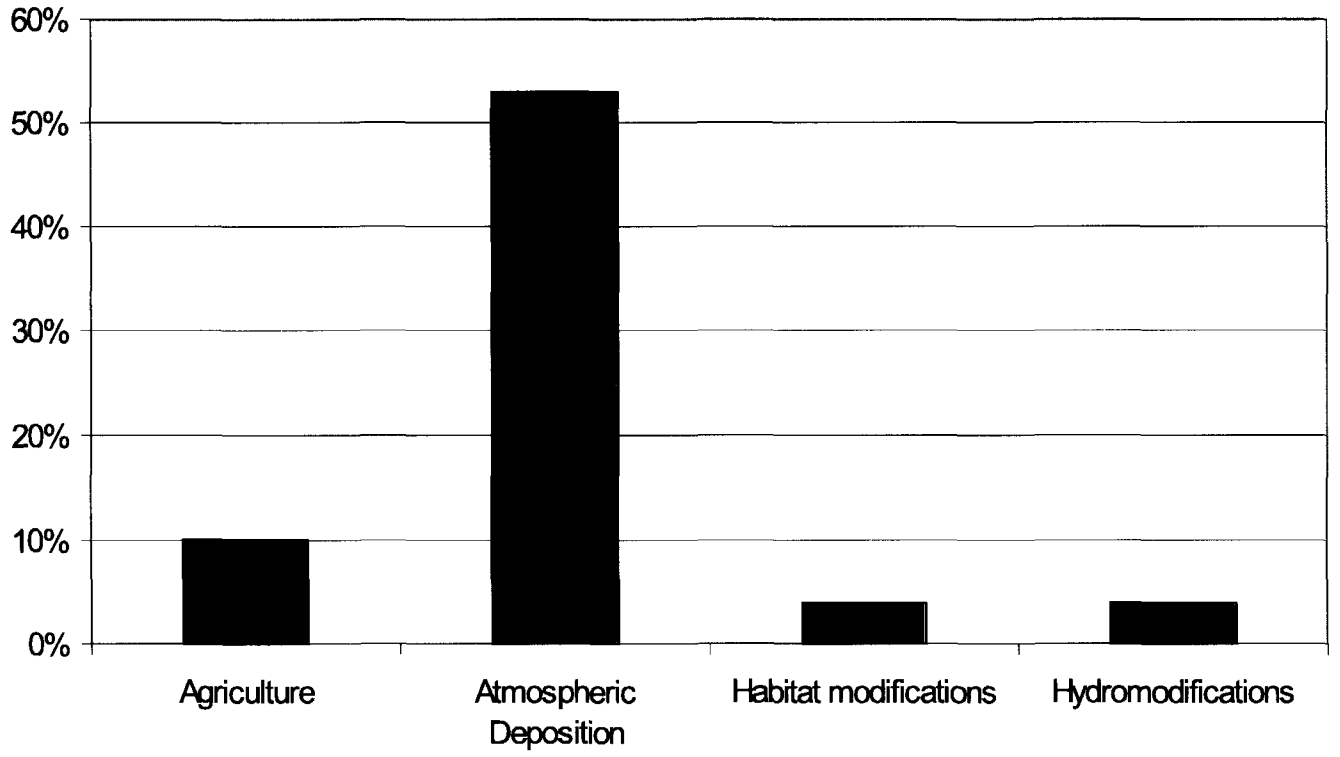
The impairments identified through the assessment process reveal how a healthy biological community can be disrupted. Because the problems are created by both point and nonpoint sources or pollution, solving them requires a combination of traditional and innovative approaches. EPA and the states are using a mixture of voluntary, incentive-based and regulatory tools to restore and protect aquatic biological communities.

Many problems originating from point sources have been addressed since the passage of the Clean Water Act in 1972, as is evidenced by the most often cited causes and sources in state 305(b) Reports. As a result of the Clean Water Act, all point-source dischargers to surface waters in the United States are required to obtain a permit to discharge. Such a permit includes limits on pollutants in the discharge that ensure that certain standards of wastewater treatment are achieved and that water quality standards will not be exceeded. Also, all states have water quality criteria for toxic pollutants. These criteria are intended to ensure that aquatic life is protected from toxic effects. To address water quality impacts resulting from nutrients, Region 5 states and tribes are developing water quality criteria that establish levels of nutrients that will not adversely affect surface waters.

As revealed by the state assessment process, nonpoint-source pollution and related issues are the leading cause of aquatic life impairment. State nonpoint- source programs established under Clean Water Act Section 319 target various problems facing aquatic communities. These programs reduce polluted runoff, restore habitat and improve water quality. The programs also promote education and outreach activities to increase public awareness about nonpoint-source

Figure 1-7

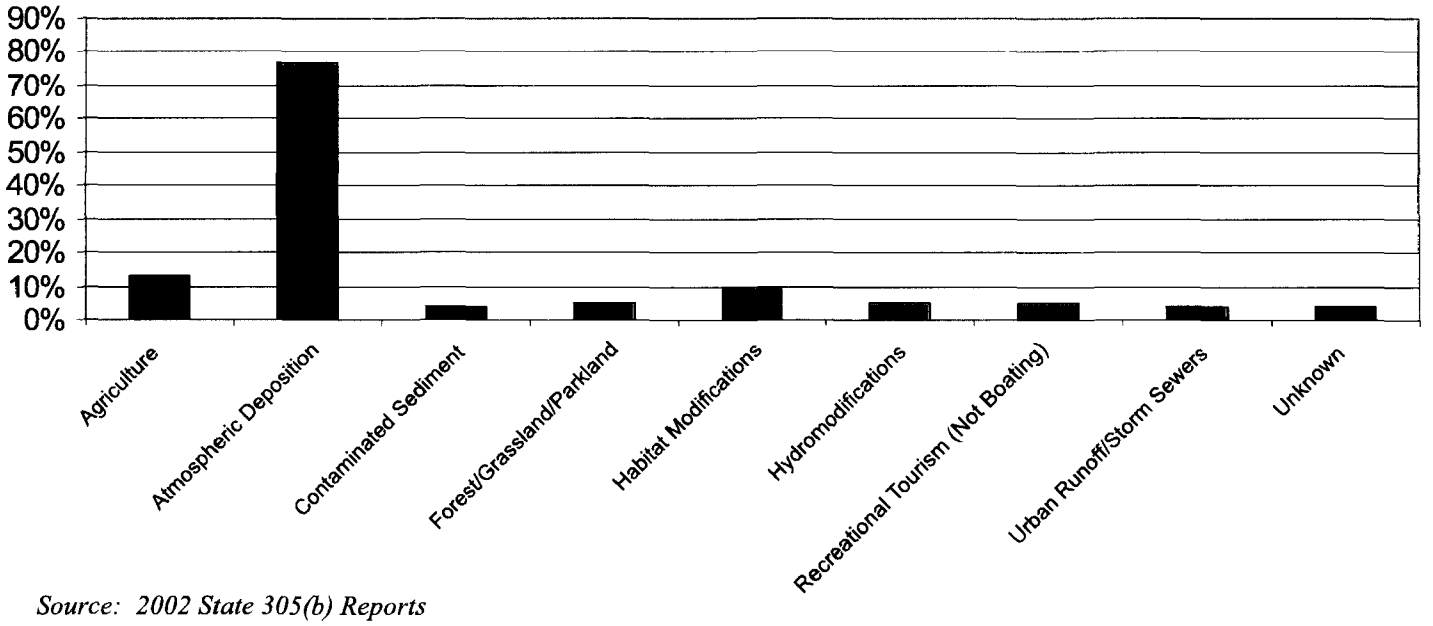
Major Sources of River and Stream Impairment in Region 5



Source: State 2002 305(b) Reports

Figure 1-8

Major Sources of Inland Lake and Reservoir Impairment in Region 5



Source: 2002 State 305(b) Reports

issues and to involve citizens in resolving problems. Examples of how nonpoint- source programs are being used to improve water quality, rehabilitate degraded habitat and restore natural flow regimes are provided the accompanying text boxes. For additional information on specific issues related to critical aquatic habitats, see Section 2.

Additional Data Sources

Biological Indicators of Watershed Health: http: //www.epa.gov/bioindicators/

The Conservation of Biological Diversity in the Great Lakes Ecosystem: Issues and Opportunities: http://www.epa.gov/glnpo/ecopage/issues.html

Sauk River Chain of Lakes Watershed in Minnesota

The Sauk River Chain of Lakes Watershed includes popular recreational water bodies between Richmond and Cold Sprint, Minnesota. Over the years the river suffered from increased nutrient and sediment loading, causing deterioration of water quality. In 1985, many partners and several EPA funding sources began a long-term, urban and rural, basin-wide nutrient and sediment reduction program. The Sauk River Watershed District and Stearns County have continued the effort with defined phosphorus management goals for each river tributary. Environmental results include a decrease in severe algal scums and signs of improved fisheries. Continued nutrient reductions will be cumulative and will improve water quality for recreation as well as the fisheries.

Source: EPA

Spring Creek Best Management Practices in Wisconsin

The Spring Creek Watershed Team in southeastern Wisconsin used EPA funding to encourage farmers to adopt a series of best management practices (BMP) in order to reduce runoff pollution. Watersheds where BMPs had been adopted were compared with watersheds where BMPs were not employed to address changes in stream habitat, reductions in fish and macroinvertebrate populations and stream bank erosion. Trout populations in Spring Creek improved after BMP implementation, and the stream's physical habitat and water quality have also improved. Spring Creek now meets water quality standards as a trout stream and is expected to be removed from Wisconsin's list of impaired waters.

Pair of Wood Ducks
Photograph Courtesy of
The National Park Service

Restoring Streams to Natural Flow Regimes in Michigan and Wisconsin

Improved Salmon Reproduction

For 80 years, hydroelectric dams caused large, daily fluctuations in water flow in western Michigan's Manistee River. Fluctuations such as these can impact the biological community in a stream by increasing erosion and either stranding or sweeping downstream the aquatic organisms that fish rely on for food. In 1989, the Manistee River hydroelectric dams began more natural "run-of-river flow management" consistent with conditions specified by the state in the dams' new hydropower licenses. As a result, stable flows were restored to the Manistee River.

Today, more young Chinook salmon survive as a result of the more stable flows in the Manistee River. Based on available sampling data, the number of young Chinook salmon entering Lake Michigan is estimated to have increased from 100,000 to 250,000 per year. Stable flows and erosion control projects have also increased the percentage of cobble and gravel in the first 1.7 kilometers downstream of the Tippy Dam from 63 percent of the stream bottom in 1990 to 82 percent in 1996. Cobble and gravel stream bottoms are important because they provide better habitat for fish and invertebrates.

Dam Removal

Wisconsin waters are impounded by over 3,500 dams. Returning rivers to a free-flowing condition eliminates safety risks posed by aging dams and improves the biological health of streams. Dam removal can also make sense economically, as the cost of repairing a small dam is on average 300 percent greater than the cost of removing a dam. In the last three decades, about 60 dams have been removed from Wisconsin streams–the largest number of dam removals in the nation.

The 1998 removal of the Waterworks Dam in Baraboo is an example of how dam removal can be a river restoration tool. Dams transformed the Baraboo Rapids segment of the Baraboo River from a fast-moving stream with healthy fish populations to a series of sluggish impoundments. The river once supported a spawning lake sturgeon population but became known for its carp. With removal of the dam, three-quarters of a mile of high-quality riffle habitat, which is rare in southern Wisconsin rivers, was restored to its free-flowing condition. Within 18 months of dam removal, water quality improved significantly, and the Wisconsin Department of Natural Resources found 24 species of fish in the newly free-flowing stretch of river, of which smallmouth bass was the dominant species. Partners in the project included the Wisconsin Department of Natural Resources, the City of Baraboo, the Baraboo River Canoe Club, the River Alliance of Wisconsin, the State Historical Society, Circus World Museum and many others.

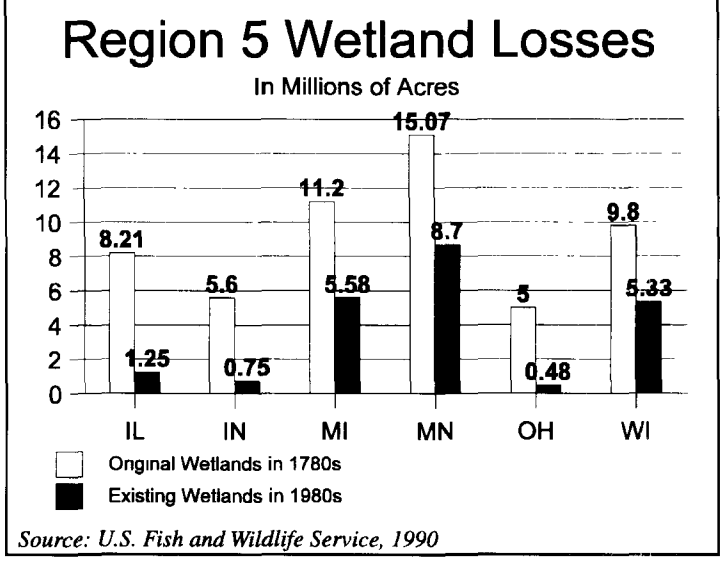
Our Goal: The Quantity and Quality of Critical Aquatic Habitat in Region 5, Including Wetlands, Will Be Maintained or Improved

In Region 5, we have access to abundant water and spectacular rivers, streams and lakes. In addition to the resources that often come to mind when thinking of our region—the Ohio and Mississippi River, the Great Lakes and thousands of inland lakes—other unique and often critical habitats exist. Although this report does not address every type of critical aquatic habitat, it does provide information on two special types: wetlands and the shorelines of lakes and streams (also called riparian areas).

A wide variety of hydrologic and biological wetland types can be found in the Midwest, including marshes, swamps, bogs, wet meadows and more. Wetlands have increasingly been recognized for the valuable role they play in supporting biological diversity, maintaining valuable economic resources such as fisheries and acting as a natural method of flood control and some pollution removal. Maintaining shoreline habitat is also important for protecting surface waters from land erosion and associated water quality problems. Like wetlands, these buffer areas provide vital habitat for native species and increase the overall habitat value and water quality of the waters they surround.

Over the years, the Midwestern landscape has been altered by human activities. Land has been drained to create more suitable conditions for agriculture; and wetlands, shoreline habitat and other open space have been increasingly subjected to the pressures of development. Total historical wetland losses range from 42 to 90 percent in the Region 5 states, with greater losses in the southernmost states. The Region 5 states have lost more wetland acreage than the national average. Many of the wetlands that remain are homes for rare species, in part because of habitat lost elsewhere. Likewise, the undeveloped shoreline along streams and lakes has decreased markedly.

Figure 2-1



Source: U.S. Fish and Wildlife Service, 1990

What Are the Major Problems Causing Impairments and Losses of Critical Aquatic Habitats?

Critical aquatic habitats can be lost directly by filling or draining of areas for development or by substituting walls or "manicured" landscaping for natural shorelines. Historically, the biggest losses of wetlands in the Midwest were the result of creating drainage for agriculture during projects conducted from the 1800s to the present. A drained wetland is not necessarily suitable for crops—it can be extremely productive, or it may not reliably produce a crop every year because of wetness. Ephemeral wetlands, or wetlands that dry up in summer, are at particular risk of being lost to agricultural and residential development (see inset). Figure 2-1 shows that many of the wetlands in the Region 5 states have been lost since the 1780s. Other reductions in habitat value can occur when waters are dredged or channelized for navigation, development or flood control purposes.

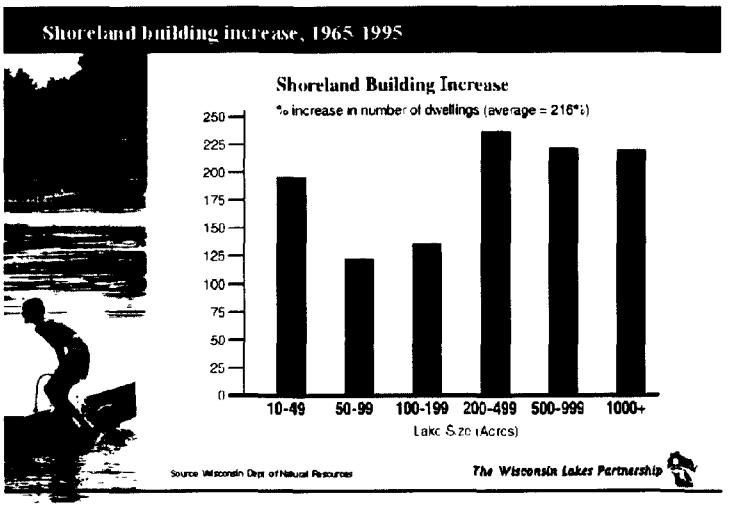
Ephemeral Wetlands

Ephemeral wetlands are depressional wetlands that temporarily hold water in spring and early summer or after heavy rains. Periodically these wetlands dry up, often in mid to late summer. They are isolated, lacking a permanent inlet or outlet, but may overflow in times of high water. As such, they are important for flood control. Ephemeral wetlands are free of fish, which allows successful breeding of certain amphibians and invertebrates, and are important habitats for migrating birds. Even small sites of less than an acre can produce hundreds of frogs, toads and salamanders.

Many ephemeral wetlands have been drained and filled to facilitate agriculture, new subdivisions or other development. This not only eliminates aquatic habitat but also increases the risk of local flooding. Other ephemeral wetlands have been excavated to construct storm water retention ponds. Pollutants are often washed into these ponds during rainstorms.

Photograph by Michael R. Jeffords, EPA

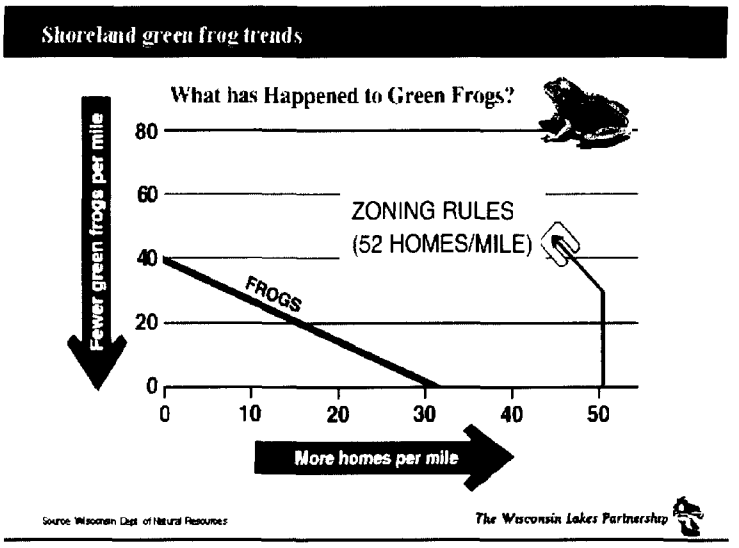
Figure 2-2



Shoreline development has also occurred over time but is increasing rapidly as our population grows and more people purchase waterfront property. New houses and other developments are expanding along lakes, rivers and wetlands, and existing seasonal cabins are renovated into year-round, often larger homes. Comprehensive figures are not available on shoreline development, but a study performed in Wisconsin shows that there has been an average 216 percent increase in the number of dwellings on lakes between 1965 and 1995 (see Figure 2-2).

Less obvious are the indirect causes of aquatic

Figure 2-3



habitat impairments, such as hydrologic changes, landscaping changes, poor land use practices and polluted runoff. Wetlands can be degraded or destroyed when they are dammed up or dug out to create deeper ponds and lakes and when water flow is diverted to or from wetlands.

The economic incentive to use the maximum amount of land on a farm or the desire to have a clear view of a lake or other water body over a manicured lawn often has led to elimination of natural vegetated buffers that normally surround a lake, stream or wetland. Studies have shown that there can be many species of plants and animals in the areas near the water's edge and that development measurably decreases the numbers and kinds of species present. For example, studies in both Wisconsin and Minnesota have shown correlations between loss of shoreline habitat and declines in various species. In Wisconsin, the number of green frogs declined rapidly with increased housing density (see Figure 2-3), and the composition of bird species changed markedly. The number of uncommon song birds, such as warblers and vieros, was higher on undeveloped land. In Minnesota, researchers found and mapped 897 crappie spawning nests and then compared the locations to shoreline developments. Only 24 of the 897 crappie nests were located near shoreline that had any type of dwelling on it.

Many wetlands in the Midwest also suffer from invasive plants such as purple loosestrife and reed canary grass that out-compete natural vegetation, greatly reducing the variety of vegetation types and the land's value to wildlife. Purple loosestrife, for example, displaces native wetland vegetation and disrupts the habitat essential for many wildlife species. Eventually purple loosestrife can overrun wetlands and almost entirely eliminate the open water habitat. The plant can also detract from recreational activities by choking waterways.

Finally, critical aquatic habitat can be impacted by pollution from point sources (such as wastewater treatment plant discharges) or from diffuse or nonpoint sources (such as runoff from agricultural areas or from urban or suburban areas). Wetlands in particular are impacted by runoff that can contain sediment, nutrients and chemicals from farm fields, animal waste and road salt, all of which decrease water quality. In addition, shoreline habitat can be impacted by sedimentation near the water's edge resulting from loss of vegetation and increased nutrient loads.

What Are We Doing to Address the Problems?

Wetland losses have slowed down since the mid-1970s, in part because of the regulatory and educational activities of EPA and the states. However, resource protection programs have historically focused on single goals or a small set of goals that do not address the entire problem of wetland loss. EPA is now developing additional tools to assist in protecting Region 5's wetlands.

Section 404 of the Clean Water Act established

Wisconsin's Wetland Program

Wisconsin has approximately 5.3 million acres of wetlands remaining from the 10 million acres that covered the landscape before European settlement. These remaining wetlands are critical to sustaining mammal, fish, amphibian and reptile habitat; to maintaining flood storage; to protecting surface water and groundwater quality; and to providing scenic beauty and recreation for boaters, hunters, wildlife watchers and others.

Since Wisconsin adopted wetland water quality standards in 1991, the wetland acreage lost under permits approved by USACE has slowed to 347 acres per year from 1,440 acres per year previously. Wisconsin's wetland standards now require people who want to pursue a project that potentially impacts a wetland to obtain Wisconsin Department of Natural Resources (WDNR) water quality certification before applying for a wetland permit from USACE. Applicants must demonstrate that they will make every effort to avoid harming wetlands and that any such harm will be minimized. No permit is issued if a project would result in significant harm to wetlands. A recent Supreme Court decision left many isolated wetlands across the country vulnerable to filling. Wisconsin became the first state in the nation to restore protection for such wetlands when the Wisconsin legislature passed and the governor signed legislation to protect Wisconsin wetlands.

To further reduce illegal filling of wetlands and to restore wetlands where feasible, WDNR recently developed a new strategy known as "Reversing the Loss." The strategy recognizes that 75 percent of Wisconsin's wetlands are in private ownership and that WDNR needs to provide landowners with the tools and means to manage their wetlands. This strategy charts a course for WDNR programs associated with wetland education, protection, restoration, enhancement and management to follow over the next 6 years.

a permitting program in 1972 to regulate discharges of dredged and fill materials into waters of the United States, and this program was later expanded to include wetlands. Activities regulated under this program include filling areas for development; water resource projects such as dam and sea wall construction; infrastructure development through construction of homes, highways and airports; and in some instances conversion of wetlands for farming and forestry. This program is jointly administered by the U.S. Army Corps of Engineers (USACE) and EPA. EPA reviews proposals to fill wetlands based on environmental criteria. These criteria stress that projects should avoid wetlands and waters to minimize their direct and indirect impacts on waters and to adequately compensate for any unavoidable impacts.

Using a combination of EPA and other funding, states, tribes and localities have strengthened their wetland protection programs, and some have become national leaders in using innovative approaches to protect their wetland resources. Michigan, for example, is one of only two states in the nation to have assumed responsibility for the Section 404 permitting program. Several midwestern states and some counties have stepped in to assert their legal role in protecting isolated wetlands in response to a Supreme Court ruling that restricted federal authority over these wetlands.

In addition to applying their traditional regulatory tools, Region 5 and the states are actively pursuing a Watershed Protection Approach to address water quality problems. EPA's and the states' traditional programs have succeeded in identifying and controlling the larger point sources of pollution such as industrial discharges to waterways. The traditional approach is especially effective for dealing with single dischargers or a localized problem. The watershed approach focuses more holistically on environmental resources and addresses problems that are more pervasive across the landscape, such as habitat destruction or diffuse sources of polluted runoff. EPA and the states are encouraging local resource managers to establish watershed plans that identify all problems impacting their resources and that integrate programs and tools for solving those problems. Among other things, EPA is developing guidance that more specifically identifies the need to link wetland protection programs to watershed planning efforts and is supporting a series of national and regional meetings on wetlands and watershed planning.

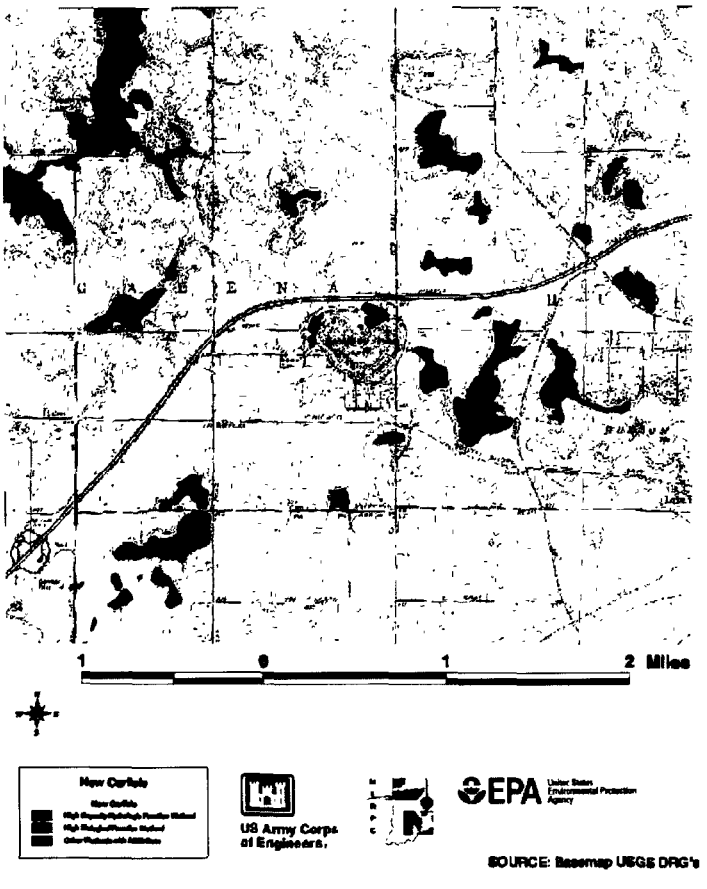
Protecting Wetland in Wisconsin and Indiana Using Section 404 Programs

A site selected for the new Superior Middle School in Superior, Wisconsin, included 35 acres of high-quality wetlands containing four species of state-listed rare plants. The project was redesigned to reduce wetland filling to 24.7 acres and to shift impacts away from the most sensitive parts of the site. EPA continues to do advance planning with the City of Superior and with state and federal agencies in order to protect important wetlands in the city and ensure that effective compensatory mitigation projects, such as creating new wetlands, are conducted.

EPA also prosecutes violators of Section 404 of the Clean Water Act, especially in cases where unpermitted fill has been placed in wetlands. EPA recently settled a case against a recreation area in Indiana for placement of soil in a lake, river and wetland.

EPA and USACE jointly conduct technical assistance projects to identify high-quality wetlands

Figure 2-4
Draft Northwest Indiana ADID Wetland Study



Ohio's Water Resource Restoration Sponsorship Program

Ohio EPA has developed an innovative way to finance restoration and protection of aquatic habitat resources. The Water Resource Restoration Sponsorship Program (WRRSP) allows recipients of loans for publicly owned treatment works from the Water Pollution Control Loan Fund (WPCLF) to sponsor a variety of habitat restoration and protection actions to benefit stream corridors and wetlands. These actions can be undertaken by park districts, land trusts or municipalities. The WPCLF reduces the interest rate for repayment of a treatment works loan by an amount sufficient to offset the cost for sponsoring aquatic habitat restoration and protection actions and to provide additional savings in the overall loan repayments for the sponsor. Through 2001, the WRRSP has provided more than $21 million for 14 habitat restoration and protection projects in Ohio.

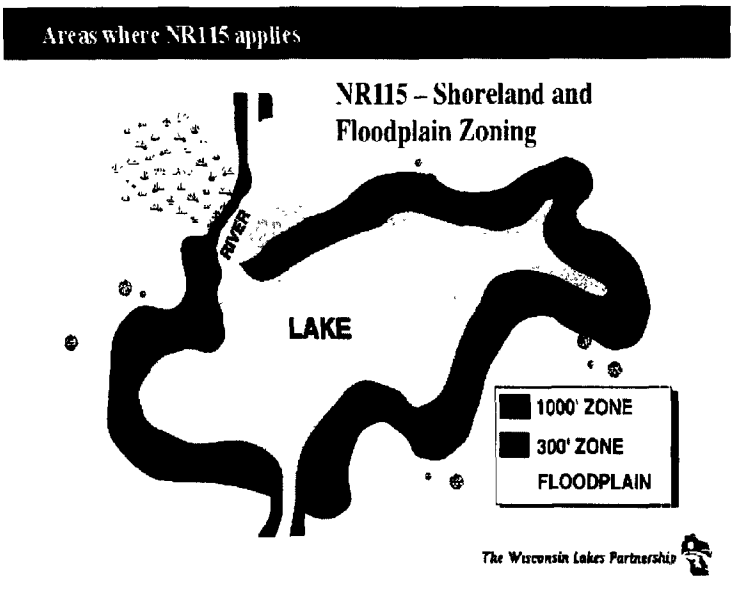
One WRRSP project was carried out to protect Sawmill Creek in Mansillon, Ohio. The Mill Creek Metroparks had a limited opportunity to acquire this undisturbed, biologically rich headwater stream before the property where it lies was sold to a developer. The property contains several wetlands along with Sawmill Creek, which is a tributary of the Meander Creek Reservoir, the drinking water source for the area. To meet the time line established by the property owner for the sale, the Trust for Public Land took out a WPCLF loan for the initial property acquisition and then entered into a lease and purchase agreement with the Metroparks. Subsequently, the City of Massillon used the WRRSP to obtain a WPCLF loan for its wastewater treatment plant improvements and to sponsor the Metroparks' purchase of the property from the Trust for Public Land. The WRRSP's involvement thus made it possible for the Metroparks to acquire and preserve an important water quality resource.

in advance of development. These projects aid local planning efforts and regulatory decision-making and most often occur in developing metropolitan areas. Region 5 has sponsored a number of such studies called Advance Identification (ADID) studies. The draft northwest Indiana ADID study has been made available to the public on a geographic information system web site (see figure 2-4). Another ADID study is being concluded for Kane County, Illinois, west of Chicago.

EPA is also promoting development of water quality standards designed specifically for wetlands. The Region 5 states are national leaders in adopting narrative water quality standards for wetlands. A more specific type of water quality standard can be developed through biological assessments using biologically based criteria; such a standard describes the qualities that must be present to support the desired aquatic life use of a water body. EPA assists many Region 5 states and tribes in developing biological criteria for their wetland types.

Along with development of water quality standards, EPA is working with the states to develop wetland monitoring programs that focus on documenting not only the quantity of wetlands (and gains and losses) but the also the quality of wetlands. Efforts are proceeding nationally to identify the critical elements of a wetland monitoring program, and within Region 5, a number of states are developing more complete monitoring programs. Michigan, Minnesota, Ohio, and Wisconsin are all developing basic biological assessment programs for wetlands. For example, Minnesota has been working to develop appropriate tools for monitoring the quality of wetlands. Currently, the Minnesota Pollution Control Agency is conducting two biological assessment projects, one for depressional wetlands and one for riparian wetlands. Ohio is developing quantitative biological criteria to support its wetland standards. The state adopted wetland water quality standards in 1998. To implement those standards, Ohio is developing biological criteria for wetlands using plants, macroinvertebrates and amphibians as indices of biotic integrity. As part of this project, the state is working to describe

Figure 2-5



reference conditions for wetlands in its four main ecoregions, and this information will then be used as a goal for wetland mitigation projects.

For the most part, protection of shorelines does not fall under the regulatory authority of EPA, but both the national and state nonpoint-source control programs promote a number of practices that can help protect this valuable habitat. These practices include leaving buffers around the edge of waters, planting with native species, installing erosion control measures and limiting land-disturbing activities on the most sensitive sites. States also use other innovative mechanisms to protect critical habitat.

In addition, states and local governments may use voluntary measures or choose to regulate how development occurs. For example, Wisconsin passed a shoreline zoning ordinance (designated as "NR115") to manage the density of development along waters and to create buffers or keep them intact. Figure 2-5 shows where the Wisconsin ordinance applies: land within 1,000 feet of the ordinary high water mark (OHWM) of a navigable lake, pond or flowage and land that is within 300 feet of the OHWM of a navigable river or stream, or from the landward edge of a floodplain if that is greater.

Finally, one major activity that is regulated nationally by EPA is runoff from construction that occurs on more than 1 acre of land. Such activity requires a permit, and developers must employ practices designed to minimize pollutant runoff, especially practices focusing on sediment. Minimizing soil loss near the water's edge is especially important because of the impact that excess sediment can have on aquatic habitat.

Identifying Critical Ecosystems

Identifying areas that support ecosystems critical to the health of a region is an important but difficult task. Critical ecosystems are areas that are potentially the most important for retaining at least some of the natural heritage of the region. Currently, these ecosystems are identified using best professional judgment, and this judgment is rarely verified through a variety of other methods. The Critical Ecosystem Team in Region 5 used geographic information system technology and best professional judgement to create a database of critical ecosystems in the region. The regional map shown in Figure 2-6 was created by overlaying

Whittlesey Creek Watershed in Wisconsin

The Whittlesey Creek Watershed project is designed to protect coastal wetlands and restore habitat in the watershed through involvement of both citizens and agencies. The project was initiated by the Bayfield County Land Conservation Committee using state nonpoint-source pollution funds. A plan for improving watershed health was developed. Since 1996, Wisconsin has provided over $120,000 for cost-sharing with landowners to restore wetlands, replant critical habitat and stabilize eroding stream banks. Whittlesey Creek National Wildlife Refuge was established in 1999 to protect coastal wetlands and restore wetland and stream hydrology. Private landowners are given technical and financial assistance for habitat restoration projects that improve both aquatic and terrestrial community health in the watershed. State, federal and nonprofit organizations are working cooperatively to restore the native coaster brook trout to Chequamegon Bay and Whittlesey Creek. A fishery assessment of Whittlesey Creek was conducted in summer 2001 as a precursor to this restoration work. The U.S. Fish and Wildlife Service is offering to purchase conservation easements from landowners in the watershed to protect fish and wildlife habitat. Bayfield County and the U.S. Geological Survey are completing a hydrologic study of surface water and groundwater flows and of the effects of land use on those flows. The study results will help direct future habitat protection and restoration work.

Photograph Courtesy of WDNR

Sugarloaf Cove: A Unique Restoration in Minnesota

An uncommon effort to restore a wetland on Lake Superior's north shore (near Schroeder, Minnesota) has had impressive results. A joint effort between the Minnesota Department of Natural Resources (MDNR) and the Sugarloaf Interpretive Center Association (SICA) restored coastal wetland and extensive upland areas at the Sugarloaf Point Scientific and Natural Area and on surrounding property owned and managed by SICA.

The site was used by Consolidated Paper to create log rafts bound for Ashland, Wisconsin, where they were loaded on railcars headed for inland paper plants. During the time the land was used for moving logs, low areas were filled, and much of the forest was cut so that buildings and roads could be constructed. When the paper company stopped using the site, most of the buildings were removed.

Photograph by Patrick T. Collins, MDNR

After being considered as a site for a safe harbor development, the Sugarloaf Point natural area was expanded, and the surrounding land came under the management of the nonprofit SICA. Restoration of native plant communities is a priority both for SICA and for MDNR's Division of Ecological Services, which manages the natural area. Cooperation between MDNR and SICA as well as grant money from EPA's Great Lakes National Program Office allowed a thorough survey of remaining natural plant communities as well as a subsurface investigation beneath the fill placed on the wetland in the past. The results of these studies were used to carefully define restoration targets for both uplands and wetlands, and restoration began in earnest in 1999. Fill removed from the wetlands was used to restore upland areas such as an old road site.

The strong educational focus of SICA will ensure that the lessons learned in restoring wetland and upland plant communities on the shores of Lake Superior are available to residents and visitors alike. Tours and a slide show of the restoration project as well as an informational brochure may be obtained by contacting Terri Port Wright at (218) 879-4334 or via e-mail at sugarloaf@qwest.net.

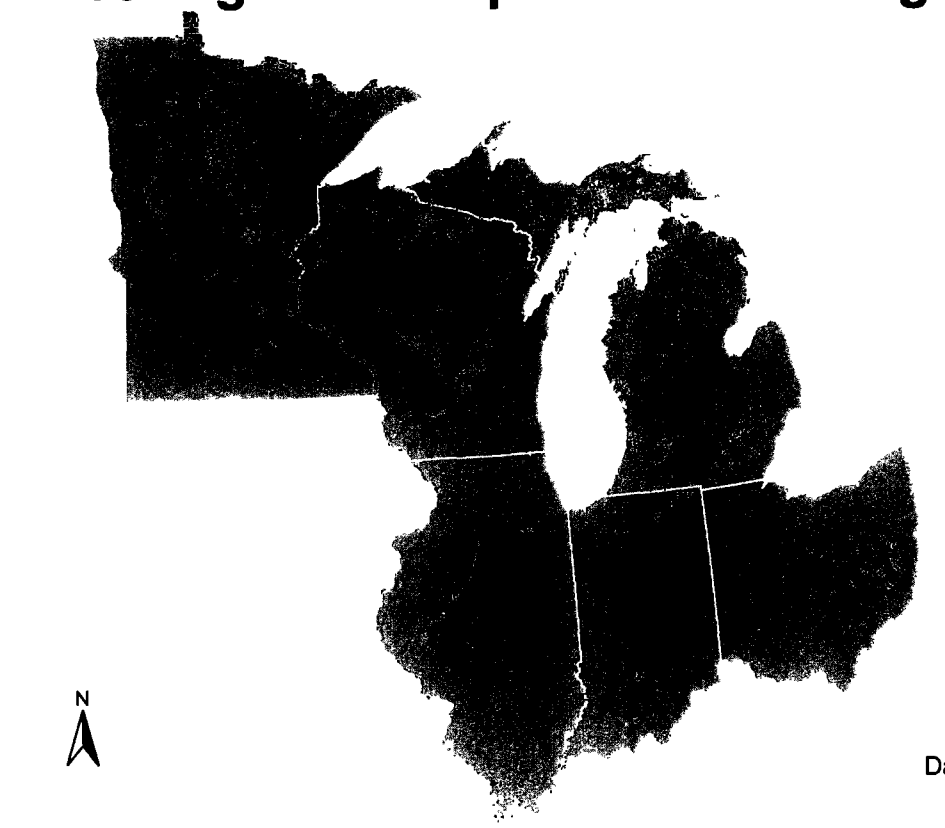
many different datasets that described ecological characteristics in three broad categories: diversity, sustainability and rarity. The resulting composite map indicates areas in Region 5 that support potentially critical ecosystems—those with high ecological diversity, many rare species and enough space to sustain the ecosystem. The mapping project will assist Region 5 and the states in protecting the region's invaluable aquatic habitat.

Additional Data Sources

Visit the EPA Office of Waters, Oceans, and Wetlands web site at *http://www.epa.gov/owow* for more information on critical aquatic habitat, wetlands and polluted runoff control.

Figure 2-6

Wetlands and Waters Within Ecosystems Scoring in the Top 10% for Ecological Quality



emergent wetlands
swamp
open water
Region 5 states

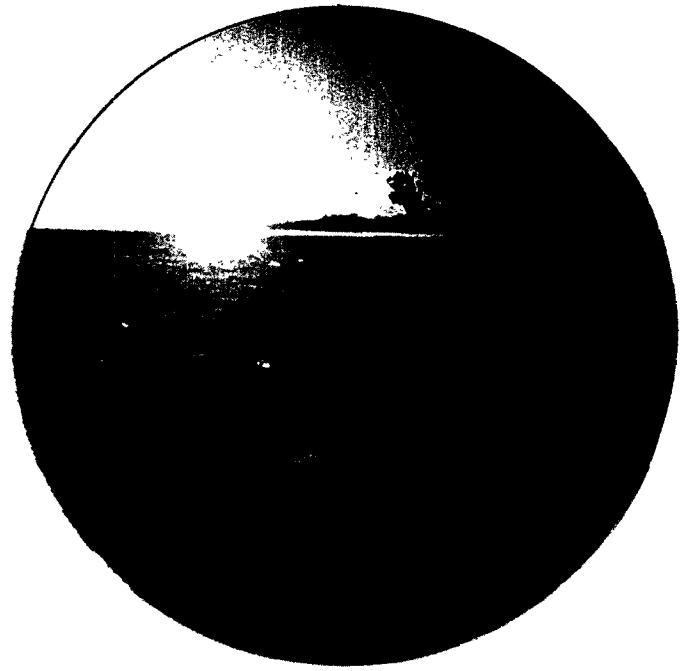
Data compiled from Critical Ecosystem Team analysis performed on 1990-1992 National Land Cover Dataset

300 0 300 600 Miles

Source: EPA

Great Blue Heron
Photograph by Don Breneman

Our Goal: All Waters in Region 5 Will Support Fish Populations with Safe Levels of Contaminants



Fishing is one of the most popular forms of outdoor recreation in the Midwest, and Americans are eating more fish as our diets shift toward more low-fat foods (for additional information, see *http://www.usda.gov/factbook/intro.htm*, which provides statistics on fish consumption). Fish consumption, however, has been shown to be a major pathway of human as well as wildlife exposure to persistent toxic substances such as polychlorinated biphenyls (PCBs) and mercury. Contaminants released from many sources are transported through the environment and are carried into streams and lakes. Small organisms absorb these contaminants in water and are in turn eaten by other organisms and small fish. Some of these contaminants bioaccumulate in the fish – and in humans who eat them – to levels that can pose health risks.

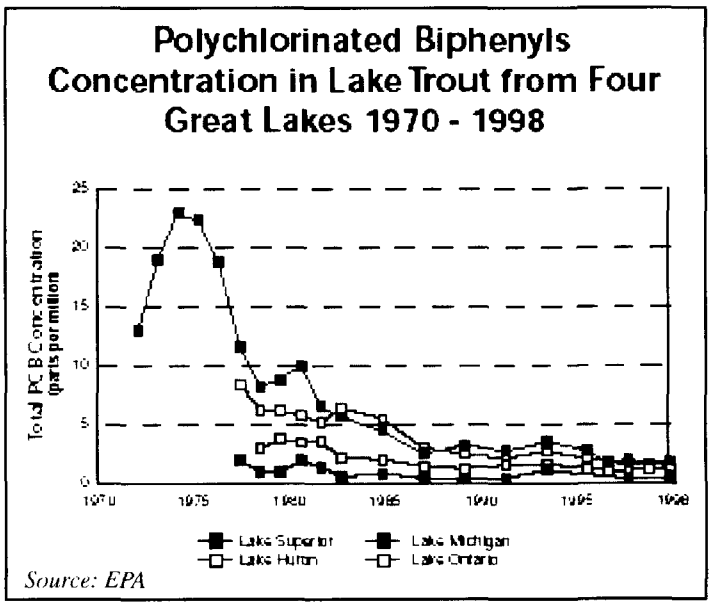
State fish consumption advisories are issued to protect people from potential adverse health effects associated with contaminants found in fish. These advisories recommend amounts and types of fish that are safe to eat. Fish consumption advisories may also include information to educate the public on how to minimize exposure to certain contaminants through proper preparation and cooking of fish. The advisories are viewed as a temporary measure to protect the public while control measures and site cleanups reduce contamination in water to safe levels.

What Substances Contaminate Fish?

Mercury, PCBs and dioxin are the contaminants of greatest concern in Region 5 fish. These contaminants originate from various sources. Mercury occurs naturally and is distributed throughout the environment by both natural processes and human activities. Solid waste incineration and fossil fuel combustion facilities generate approximately 87 percent of the mercury emissions in the United States. There are no known natural sources of PCBs; therefore, all sources of PCBs are related to commercial manufacturing, storage and disposal activities. The manufacture of PCBs was banned in the United States in 1979; however, PCB-containing products manufactured before the ban may still be in use. Dioxin is also not a natural chemical. Manufacturing processes, paper bleaching and burning of various organic materials have resulted in incidental creation of dioxin and its release into the environment. In the past, DDT and a number of other pesticides had been present at levels of concern in the region, but their levels have declined dramatically in most places since they were taken off the market. Levels of other contaminants such as PCBs have also declined noticeably since their ban (see Figure 3-1).

Since the 1970s, EPA, other federal agencies and the states have aggressively tested fish found in Region 5's waters for contaminants. Region 5 states analyze 3,500 to 4,000 fish tissue samples each year. States may test a number of species sampled at a

Figure 3-1



single site for a variety of contaminants (see Figure 3-2). Because a major objective of fish testing programs is assessing risk to human health, wildlife or both, sampling sites are selected where fishing is popular or in waters that are known or suspected to contain higher contaminant levels. Because these programs are not specifically designed to track trends, data for the Great Lakes is often used for this purpose.

The states use the information collected to reduce people's exposure to contaminants by issuing advisories to help people choose what fish to eat as well as how often and how much. This information is not intended to discourage people from eating fish, but it should be used as a guide for choosing fish that are low in contaminants. After consulting the advisories, people may find that they do not have to change their fish consumption habits, or they may choose to eat different fish or to space fish meals farther apart. The number of advisories issued varies by state (see Figure 3-3).

While fish are a good, low-cost, low-fat source of nutrition, some individuals, particularly pregnant women, developing fetuses and young children, are more sensitive to contaminants than the general adult population. State fish consumption advisories include advice specifically targeted to these sensitive populations.

As noted above, the primary contaminants that lead to issuance of fish consumption in Region 5 include mercury, PCBs, and dioxin. The levels of PCBs in fish have declined significantly over the last 25 years since their manufacture and sale were curtailed, and dioxin levels have decreased over the past 10 years as its sources were controlled. Mercury levels in fish have remained generally stable. Recent research linking mercury to developmental problems in children has resulted in a more stringent threshold for mercury in fish. All the Region's states now have revised fish advisories reflecting this new threshold.

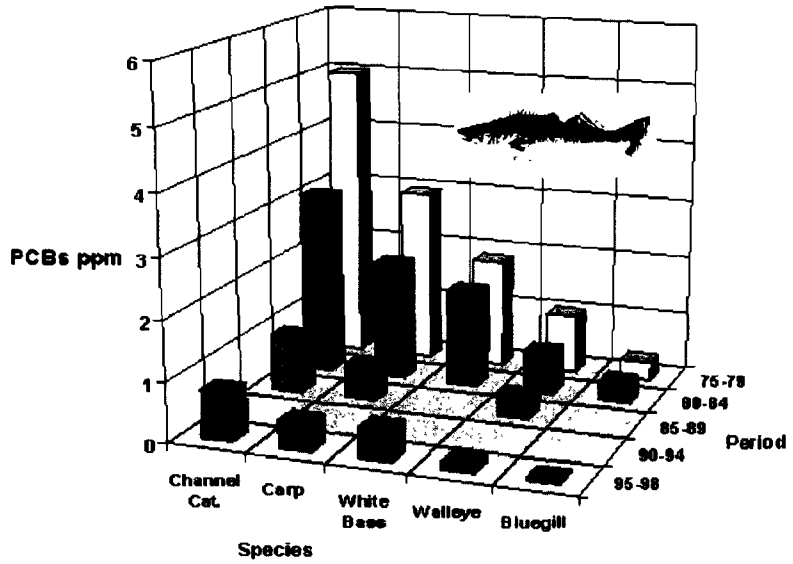
Fish Contaminant Research and Pollution Control Follow-Up

By the late 1970s, it had become obvious that fish could accumulate pollutants to levels posing human health concerns. During this period, analytical methods and equipment were improving to the point that low—yet potentially unhealthful—levels of contaminants could be detected in fish tissue. A plan was developed by the EPA Regional Office in Chicago and the Duluth Research Laboratory to use fish tissue analysis to search for previously unidentified sources of bioaccumulative contaminants and to scan the tissue samples for contaminants that had not been previously identified. This project was one of the earliest attempts to team up experts in laboratory analysis, staff with knowledge of manufacturing facilities and processes, and state and federal fish experts in order to systematically search for and identify fish tissue contaminant issues.

The results of the study provided an increased understanding of bioaccumulative pollutants and their possible sources in the region that has been critical to regulatory activities and investigations since that time. Experience gained in this study and a concurrent regional analysis of manufacturing processes conducted to identify contaminant sources provided the basis for pollution control efforts that continue today. For example, industrial facilities that discharge waste to municipal wastewater treatment plants must follow pretreatment regulations to control pollutants that might otherwise interfere with plant processes or contaminant biosolids. This has helped to control sources of contaminants. Another spinoff of the study has been development and implementation of new fish tissue analysis procedures that have aided the development of fish consumption advisories. Overall, the study has led to significant reductions in bioaccumulative pollutants in fish and wildlife in the Great Lakes region and a better-informed public.

Figure 3-2

Median PCB Concentrations of Different Fish Species in the Upper Mississippi River



This illustration shows median PCB concentrations (in parts per million [ppm]) in fillets of different fish species collected from the upper Mississippi River by the Wisconsin Department of Natural Resources)WDNR) from 1975 to 1998. Over this 24-year period, WDNR intensively monitored PCB concentrations in the upper Mississippi River. Evaluation of the fish fillet data clearly show higher PCB concentrations in channel catfish, carp and white bass than in walleye and bluegill. These differences were most pronounced in the fish collected during the late 1970s and early 1980s before widespread PCB regulation reduced the amount of PCBs in the environment. The fat content of channel catfish, carp and white bass is greater than that of walleye and bluegill and is an important factor influencing the differences in PCB concentrations.

Source: WDNR

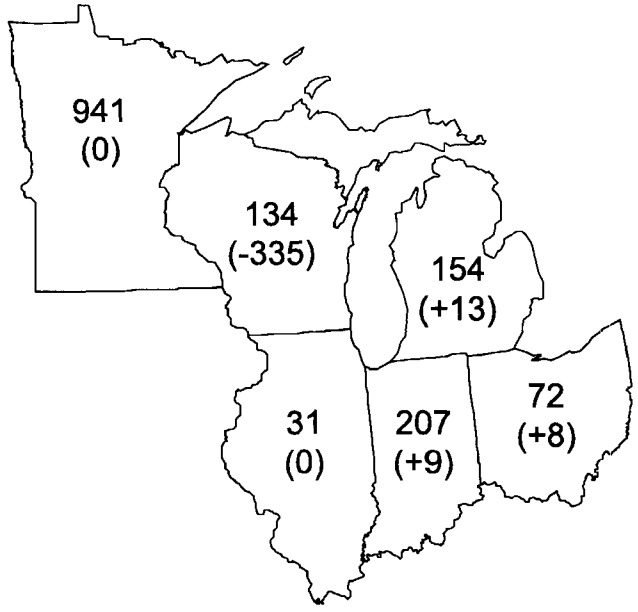
What Is Being Done to Make Fish Safer?

EPA and the states have had significant success in reducing the levels of persistent chemicals in the environment. Levels of such substances as DDT and PCBs in fish decreased significantly when their use was banned in the 1970s and 1980s. EPA is examining policies that will reduce mercury releases to the environment through various source reduction and regulatory programs.

Contaminated sediment in waterways is a significant source of fish tissue contamination. Substances found in sediment reflect the land uses in the watersheds of the region. A number of industries have been identified as potential sources of specific contaminants and have been required to change their processes in order to reduce or prevent their generation of these substances. In addition, runoff from agricultural lands may carry agricultural chemicals and unsafe levels of nutrients into water bodies. Urban runoff also contributes sediment contaminated with pesticides, nutrients, oils and other pollutants.

Figure 3-3

Total Number of Fish Consumption Advisories - 2001 (Change from 2000)



The Region 5 states issue 58 percent of all fish advisories in the United States, reflecting a long history of these states monitoring and assessing fish contaminants. As a result, more and better information is provided to the region's citizens to protect public health. Source: EPA

Finding Mercury in Minnesota Schools

Mercury is found in fish from many of Minnesota's more than 14,000 lakes, and no individual is doing more to raise public awareness about the impacts of this toxic metal than Clancy, the Minnesota Pollution Control Agency's (MPCA) mercury-detecting dog. This energetic Labrador retriever mixed breed, a linchpin of the agency's Mercury-Free Zone Program, is the only dog in the nation trained to detect vapor from as little as a half gram of mercury.

Photograph by David L. Hansen

EPA's Great Lakes National Program Office, the Minnesota Office of Environmental Assistance, Xcel Energy and the St. Paul Police Department Canine Unit provided funding and in-kind services to MPCA to train Clancy for the statewide Mercury-Free Zone Program, which debuted in October 2001.

To date, 150 schools have pledged to become mercury-free zones, and Clancy's investigative skills have resulted in removal of 250 pounds of mercury from participating schools. For more information, visit MPCA's web site at http://www.pca.state.mn.us/programs/mercury-free/index.html.

Clancy works through a science classroom with his trainer and handler Carol Hubbard, locating broken thermometers and fluorescent tubes, forgotten mercury in cabinets, accumulations in sink U-bends and spills in the cracks between floorboards and tiles.

All these sources are being targeted by Region 5 and the states through a range of policies. EPA works closely with the states to clean up contaminated sediment so that it does not pose a threat. EPA and the states have taken a multimedia approach to contaminant cleanup through such programs as Superfund, the Resource Conservation and Recovery Act (RCRA), state cleanups and voluntary remediation programs.

Sources of mercury contamination are being

Dioxin Sources – Burn Barrels in Indiana and Michigan

Dioxin has been identified as a fish tissue contaminant that causes fish consumption advisories. Dioxin is created as a by-product of the manufacture and burning of organic chemicals and plastics that contain chlorine. Many large combustion sources are now controlled to prevent dioxin formation. One of the major sources of dioxin, however, is backyard burning of trash in "burn barrels."

In Indiana, it is against the law to burn garbage or household trash such as household waste, plastic, batteries, rubber, disposable diapers and painted or stained wood. In addition, there are local open burning laws that provide more limitations. For more information, see http://www.in.gov/idem/air/compliance/burn.html.

A "Burning Household Waste" brochure developed by the Michigan Department of Environmental Quality (MDEQ) lists pollutants emitted from burn barrels, some of the health consequences and national household burn barrel emissions. It is available at the MDEQ Environmental Assistance Center, from district staff or at http://www.deq.state.mi.us/documents/deq-aqd-bhw.pdf.

Source: EPA

Tribal Monitoring of Fish Contaminants

Fish and other aquatic species are an important food source for many tribal peoples. Tribe members consume significantly greater amounts of fish than other residents of the Midwest. For this reason, it is especially important for tribes to understand what contaminants are present in fish tissues and the health risks that these contaminants may pose.

Great Lakes - For the past several years, an intertribal consortium in Michigan has collected fish samples from waters of the Great Lakes used by tribal fishers and analyzed the samples for contaminants. The fish tissue data is compared with Food and Drug Administration (FDA) action levels to determine the saleability and safety of the fish for human consumption. Lake Huron was sampled in 1999 and Lake Michigan in 2000. The analyses showed that the whitefish and lake trout collected had contaminant levels below the FDA action levels.

The data collected in 1999 and 2000 was compared with data from previous years to assess trends. The data demonstrates dramatic declines in PCB levels in whole lake trout from 1972 to 1990. Since 1990, the data has fluctuated, and there has been no further obvious decline. Mercury concentrations have generally been constant.

Inland Lakes - For several years, a number of tribes in Minnesota and Wisconsin and an intertribal consortium in Wisconsin have collected fish samples from inland lakes fished by tribe members, analyzed the samples and developed tailored education and outreach information for tribe members on potential risks associated with eating the fish. The intertribal consortium in Wisconsin uses an innovative system for communicating the risks of consuming walleye in which maps of the lakes are color-coded (see http://www.glifwc.org/).

addressed through voluntary efforts such as clean sweep programs and thermostat trade programs that encourage people to properly dispose of mercury-containing products. EPA is also working with the Region 5 states to develop proposed policies to virtually eliminate mercury emissions.

Cleaning up the legacy of contaminated industrial sites and sediment continues to be a high priority, and some progress has been made toward cleaning up the most highly contaminated sites in recent years. From 1997 to 2001, almost 2 million cubic yards of contaminated sediment was remediated at sites within the Region 5 portion of the Great Lakes basin. Furthermore, progress is being made to minimize future siltation and sediment contamination problems.

Hook into Healthy Fish

You cannot see, smell or taste mercury, PCBs or dioxin in fish. That is why it is important to know which fish are safer than others to eat. State health programs in Region 5 have joined together to improve public understanding of fish consumption advice (see Figure 3-4). One product of their efforts is a common theme, "Hook into Healthy Fish." They are promoting selection of fish with the lowest contaminant levels for home consumption. There is no need to stop eating fish. By following health guidelines and selecting fish carefully, you can reduce your exposure to contaminants, reduce your health risks and still get the benefits of eating fish.

When you're deciding which fish are safer to eat, keep in mind that larger fish, older fish and fatty fish generally have greater amounts of contaminants. Fish that feed on other fish—such as walleye, northern pike and bass—have the greatest amounts of mercury in their meat. They can still be eaten in reasonable quantities, but both you and the fishery will benefit if the larger individuals are released or kept only when they are trophy-sized.

To reduce your risk of exposure to contaminants in fish,

- Eat smaller fish.
- Eat more panfish (such as sunfish and crappies) and fewer predator fish (such as walleye, northern pike and lake trout).
- Trim fish skin and fat, especially belly fat, and eat fewer fatty fish such as carp, catfish and lake trout. PCBs build up in fish fat. Mercury cannot be removed from fish through cleaning or cooking because it gets into their flesh; however, you can reduce the amounts of other contaminants like PCBs by removing fat when you clean and cook fish (see Figure 3-5).

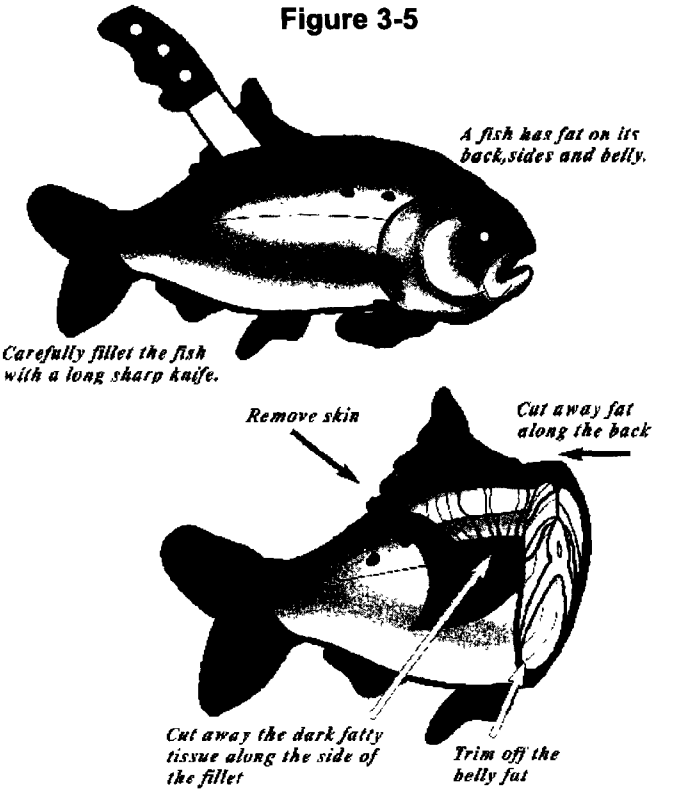
Figure 3-4

HOOK INTO HEALTHY FISH

Reel in your **FREE** copy of the WI Fish Advisory.
Call your local health department.

Source: Wisconsin Department of Public Health

Figure 3-5



Source: WDNR

Fish Contaminant Monitoring in Michigan

MDEQ conducts fish contaminant monitoring in the waters of Michigan. The goals of the monitoring are to determine the need for sport fish consumption advisories and commercial fishing regulations, identify water quality trends and evaluate whether existing programs are effectively reducing chemical contamination in the water.

Edible portion fish tissue samples, caged fish samples and whole adult fish samples are analyzed to address fish contaminant monitoring goals. MDEQ collected edible portion samples from 38 sites in 2000. Based on monitoring results, sport fish consumption advisories were relaxed at nine of the water bodies that had been monitored prior to 2000. Also, recent caged fish monitoring demonstrates the effectiveness of source control and contaminated sediment removal at sites like Portage Creek and River Raisin. In addition, results of EPA's and MDEQ's whole fish monitoring indicate that contaminant concentrations declined dramatically (because of the banning and phaseout of many pesticides and PCBs) between the late 1970s and early 1980s and then either stabilized or declined more slowly.

Where Can You Find Information About Local Fish Advisories?

Individual state fish advisories can be found at the following web sites:

Illinois: http://www.idph.state.il.us/envhealth/fishadv/fishadvisory02.htm

Indiana: http://www.state.in.us/isdh/dataandstats/fish/fish_adv_index.htm

Michigan: http://www.michigan.gov/documents/Fishing_Advisory_2002_26575_7.pdf

Minnesota: http://www.health.state.mn.us/divs/eh/fish/index.html

Ohio: http://www.odh.state.oh.us/alerts/fishadv.pdf

Wisconsin: http://www.dnr.state.wi.us/org/water/fhp/fish/advisories

Our Goal: Designated Swimming Waters in Region 5 Will Be Swimmable

Most water at beaches is safe for swimming; however, there are potential risks associated with the quality of the water. Beach water should be tested for the presence of disease-causing microorganisms. Monitoring of beach water quality by local health and environmental agencies is necessary to warn citizens when there is a problem. When bacteria levels in the water are found to be too high, these agencies notify the public of beach advisories or closings, as swimming or playing in water that is polluted may make people sick. The people who are most at risk are children, the elderly and individuals with weakened immune systems.

Photograph Courtesy of Michigan Travel Bureau

A beach advisory or closing typically occurs when monitoring results indicate that water quality may pose a health risk. About 28 percent of the Great Lakes beaches that participated in the National Beach Health Survey (315 of approximately 580 beaches contributed information) had at least one advisory or one area closed during the 2001 swimming season. The main reason given for the advisories and closings was elevated bacteria levels. For more information on Great Lakes beach closings, see: http://www.epa.gov/grtlakes/beach.

Region 5 and state public health and environmental agencies are committed to reducing problems

Beach Programs in Ohio

In Ohio, much work is being done along the Lake Erie shoreline to ensure biologically safe swimming areas. Many agencies are involved in identifying factors that adversely affect beach water. Some local health departments have instituted programs specifically aimed at locating and eliminating failed septic systems that might contribute to high bacteria counts at public beaches. Other organizations are concentrating on controlling the migratory habits of numerous waterfowl (seagulls, geese, and so on) to minimize their effects on beach water quality. By employing intense sampling surveys and sophisticated DNA fingerprinting technologies, researchers are seeking the sources of disease-causing bacteria on Lake Erie beaches. In recent years, high levels of fecal coliform and E. coli bacteria have resulted in Lake Erie beach postings warning people to enter the water only at their own risk. Two Lake Erie Commission-funded projects, one at Maumee Bay State Park in the western Lake Erie basin and one in the Cleveland area, are working to identify and eliminate the sources of these pathogens. The goal is to ensure the health of all that enjoy our Lake Erie beaches.

associated with disease-causing microorganisms at recreational beaches. Agencies in charge of protecting the health of swimmers typically monitor water quality at beaches. Most water quality standards for beaches are based on the risk of human exposure to pathogens. Because pathogen detection is difficult and expensive, pathogens themselves are usually not measured directly. Instead, one or more "indicator organisms" are measured and used to predict the presence of pathogens.

What Are the Major Problems Causing Beach Closings?

When pathogen levels exceed water quality standards, beach managers post signs advising the public that it may not be safe to swim, or post "No Swimming" notices to protect human health. Beach water can be polluted by bacteria and other microorganisms like viruses and parasites. The most frequent sources of disease-causing microorganisms are combined and sanitary sewer overflows, polluted storm water runoff, sewage treatment plant malfunctions, boat sewage and malfunctioning septic systems. Levels of pollution in beach water are often much higher during and immediately following rainstorms because water draining to the beach often carries sewage from overflowing sewage treatment systems or other contaminants. Rainwater flows to beaches after running off farmland, lawns, streets, construction sites and other urban sites and thus can carry animal waste, fertilizer, pesticides, trash and many other pollutants.

CSOs and SSOs

A combined sewer overflow (CSO) occurs when the flow capacity of a sewer system designed to carry both sanitary sewage and storm water is exceeded and a mixture of domestic waste and storm water is discharged untreated into surface water. A sanitary sewer overflow (SSO) occurs when untreated sewage is unintentionally released from a sanitary sewage collection system before treatment. Both CSOs and SSOs occur most often during excessive wet weather conditions such as heavy rains.

CSOs are a remnant of the country's early infrastructure and are typically found in older communities in the Northeast, Great Lakes states and the Pacific Northwest. Region 5 has 364 CSO communities, which is about 47 percent of the national total. Approximately 135 of these CSO communities discharge to the Great Lakes, and the Region 5 states are giving high priority to development and implementation of CSO controls for these communities.

EPA and the Region 5 states have taken a number of steps to control CSOs and bring CSO communities into compliance with the Clean Water Act. EPA's 1994 CSO policy requires communities to implement nine minimum controls, which are measures that can reduce CSOs and their effects on water quality without requiring significant engineering studies, construction activity or financial investment. The policy also calls for communities to develop CSO long-term

Decreasing Fecal Coliform Contamination in the Chippewa River in Minnesota

The Chippewa River is one of 13 major tributaries to the Minnesota River, which ranks as one of the most threatened rivers in the nation. The Chippewa contributes significant sediment, nutrients and harmful bacteria to the Minnesota River, and the lower reaches of the Chippewa exceed the fecal coliform standard. But with the help of a state $300,000 Clean Water Partnership grant–and $418,700 in matching and in-kind support–the Chippewa River Watershed Project is tackling a 10-year program to develop a network of people and projects focused on improving water quality. Program sponsors, including four county governments, hope to make the Chippewa River a major recreational resource in the Minnesota River basin.

The strategies for improving water quality have included

- Working with the sugar beet industry (the largest industry in the watershed).
- Publishing a newsletter for 8,000 residents.
- Consulting with Glenwood, a city in the watershed, on a storm water management plan.
- Encouraging soil and water conservation districts to participate in the Conservation Reserve Enhancement Program.
- Conducting water quality monitoring across the watershed.
- Offering seminars for farmers on nutrient management.
- Conducting a Chippewa River tour during a River Leaders Summit.

CSOs in EPA Region 5

There are currently 364 communities in the Region 5 states with CSOs (Illinois - 107, Indiana - 107, Ohio - 93, Michigan - 52, Minnesota - 3 and Wisconsin - 2). In its 2001 Report to Congress on CSO policy implementation, EPA reports that in Region 5, 79 percent of CSO communities have been required to implement the nine minimum controls, and 56 percent have been required to develop CSO LTCPs. An additional 30 percent of the communities were required to develop CSO controls outside the LTCP process.

Planning is only one step in the process of bringing CSOs under control. Following review and approval of LTCPs, communities must finance and build the controls, and this may take a number of years. Nevertheless, there have been many successes in controlling CSOs in Region 5. For example,

- In Chicago, the Tunnel and Reservoir Plan, construction of which began in the 1970s, has reduced CSO frequency from nearly 100 per year to fewer than 15 per year. Discharges reaching Lake Michigan are now an infrequent occurrence.
- Under the Rouge River Wet Weather Demonstration Project, CSO controls in 16 communities in the Rouge River watershed have removed CSOs from 30 miles of the river. In other areas where treatment basins have been built, treated overflows occur approximately one to seven times per year, whereas previously, untreated overflows occurred 50 times per year.
- Minneapolis and St. Paul have completed the separation of their formerly combined sewers.
- Numerous other communities have either designed or constructed CSO controls, including sewer separation, CSO storage for later treatment at a wastewater treatment plant or stand-alone treatment systems for wet weather events.
- In 1988, Michigan identified 90 municipal entities with untreated CSO discharges. Through the efforts of these municipalities and the state, CSO discharges have been eliminated or adequately treated in 36 communities. All the remaining 54 communities have Long-Term CSO Control Programs, most of which are in advanced stages of implementation. Based on the number of completed projects and the advanced stages of most of the remaining LTCPs, a large percentage of the historically untreated CSO discharge has been eliminated or is being adequately treated. Treatment includes disinfection to protect public health.

control plans (LTCP) that provide for compliance with the technology- and water quality-based requirements of the Clean Water Act.

Together with its state partners, EPA is continuing to improve the inventory and assess the impact of Region 5 CSOs and SSOs, particularly those near beach areas. These efforts will strengthen the ability to target CSOs and SSOs that may be contributing to beach closings in order to reduce or eliminate them as sources of pollution.

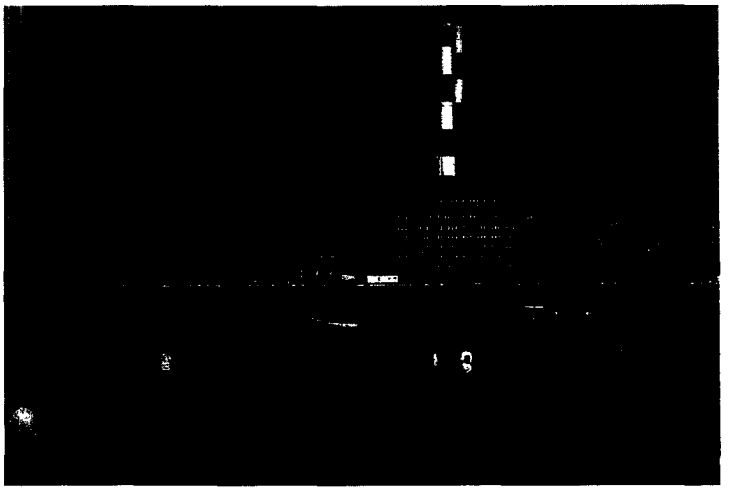
Beach closings cannot in all cases be directly linked to CSOs or SSOs. Such pollutant sources, in fact, are only part of the story. Pollution of coastal waters and beaches is a complex issue. Many conditions can affect beaches, including weather, wind direction, water currents, water depth, beach location and geography, nearby animal and bird habitats, and human activity. Recent research indicates that bacteria and pathogens existing in nearshore areas and at beaches may multiply when weather and water conditions provide a suitable environment, thus creating unsafe conditions for beach users.

Pinpointing the sources of beach contamination takes time and consistent teamwork, as is evidenced by the efforts of an interagency task force convened to investigate beach closings along the Indiana shoreline of Lake Michigan. Beginning in 1997, this group of 19 public and private-sector organizations coordinated E. coli monitoring at 60 locations in northwest Indiana. The task force identified a variety of suspected sources of contamination ranging from a mobile home park on an upstream tributary to malfunctioning waste facilities in a state park on the lakeshore. EPA and other state and local regulatory agencies have used various methods to address contamination from these sources, including both direct enforcement and compliance assistance.

What are We Doing to Address the Problems?

EPA's BEACH Program

EPA's Beaches Environmental Assessment Coastal Health (BEACH) Program is aimed at reducing health risks for swimmers by minimizing their exposure to disease-causing microorganisms at recreational beaches. For example, EPA is providing storm water controls and is working with states and various stakeholders to control boat sewage discharges. Moreover, EPA is working to improve beach programs across the country. The goal is to improve beach monitoring, strengthen recreational water quality standards, improve public notification procedures and find ways to eliminate pollution sources. One important factor is the proximity to beaches of CSOs and SSOs. Region 5 is working with its state program partners to inventory all known CSOs and SSOs, particularly



Photograph by David Riecks; Photograph Courtesy of Illinois-Indiana Sea Grant

those near Great Lakes beach areas. Region 5 and the state programs will then target CSOs and SSOs as well as confined animal feeding operations that may be contributing to beach closings in order to reduce or eliminate them as sources of pollution. Moreover, EPA's Great Lakes National Program Office developed a Great Lakes Strategy that includes promoting clean and healthy beaches. Many key actions are outlined in the strategy, including working with state, local and tribal governments and federal agencies to reduce or eliminate beach closings and trying to identify pollution sources for all monitored beaches.

BEACH Act Grant Program

EPA is making $10 million in grants available to eligible coastal states, tribes and territories in order to protect public health at the nation's beaches. These grants are available to coastal and Great Lakes states for developing programs to monitor water quality at beaches and to notify the public when water quality problems exist. During the first year of BEACH Act development grants, each of the coastal and Great Lakes states that applied for the grants received $58,600 to develop a beach monitoring and notification program.

In March 2002, the availability of additional BEACH Act development grant funding was announced. Region 5 grants will be allocated as follows based on swimming season length, number of coastal miles, and beach use: Illinois - $248,615; Indiana - $206,670; Michigan - $287,556; Minnesota - $204,631; Ohio - $227,879; and Wisconsin - $228,396. Over the next few years, EPA is authorized to issue additional funds to eligible states, tribes, territories and local governments in order to support development and implementation of beach monitoring and notification programs.

Research

A great deal of research is needed to improve the science supporting recreational water quality monitoring programs. A major problem with current monitoring procedures is that the process of collecting and preparing samples, incubating

Beach Programs in Illinois

Most of the Illinois beaches on Lake Michigan are monitored for water quality in an effort to ensure the safety of the thousands of people that use them. In Lake County, water at the nine beaches on Lake Michigan is sampled daily by the Lake County Health Department. Water at the 32 beaches operated by the Chicago Park District is sampled from Monday through Friday, and test results are posted daily at *www.chicagoparkdistrict.com/index.cfm/fuseaction/swim.swimreport.*

The Illinois Department of Public Health will be working with several local and state entities to meet the objectives of an EPA developmental grant. Although the number of beach closings in Illinois is a concern, efforts are underway to determine the causes of the high bacterial counts at the beaches, and there have been no reports of illness associated with swimming at the beaches.

Photograph by Carol Y Swinehart, Michigan Sea Grant Extension

bacteria, conducting the analyses and reporting the results requires 24 to 48 hours before problems can be detected and notifications issued. As a result of this delay, a beach can be left unprotected for swimmers to become exposed to contaminants, or a beach can be closed when the problem has already passed. Methods are needed to identify water quality problems before exposure takes place. Moreover, research is needed on the health risks associated with swimming in polluted water. Swimmer patterns, such as time spent in the water and the amount of water swallowed, need to be assessed. Also, research needs to be conducted in order to determine what types of respiratory illnesses may be caused by swimming in contaminated water and whether cuts in a swimmer's skin may contribute to infection.

The Region 5 states currently use different standards and measurement methods to determine the need for beach closings. As a result, there are limitations on the ability to compare frequencies of exceedances of microbiological standards in order to evaluate trends in recreational water quality. Given these limitations, the frequency of beach postings has traditionally been used as an indicator of recreational water quality. However, microbial standard exceedances may be a better measure of the actual health risk associated with recreational waters. By April 2004, all the Region 5 states intend to adopt bacteria criteria at least as protective as the EPA Ambient Water Quality Criteria for Bacteria issued in 1986. EPA's annual voluntary beach survey program provides an indication of the status of beach health.

For more information about EPA's BEACH Program, visit the BEACH Watch web site at www.epa.gov/OST/beaches. The web site contains information about individual beaches, protection programs, workshops and results of annual national beach surveys as well as links to other web sites for regional beach projects.

Beach Monitoring Grants in Michigan

The Michigan Department of Environmental Quality (MDEQ) has provided grants to local health departments for monitoring water at public beaches for E. coli. An average annual amount of approximately $150,000 has been awarded to local health departments for this purpose over the past few years. MDEQ has applied for federal funds so that it will be possible to provide local health departments with additional money to develop and enhance their beach monitoring programs. MDEQ has also developed a beach monitoring web site (*http://www.deq.state.mi.us/beach*) where local health departments can make the results of their beach monitoring available to the public.

Photograph by Patrick T Collins,
Michigan Department of Natural Resources

Photograph Courtesy of Wisconsin Travel Bureau

Local Beach Programs in Wisconsin

Wisconsin has formed a BEACH Act workgroup composed of local and state health officials and interested parties to develop a comprehensive beach monitoring and public notification plan. Several efforts to collect water quality data are already underway at Wisconsin beaches. The information collected will support assessment of short-term increases in bacteria resulting from storm events.

Wisconsin Department of Natural Resources Beach Pilot Project

The Bureau of Watershed Management, in conjunction with the Bureau of Parks, designed a beach water testing pilot project for the duration of the 2001 swimming season. The pilot project involved weekly sampling of beach water at Harrington Beach State Park, Kohler-Andrae State Park and Point Beach State Forest.

City of Milwaukee EMPACT Study of Water Quality at Local Streams and Public Beaches (1998 and 1999)

The City of Milwaukee Health Department (MHD) partnered with the City of Racine Health Department (RHD), the U.S. Geological Survey, the University of Wisconsin-Milwaukee Great Lakes WATER Institute and other organizations to study five beaches in Milwaukee and Racine. The targeted locations were Bradford Beach, McKinley Beach and South Shore Beach in Milwaukee and Zoo Beach and North Beach in Racine.

Water at beach sites in Milwaukee and Racine was sampled from Monday through Friday during the 2002 swimming season. Additional samples were collected on Saturdays and Sundays if high E. coli counts were anticipated based on the previous week's sample results. MHD sampled Bradford, McKinley and South Shore Beaches, while RHD sampled the water at North Beach (in four different places), Zoo Beach (in three different places) and the English Street outfall.

Kenosha County Division of Health

Water at Kenosha's Eichelman Beach is sampled from Monday through Thursday. If E. coli standards are exceeded, additional samples are collected every day of the week until test results are again within the standards.

Ozaukee County Health Department

The Ozaukee County Health Department collects water samples at Port Washington Beach twice each week to monitor water quality. In addition, the following information is being collected at South Shore Beach in Milwaukee and North Beach in Racine: rainfall; wind speed and direction; air temperature; wave height; and water temperature, turbidity and conductance. This information and the Port Washington Beach monitoring data will be used to help identify short-term pathogen increases and pathogen increases resulting from storm events.

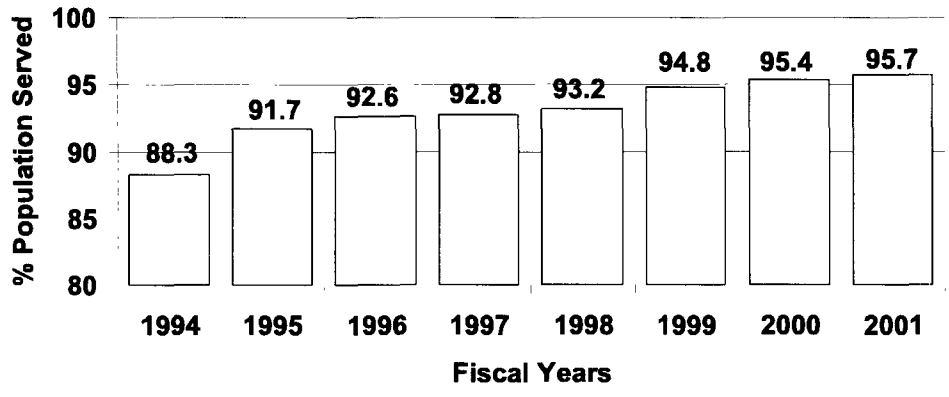
Our Goal: All People in Region 5 Served by Public Water Supplies Will Have Water That Is Consistently Safe to Drink

The vast majority of people in the Midwest have easy access to clean, safe drinking water. To make sure this does not change, EPA requires community water systems to sample and analyze their water regularly and to report on the quality of the drinking water that they are providing to the public. Each year, the Region 5 states receive analytical results for some 83 different contaminants found in samples collected from over 7,700 community drinking water supplies. As indicated in Figure 5-1, over 95 percent of the community water systems' customers receive water meeting all EPA health-based standards. The Region 5 states face a unique challenge in ensuring safe water in over 41,000 non-community water systems, or about 40 percent of the non-community water systems in the country. These non-community systems are usually very small and require extensive technical assistance.

The drinking water quality that we enjoy is no accident and should not be taken for granted. Region 5 and its state partners work with water

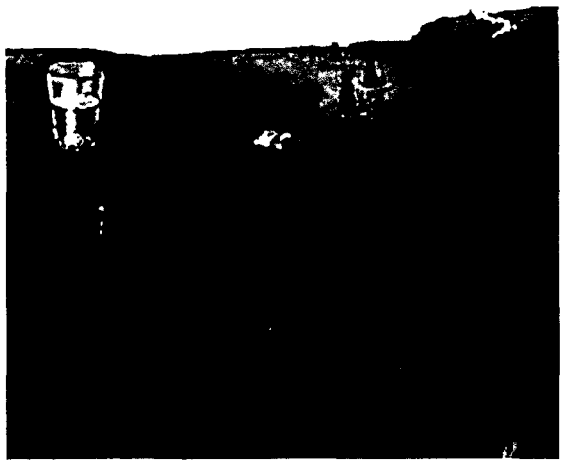
Community water systems are defined as systems that provide drinking water year-round to 25 or more of the same people or that have 15 or more water service connections. In addition, there are two other types of water systems: *non-transient non-community water systems* such as schools and *transient non-community water systems* such as highway rest stops. Each type has its own monitoring requirements.

Figure 5-1
Percentage Population Served by Community Water Systems Meeting All Health-Based Standards
Region 5 Totals



Source: EPA Region 5

In Region 5, about 23 million people (49 percent of the total population) rely on groundwater for their potable water supply, and the rest use surface water sources for their water supply.



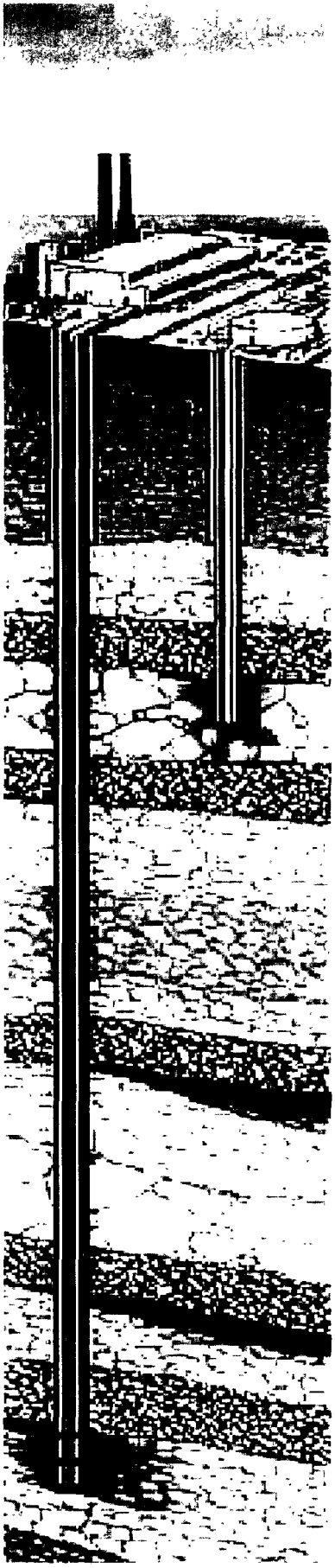
Source: EPA

suppliers to minimize the presence of harmful contaminants in drinking water, including total coliform bacteria, lead, nitrates and pesticides. In Region 5, all six states have primary authority for implementing EPA's drinking water program.

The importance of maintaining a safe water supply led Congress to pass the Safe Drinking Water Act in 1974 and to amend the act in 1986 and 1996. Under the act, each municipality, community or other group that operates a community water system, including groups on tribal reservations, must regularly monitor the quality of its drinking water.

EPA does not require testing of private water supplies, such as those serving just one home. People using a private well, however, would be well advised to monitor their water for both nitrate and bacteria. Nitrate contamination can come from fertilizers, septic systems and animal feedlots, and it poses a significant problem in many Region 5 groundwater sources. Excessive nitrate levels in drinking water can cause serious illness or death for infants under the age of 6 months. Information on how well owners can ensure the safety of their water supply is available on EPA's web site at http://www.epa.gov/safewater/pwells1.html.

In addition, the Safe Drinking Water Act established an Underground Injection Control (UIC) Program to deal with the largely uncontrolled discharge of fluids into the subsurface through deep or shallow wells and subsurface fluid distribution systems such as many of the tilefields that distribute effluent from large-capacity septic tanks. Deep injection



Deep injection wells
Source: EPA

Storm sewer outfalls inventoried during source water assessments are manageable contaminant sources for surface water supplies such as that served by the Alpena, Michigan, Water Treatment Plant.
Photograph Courtesy of EPA

wells include those drilled to dispose of industrial and municipal wastes, the by-products of oil and gas production, and fluids involved in mineral production. Shallow wells account for nearly all point- source discharges into the subsurface except for domestic sewage from single-family septic systems and small nonresidential septic systems serving fewer than 20 people per day.

Understanding Groundwater Dynamics in Minnesota

To help private well owners and decision-makers understand groundwater dynamics, the Minnesota Pollution Control Agency's Rochester Office partnered with EPA and the Minnesota Department of Natural Resources to present "Rocks and Water: Understanding Minnesota's Limestone Country"on the porous karst geology that allows quick migration of contaminants into groundwater, and their subsequent, rapid and unpredictable migration to potential points of human exposure, such as water wells and surface waters. For more information about groundwater in Minnesota, see *http://www.pca.state.mn.us/water/southeast-gwp.html.*

What Are the Major Sources Of Contamination in Drinking Water?

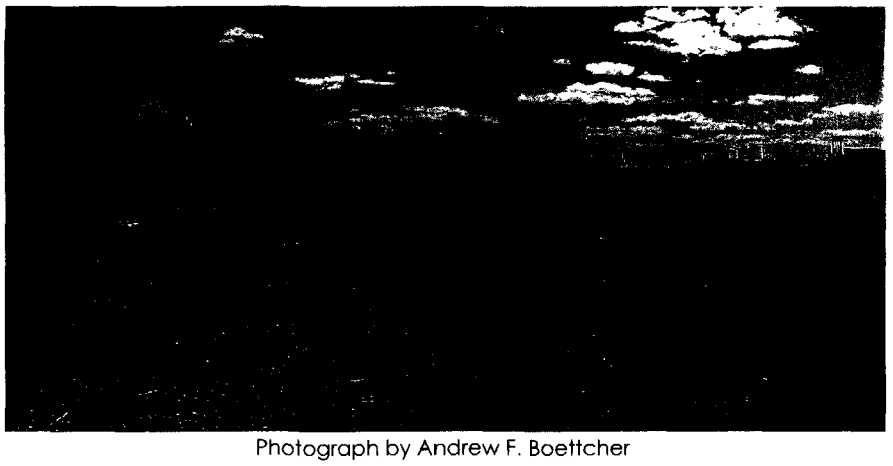
Although we know a great deal about the health impacts of drinking water contamination, many questions remain. Research continues to provide new information on health effects and to identify new potential drinking water threats.

The major sources of drinking water contamination include spills and faulty fuel storage, waste disposal, agricultural and industrial practices. Microbiological or chemical pollutants are released into the environment from these sources and make their way into groundwater or surface water. Some contaminants found in certain areas of the Midwest, such as arsenic and radium, occur naturally in soil and rock.

Uncontrolled and improperly managed injection wells are one of the major pathways though which contaminants can reach underground aquifers. Deep injection wells can pose a threat if they are not properly regulated, but shallow wells have had a far greater impact in Region 5. As many as 500,000 shallow injection wells are thought to exist nationally, and funding to control them has been very limited. Through these wells, untreated contaminants are often discharged directly into

Underground Injection Wells for Wisconsin Brownfield Cleanup

A Burlington, Wisconsin, brownfield site located along the Fox River near downtown Burlington formerly contained a coal gasification plant that contaminated soil and the underlying portion of the shallow aquifer. Among the contaminants found at the site are benzene, toluene and xylene. Approximately 300 injection wells are being used to introduce a mixture of iron oxide and hydrogen peroxide into the subsurface to promote degradation of the hazardous substances present. This project is being managed by the Wisconsin Department of Natural Resources (WDNR) and is a joint effort between the Bureau of Drinking Water and Groundwater, which has provided guidance for use of such injection wells as well as general oversight for the project, and the Bureau of Remediation and Redevelopment, which is directing the cleanup. With bioremediation the increasing choice at many cleanup sites, the role of UIC wells in such activities is expected to increase.



Photograph by Andrew F. Boettcher

actual or potential drinking water sources, or where treatment does occur, as in septic tanks, it is often insufficient to remove organic compounds, solvents, viruses and other potential health threats.

What Are We Doing to Address the Problems?

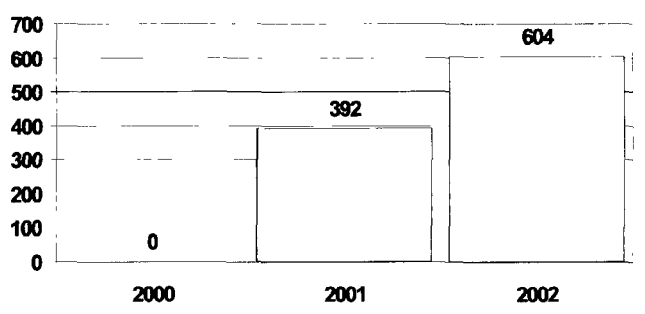
Source Water Protection

Preventing contamination from reaching drinking water supplies is the key to maintaining safe, affordable drinking water. To help accomplish this, states are establishing source water protection programs for drinking water supplies and are doing source water assessments to evaluate the potential for the water supplies to become contaminated. Figure 5-2 shows the number of assessments that have been completed in Region 5. Based on these assessments, source water protection areas are established and potential sources of contamination are identified. After the source water assessments are completed, activities to protect surface water and groundwater from the potential threats need to be identified and implemented. Protection efforts are most effectively implemented at the local level. Thus, the participation of the public in promoting protection of drinking water is key. It is much more expensive to clean up groundwater once it is contaminated than to prevent it from being contaminated in the first place.

The Region 5 states have been very active in source water protection. In Illinois, for example, the community of East Alton has been faced with a methyl tertiary butyl ether (MTBE) plume threatening the groundwater that is the source of its drinking water. MTBE is a natural gas derivative that boosts oxygen to make gasoline burn cleaner. Two leaking underground storage tank sites within the source water protection area for East Alton's water supply are being aggressively pursued for cleanup. Nearly $1 million has been spent to clean up each of the two sites, but the remediation is not yet complete. East Alton is also working on a groundwater protection ordinance and contingency planning procedures to safeguard its water supply from future problems.

Illinois has also adopted the state's first regulated recharge area regulation for the Pleasant Valley Public Water District. In the regulated recharge

Figure 5-2
Number of Community Water Systems With Source Water Assessments Complete Region 5 Totals



Source: EPA Region 5

area, a regulatory approach has been adopted to protect the district's source water protection area from potential contamination. Citizen involvement to support this action was key. The recharge area regulation requires existing and new potential sources of groundwater contamination to be registered with Illinois EPA. Certain types of new potential sources will be prohibited under the regulation, and a suitability assessment will be required for others.

In Michigan, 40 stakeholder groups were invited to assist with developing a Source Water Assessment Program (SWAP) by participating in the SWAP Advisory Committee. Implementation of the Michigan SWAP has strengthened federal, state and local partnerships to protect Michigan's public drinking water sources.

Michigan has also developed partnerships with EPA, the U.S. Geological Survey, the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration, the Detroit Water and Sewerage Department, Environment Canada and the American Water Works Association Research Foundation to develop a flow model used to define source water areas for 14 public water supply intakes on the connecting channels of the St. Clair River-Lake St. Clair-Detroit River system. These water supply intakes serve almost one-half of Michigan's population. Additional information on the Michigan SWAP and the Connecting Channels Flow Model is available at http://www.michigan.gov/deq and http://mi.water.usgs.gov.

Ohio EPA, with partial funding from a grant from EPA, partnered with the Great Lakes Rural Community Assistance Program to complete a regional source water assessment and protection plan for the karst region in Seneca, Sandusky, Huron and Erie counties. The karst region is characterized by high groundwater flow rates as well as a high susceptibility to and history of contamination. The protection area encompasses 15 public water systems that use groundwater and the watershed protection area for the City of Bellevue. Because groundwater in this region moves via large fractures and conduit flow, Ohio EPA delineated the entire region that contributes water via the karst system as a source water protection area. The karst region also includes portions of the watershed protection areas for Clyde, Tiffin and Fremont.

Education Programs in Minnesota

As part of an ongoing effort to develop an informed citizenry and increase drinking water awareness among teachers and students, the Education Committee of the Minnesota Section of the American Water Works Association, in conjunction with the Science Museum of Minnesota, a premier organization for teacher education in the state, held a 4-day seminar, "Water Works! A Drinking Water Institute for Educators." The seminar was designed to teach Minnesota teachers about drinking water, get them involved in inquiry-based activities and have them develop a plan for incorporating lessons and activities involving drinking water into their science curriculum. The goal of the seminar program is to eventually produce high school graduates in Minnesota who are both knowledgeable about drinking water and able to apply their knowledge in their daily lives.

Underground Injection Control

Under the UIC Program, deep injection wells have been strictly regulated because they can cause great harm to aquifers used as sources of drinking water. EPA and Region 5 state agencies, which have primary authority for the UIC Program, have gone to great lengths to ensure that these wells are properly sited, designed, constructed and operated. Among the safeguards taken is ensuring that these wells are completed in deep formations well below usable aquifers and that the waste is confined by shale and other impermeable layers. Deep injection wells are also required to have several layers of pipe and cement and are tested on a frequent basis using sophisticated logging techniques to ensure that leakage does not occur. In addition, a search is conducted for abandoned wells and other boreholes that could be close enough to an injection well to serve as unintended conduits for the fluids injected. If such abandoned wells are found, they must be properly plugged before use of the injection well is authorized.

Because shallow injection wells clearly pose a threat to shallow aquifers, EPA developed new regulations that became effective on April 5, 2000, for two of the most endangering well types: large-capacity cesspools and motor vehicle waste disposal wells. New wells of both types are banned, and existing large cesspools must be closed by 2005. In the Midwest, all existing motor vehicle waste disposal wells will be closed or required to obtain a strict permit. Any such wells located in source water protection areas will be addressed first in a phasing approach. States with primary authority and EPA are now implementing the new regulations. For instance, of the 12 injection wells that Ohio EPA closed during state fiscal year 2002, seven were motor vehicle waste disposal wells. Ohio EPA has

also completed a UIC inventory of endangering wells in five major Ohio counties, which included sending notifications to known motor vehicle repair facilities. The EPA Region 5 Direct Implementation Program, which covers Indiana, Michigan, Minnesota and tribal areas, has hired three new Class V field inspectors under the Senior Environmental Employment Program. Working on a county-by-county basis, these inspectors are identifying substantial numbers of motor vehicle waste disposal and other endangering wells. Regional office staff members are then working with the operators of these facilities to close or otherwise mitigate the problems caused by the wells.

Compliance Assistance

Region 5 states are providing compliance assistance to help water supply systems meet safe drinking water requirements. For example, the Indiana Department of Environmental Management (IDEM) initiated a compliance assistance program in July 2002 to help about 2,400 small systems serving fewer than 100 people each to do required water sampling for nitrate and bacteria analyses. If the required sampling and analysis are not done, the quality of the drinking water is unknown. IDEM is using state funds to analyze samples for the small systems. This small-system assistance program will be continued to complement IDEM's ongoing efforts to provide safe drinking water to the public.

WDNR has developed partnerships with state health agencies, the Wisconsin Department of Commerce, local municipalities and local health agencies to complete well sampling intended to determine whether arsenic levels in groundwater exceed the new safe drinking water standard that goes into effect in 2006.

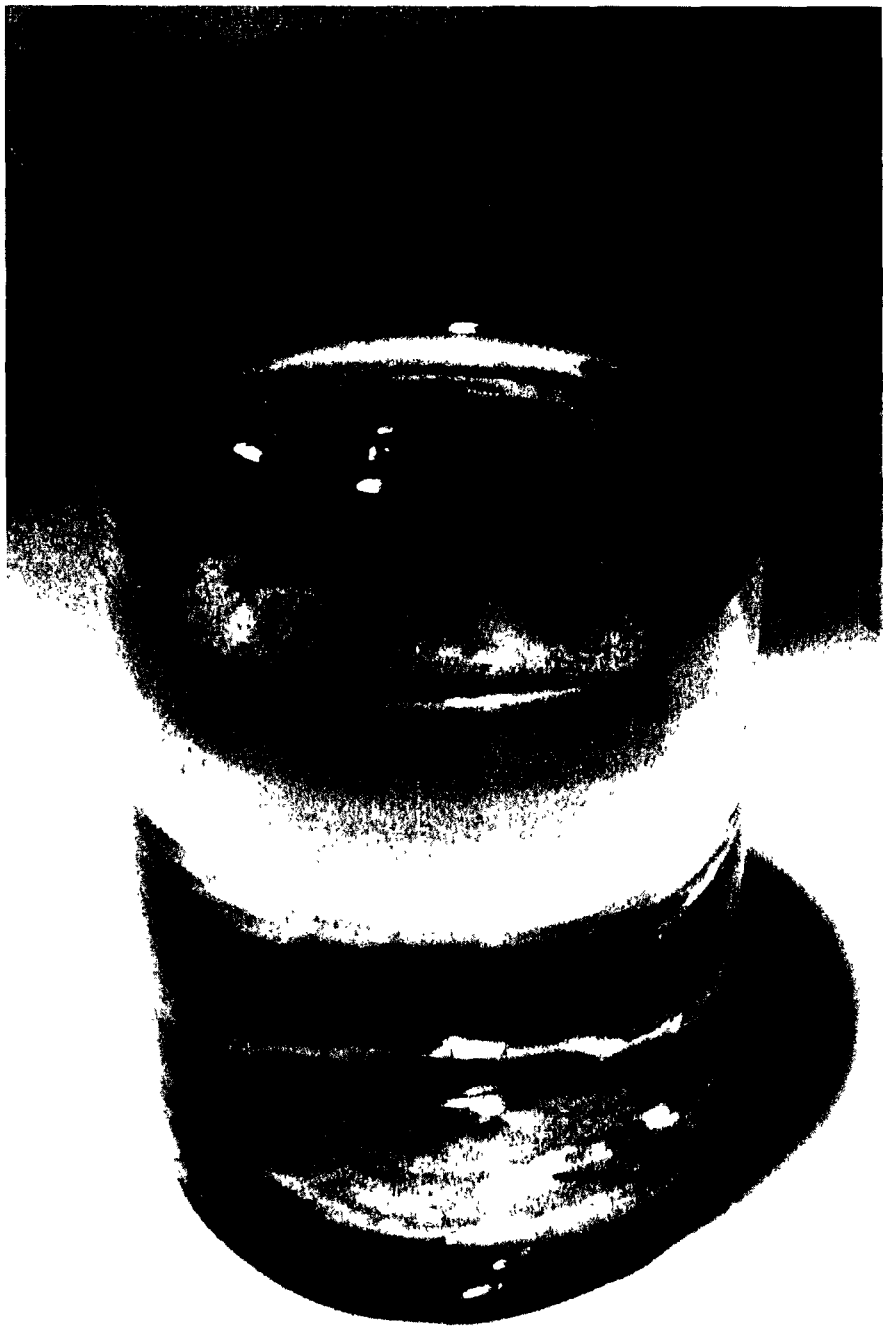
In addition, WDNR created a public information brochure on arsenic in cooperation with the Wisconsin Department of Health and Family Services. Moreover, in 2000, informational meetings were held in many of the townships in the Lower Fox River area to educate local residents about arsenic in their water supplies and possible solutions

Source EPA

Drinking Water Security

Following the events of September 11, 2001, EPA and the states have increasingly focused on protecting drinking water systems from possible terrorist threats. In Region 5, EPA has awarded over $5 million in grants to large public water systems in order to help them assess their potential vulnerabilities.

This effort represents a major step toward improving the security of large water systems and protecting the drinking water of millions of people. Each vulnerability assessment performed for a water system provides a prioritized plan for security upgrades, modifications of operational procedures, policy changes or a combination of approaches to mitigate the risks and vulnerabilities associated with the utility's critical assets.



to remedy the problem. See http://www.epa.gov/safewater/arsenic.html to get more information on the new arsenic standard for drinking water.

The vigilance of EPA's drinking water program extends beyond the tap. EPA is working cooperatively with the Region 5 states to

- Ensure that underground injection wells are properly drilled and operated so that groundwater aquifers are protected.
- Safeguard lakes and streams from spills of hazardous materials, effluent from sewage treatment plants and industrial facilities and runoff from agricultural and urban areas.
- Prevent contamination of groundwater and surface water by sponsoring household waste collection programs.

For more information on the Safe Drinking Water Act and frequently asked questions about drinking water, see EPA's web site at http://www.epa.gov/safewater or call the Safe Drinking Water Hotline at 1-800-426-4791.

Photograph by Jeffrey E. Edstrom

Consolidation of Tribal Public Water Systems

Small water supply systems often have difficulty complying with all the requirements necessary to ensure long-term protection of public health because of the complexities of drinking water regulations and of operation and management of a drinking water system. Therefore, Region 5 encourages consolidation of small tribal public water supply systems wherever possible. (EPA, not the states, has responsibility for overseeing tribal systems.) There are many benefits to consolidating small public water systems, such as reducing sampling and analysis costs, the required number of certified operators, the cost of source water protection efforts and the cost of the water produced. Consolidation also provides greater assurance of a safe, reliable supply of drinking water. During the past 5 years, a total of 26 tribal water supply systems have been consolidated with other systems, and about a dozen more consolidations are either proceeding or planned.

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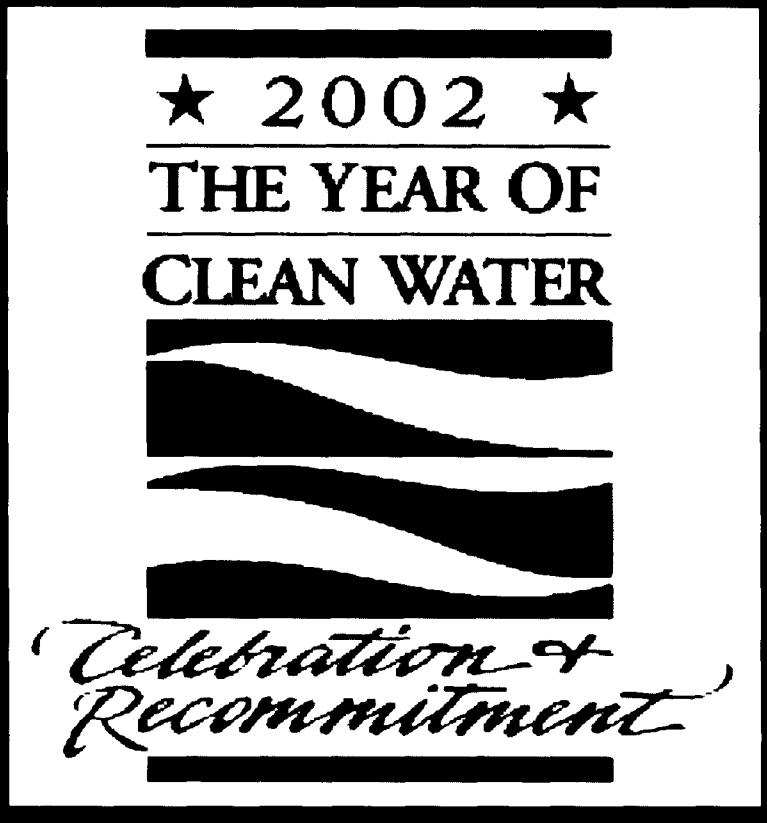
EPA Region 5 Partners and Stewards

Over the past 30 years, EPA Region 5 has worked in cooperation with the states, tribal nations and other federal agencies in our six state region to improve the quality of our water resources. Much progress has been made through our mission of working together to identify, solve, and prevent important water resource problems. This report is intended to provide information on the status of our waters and recognize some of our partners' efforts and successes for our five shared water goals. The results reflected in this report are the outcomes of the collaborative efforts of many key partners.

In addition, there are many other entities that carry out programs that contribute to improving the quality of water resources within the Region, including: county soil and water conservation districts, county health departments, multi-county planning commissions, universities and extension offices, state and federal agricultural agencies, industry, environmental groups, local watershed groups and interstate basin organizations.

Finally, EPA Region 5 recognizes the citizens that contribute to the accomplishments reflected here, both individually and through the collective outputs of many volunteer organizations, and who will continue to carry the banner of environmental stewardship into the future.

Clean Water Everywhere for Everyone, It's Up to You!



2002: The Year of Clean Water - To commemorate the 30th Anniversary of the Clean Water Act, Congress has proclaimed 2002 as "the Year of Clean Water." This Anniversary provides an excellent opportunity for all Americans to participate in the process of cleaning and protecting our nation's rivers, lakes, bays, estuaries and oceans. For more information see: www.yearofcleanwater.org