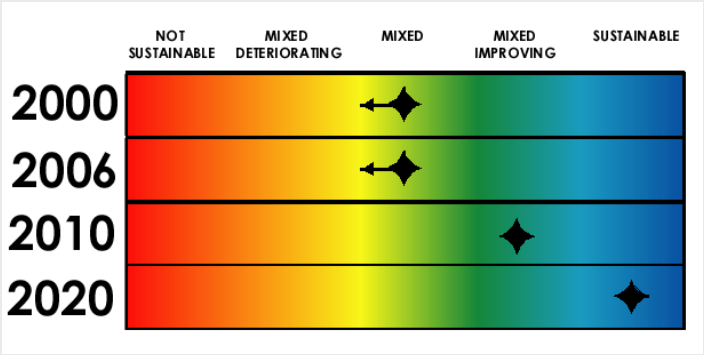
Subgoal 4
Are all habitats healthy, naturally diverse, and sufficient to sustain viable biological communities?

Status

The Lake Michigan ecosystem continues to experience profound changes because of development, impacts of nuisance species, and pollutant loading. Many species' habitats rank as globally rare or imperiled based on their restricted distribution, the level of threat, their ecological fragility, and widespread damage or because they are part of the single largest source of fresh surface water in the world.

Lake Michigan Target Dates for Sustainability



Indicators (State of the Lakes Ecosystem Indicators by Number)

- 6 - Fish Habitat
- 8 - Salmon and Trout
- 17 - Preyfish Populations and Communities
- 93 - Lake Trout
- 104 - Benthos Diversity and Abundance
- 109 - Phytoplankton Populations
- 111 - Phosphorus Concentration and Loadings
- 116 - Zooplankton Populations
- 117 - Atmospheric Deposition of Toxic Chemicals
- 124 - External Anomaly Prevalence Index for Nearshore Fish
- 125 - Status of Lake Sturgeon in the Great Lakes
- 1123 - Benthic Amphipod (Diporeia spp.)
- 4504 - Coastal Wetland Amphibian Diversity and Health
- 4507 - Wetland Dependent Bird Diversity and Abundance
- 4510 - Coastal Wetland Area by Type
- 4858 - Climate Change: Ice Duration on the Great Lakes
- 4861 - Effect of Water Level Fluctuations
- 4862 - Coastal Wetland Plant Community Health
- 7000 - Urban Density
- 7002 - Land Cover- Land Conversion
- 7006 - Brownfield Redevelopment
- 7028 - Sustainable Agricultural Practices
- 7043 - Economic Prosperity
- 7056 - Water Withdrawal
- 7100 - Natural Groundwater Quality and Human Induced Changes
- 7101 - Groundwater and Land: Use and Intensity
- 7102 - Base Flow due to Groundwater Discharge
- 7103 - Groundwater Dependent Plant and Animal Communities
- 8114 - Habitat Fragmentation
- 8129 - Area, Quality, and Protection of Special Lakeshore Communities - Alvars; Cobble Beaches; Islands; Sand Dunes
- 8131 - Extent of Hardened Shoreline
- 8132 - Nearshore Land Use
- 8136 - Extent and Quality of Nearshore Natural Land Cover
- 8137 - Nearshore Species Diversity and Stability
- 8142 - Sediment Available for Coastal Nourishment
- 8146 - Artificial Coastal Structures
- 8150 - Breeding Bird Diversity and Abundance
- 8161 - Threatened Species
- 9003 - Climate Change: Effect on Crop Heat Units

Challenges

- Restore and protect 125,000 acres of wetlands in the basin
- Changes in climate, lake levels, ground water recharge of streams at both the lake basin and sub watershed scale
- To make habitat information on status and value readily available
- To build on the above challenge to promote projects, to identify, enhance, restore, or protect critical ecosystem features and habitat through purchase or voluntary protection or improved management
- Stress on habitats based on predicted growth and development of coastal areas of the basin

Next Steps

- Develop process to refine targets through public discussion and promote work toward targets
- Continue to support components of lake basin biodiversity plan though watershed academy grants
- Identify species sensitive to ground and surface water interaction
- Provide GIS tools and land use models in workshops to promote knowledge of and protection of key habitat areas and trends in loss and gain
- Promote new stream buffers, wetlands, and dam removals using, federal, state, local, and private resources and monitor loss and gain trends

Background

Habitats in the Great Lakes basin are many and varied. This chapter discusses the status and challenges of aquatic, terrestrial, and animal habitats. Each face challenges based on significant changes in land use, invasive species, pollution, and climate change.

Past LaMP Updates have detailed the elements that make up the Lake Michigan basin's many diverse ecosystems- from southern dune and swale to northern forest and the open lake's very significant aquatic food web. For LaMP 2006 we are presenting the lake by its 33 drainage basin watersheds. These watershed fact sheets contain information that resulted from a unique partnership with the Nature Conservancy's Great Lakes Program. They have provided us with the "headlines" of their very detailed work on Great Lakes biodiversity and the Natural Heritage Programs' data and for the first time broken down to the watershed level. Their complete work can be found at www.nature.org/greatlakes or contact them at greatlakes@tnc.org (see Chapter 12).

An important component of the Great Lakes Regional Collaboration was the defining of restoration targets and needed resources for five lakes and eight states. This chapter begins the needed work to define the priorities for protection and restoration for the Lake Michigan basin and portions of the four states. Each of the states has taken a different approach from Illinois's consultation with other state agencies to Wisconsin's series of public sessions across the state and Indiana had an Area of Concern target that had been developed. Michigan's statewide goals then needed to be sub-divided into four lake drainage basins and was probably the most complex.

The following targets are presented for discussion and comment not only as to quantity, but location, priority and tools to accomplish the goals. The LaMP Habitat Committee responded to the GLRC target goals for the Great lakes basin by reviewing habitat losses and proposing to increase net wetlands by 125,000 acres for the Lake Michigan basin. Eighty-nine thousand of these acres would be in Michigan, 30,000 in Wisconsin, and 1,000 acres each for Illinois and Indiana. Additional details are provided in previous LaMP reports.

Great Lakes Regional Collaboration Action Items

Habitat

The plants and animals of the Great Lakes need habitat in order to survive in the future, and there is a need for significantly more **habitat conservation and species management**. The recommendations focus on:

- native fish communities in open waters and near shore habitats;
- wetlands;
- riparian (streams) habitats in tributaries to the Great Lakes; and
- coastal shore and upland habitats.

Threats to the Food Web Foundation

The plankton communities (microscopic plant and animals) of Lake Michigan are the foundation of the aquatic food web and therefore are one of the most critical components of the lake's ecosystem. Changes to these communities may be occurring as a result of the presence of contaminants and/or nutrients in the water and sediment as well as competition from invasive species such as the spiny water flea (*Bythotrephes cederstroemi*) and the zebra mussel (*Dreissena polymorpha*).

The abundance and types of phytoplankton are highly variable within the lake, depending on the time of year, area of the lake, and availability of phosphorus and other nutrients. They are generally found throughout the open lake waters to the depths of light penetration. The amount of phosphorus in the lake is an important man-induced change to phytoplankton communities, especially in nearshore areas. In addition, studies indicate that increased salinity and other (possible climate) environmental changes in Lake Michigan are enabling nonindigenous animals and algae to adapt more readily to the Great Lakes environment.

Zooplankton communities include many different invertebrates and comprise the bulk of the planktivorous fish diet. Because most zooplankton

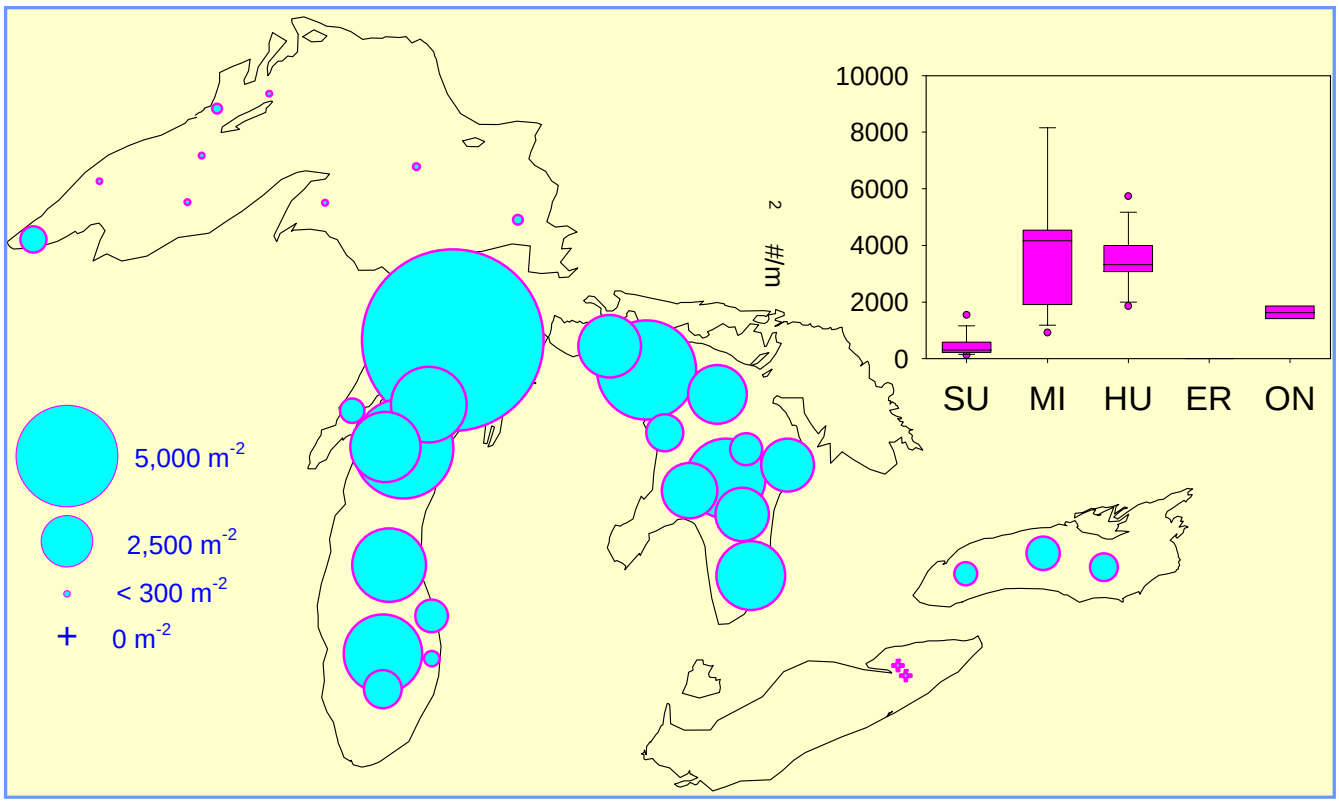


Figure 4-1. Diporeia density in the Great Lakes 1997

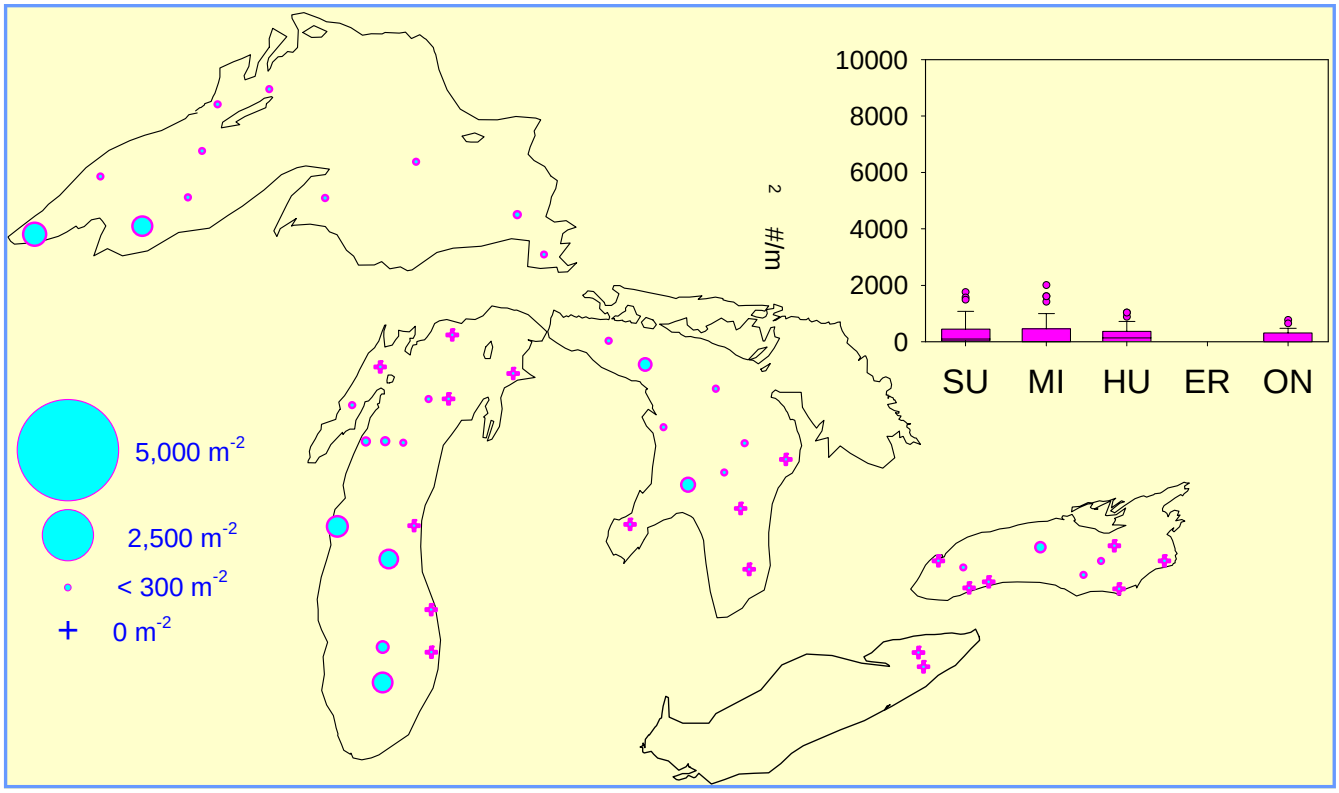


Figure 4-2. Diporeia density in the Great Lakes 2004

Source: David Rockwell, Environmental Scientist, MIRB-GLNPO; Dr. Richard Barbiero, Ph.D., Senior Environmental Scientist, CSC; Thomas Nalepa, Research Biologist, GLERL, NOAA; Dr. Mary D. Balcer, University of Wisconsin-Superior

Little River Band Releases Lake Sturgeon Fingerlings

(From an article by Jennifer Dale in "Protecting Our Resources," CORA newsletter September 2005)

Over 100 people from all walks of life came together on the banks of the Manistee River Aug. 27, 2005 with a common desire to see the Manistee River's lake sturgeon make a comeback. The group circled the streamside home of 50 baby sturgeon to celebrate the release of the youngsters into the river.

"There are children here today," said Jimmy Mitchell, chairman of the Natural Resource Commission. "When they see the sturgeon coming back as adults, they'll remember this day."

Anishinabe call the lake sturgeon "Nmé," and have an ancient relationship with it that has been treasured throughout the centuries. Every spring Anishinabe would reunite on the banks of the Manistee to await the spring run of Nmé. But no longer. The Manistee River lake sturgeon population has dwindled near extinction.

The Little River Band of Ottawa Indians decided to do something about it by developing a Nmé Stewardship Plan for the Manistee River lake sturgeon. The plan, developed by tribal biologists and a cultural taskforce, aims for a population 750 lake sturgeon in the Manistee in 25 years. It takes the wholistic approach toward the seventh generation, working a healthy habitat for Nmé and Anishinabe alike.

The lake sturgeon is considered a cultural indicator species. To lose these particular sturgeon would be to lose a significant element of the Anishinabe community's heritage and cultural identity.

"The sturgeon is an individualistic fish," said Inland Fisheries Biologist Marty Holtgrenz. "Tissue samples show a sturgeon's origin. The sturgeon returns to the river it spawned in. We want to preserve the fish genetically unique to the Manistee River."

A baby sturgeon that, hopefully, will return from Lake Michigan to spawn in the Manistee River some day. (Photo Courtesy of Stephanie Ogren)

Releasing the sturgeon into the Manistee River (photo courtesy of Robert Ogren)

feed on phytoplankton, their abundance and geographic occurrence are similarly dependent upon water temperature, seasonal changes, and food availability. Zooplankton colonize open waters from the surface to the lakebed. Research conducted in the past 15 years indicates that zooplankton populations such as *Daphnia*, may be experiencing changes induced by *Bythotrephes*, an exotic species.

The *Diporeia spp.*, also known as scuds, sideswimmers, beach hoppers, and sand fleas, belong to the group of invertebrates called amphipods and are about 0.5 inch long. *Diporeia* have inhabited Lake Michigan since the Great Lakes were formed 5,000 to 10,000 years ago, and they are environmentally sensitive, thriving only in clean, cold, well-oxygenated water. *Diporeia* are eaten by a variety of Great Lakes fish and provide an important energy source because they contain high amounts of fat.

The numbers and density of these amphipods is decreasing in Lake Michigan. The change between 1997 and 2004 is dramatic (see Figure 4-1 and Figure 4-2). While scientists have not yet determined the exact cause of the disappearance of the amphipods, they suspect it is linked to the

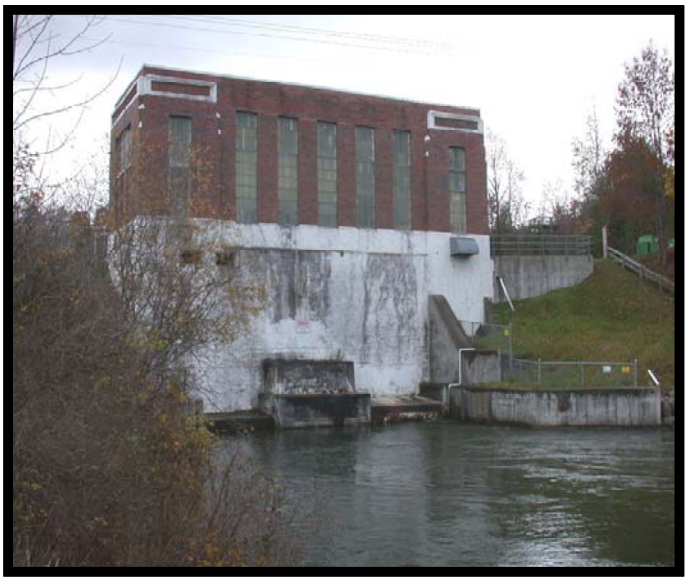
Boardman River Dam Settlement

The East Lansing Field Office of the Fish and Wildlife Service joined several parties, including the Michigan Departments of Environmental Quality and Natural Resources, the Grand Traverse Band of Ottawa and Chippewa Indians and the Traverse City and Light Power Department, in reaching a settlement regarding the future of three dams on the Boardman River. After license surrender and decommissioning, East Lansing Field Office personnel will join other signatories to explore the future of the dams, including the engineering and feasibility of possible dam removal.

This settlement has national implications as there are 79,000 dams nationwide and 2,500 in Michigan. Dam removal is becoming a more cost-effective solution in some cases as a University of Wisconsin study indicated that repairs to dams can cost three to five times more than the costs of removing a dam.

Dam removal in other areas have resulted in native species returning once a free flowing stream is restored.

More information is available at: www.theboardman.org



A dam on the Boardman River
Source: U.S. Fish and Wildlife Service

introduction of zebra mussels in Lake Michigan in 1989, severely limiting the food available to *Diporeia.*

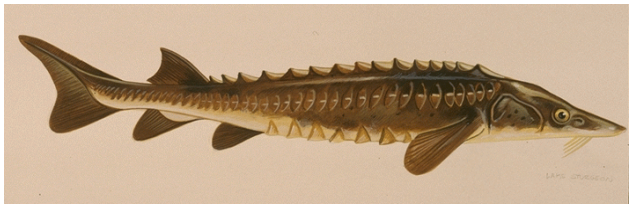
In addition, zebra mussels appear to be having a significant impact on benthic (bottom-dwelling) community structures and plankton abundance. Zebra mussels, which can attach themselves to any hard surface in the lake, have reached densities higher than 16,000/m^2 in southern Lake Michigan. Negative impacts of their presence include increased food competition (at the expense of fish fry) for nearshore fish species (such as yellow perch), increased biomagnification of contaminants in fish eaters feeding on organisms that eat benthic organisms, and possible zebra mussel-induced mycrocystis blooms, which affect taste and odor in the water.

Status of Important Fish Species at the Top of the Food Chain

Lake Sturgeon

Eight species of sturgeon live in American waters today. Four are endangered and another is threatened. Unlike most other fish, sturgeon mature late and reproduce slowly. Sturgeons survive in the Great Lakes only in scattered remnants, even though large-scale commercial fishing for them ended a century ago.

Lake sturgeon populations in Lake Michigan continue to sustain themselves at a small fraction of their historic abundance. Based on available data, an optimistic estimate of the lakewide abundance of adult lake sturgeon is below 5,000 fish, well below 1% of the most conservative estimates of historic abundance. Remnant populations currently are known to spawn in waters of at least 8 tributaries having unimpeded connections to Lake Michigan. Estimates of spawner abundance in these rivers range from just a few fish to several hundred annually. Successful reproduction has been documented in six tributaries to date, though it is suspected in several others.



Lake Sturgeon
Figure Courtesy of the Ontario Department of Fisheries and Oceans

There are currently 16 agencies and institutions involved with investigations of lake sturgeon in Lake Michigan, including determining the status of known and suspected remnant spawning populations. Reintroduction efforts have been ongoing in upriver reaches of the Menominee and Wolf rivers for several years and were initiated in the Milwaukee and Manitowoc rivers in 2003. Indications are that spawning is increasing in tributary rivers.

A Lake Sturgeon Task Group has been formed under the auspices of the Great Lakes Fisheries Commission Lake Michigan Committee to develop and coordinate the implementation of a lake-wide lake sturgeon rehabilitation plan for Lake Michigan.

The Little River Band of Ottawa Indians is supporting sturgeon restoration efforts in 4 tributaries around Lake Michigan. More information is available at www.fws.gov/midwest/Tribal/LittleRiver.html.

More information about sturgeon restoration activities is available at: www.fws.gov/midwest/sturgeon/.

Lake Trout

Lake trout *(Salvelinus namaycush)* is a North American salmonid that thrives in cold, fresh water. Following the retreat of the last glacier, the lake trout colonized Lake Michigan, and over the subsequent 10,000 years or so, it became the top predator in a complex ecosystem that co-evolved with the other fish species.

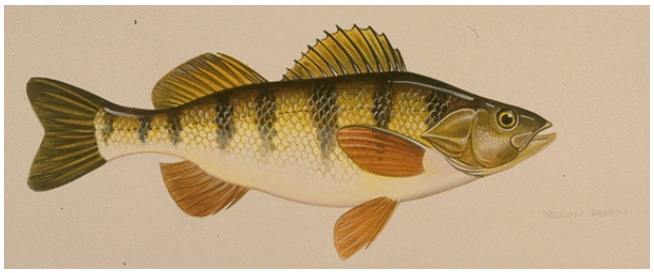
Lake Trout
Courtesy of the Ontario Department of Fisheries and Oceans

During the 1800s, Commercial fishing for lake trout also became an industry, and by the beginning of the 20th century, the lake trout population was in decline. The decline continued until the mid-1950s, when predation by sea lamprey, overfishing, and the effects of industrial pollution led to the destruction of lake trout fisheries and the disappearance forever of many of the strains of lake trout that had evolved in the lake.

Currently, federal, state and tribal management agencies around the lake are attempting to re-establish naturally reproducing populations of lake trout by planting yearlings and eggs in historical spawning areas. Assessments indicate that self-sustaining populations of lake trout have yet to be established. Research into the reasons for this failure are ongoing, but may include:

- Loss of suitable spawning habitat
- Environmental contaminants
- Predation on larval lake trout by alewife
- Thiamine deficiency from a diet of alewife
- Loss of genetically distinct strains

Lake trout are again naturally reproducing in Lake Superior.



The Perch
Courtesy of the Ontario Department of Fisheries and Oceans

Perch

The number of yellow perch in Lake Michigan dropped dramatically during the late 1980s through the 1990s. However, recent reports by the Lake Michigan Yellow Perch Task force indicates that the number and size of perch population are increasing. Although more information is needed, these studies may indicate some recovery in the yellow perch population:

- In 2002, the LaMP update reported that the number of yellow perch egg masses found in spawning areas in the lake increased from 0.5 per 1,000 square meters (m^2) searched in 1997 to 7.29 per 1,000 m^2 searched in 2001. That number increased to 11.53 per 1000 square meters in 2002.
- In 1998, a total of 4,512 yellow perch were captured during a spawning assessment, of

which only 221 or 4.9 percent were females. In 2001, a total of 1,431 yellow perch were captured; 993 were males, and 438 (31 percent) were females. The percentage of females captured in 2002 dropped to 11 percent of 1812 total captured.

- The trend to detect the 1998 year-class continued . This year was particularly strong. Trawl surveys on the bottom of the lake and surveys of angler catch show the average yellow perch is now 11 inches in Indiana waters, up from 8 inches before commercial fishing was banned. This indicates that the closure of the fishery has allowed the perch to recover. Perch hatched in 1998, the year after commercial fishery was closed has grown to maturity and spawned new young perch.
- The 2005 year is so far the best ever recorded and the recovery getting stronger.
- The size of the perch population may level off in the next few years due to the amount of food available for the fish.

More information is available at http://dnr.wi.gov/org/water/fhp/fish/lakemich/YELLOWPERCH.htm

Land Use Changes

The Lake Michigan basin is seeing changes in land use over the last several years. According to the National Land Cover database, land is used primarily for agriculture. However, according to the Coastal Change Analysis Program overseen by NOAA, development is encroaching on the farmland. Forest land has decreased by a small amount, but this decrease is being more than offset by an increase in tree farming as evidenced by an increase in shrubland. Wetlands saw a slight increase between 1996 an 2001, indicating that wetland restoration and protection programs have had an effect.

Wetland Programs

Wetland restoration programs have seen a significant increase in activity. The Great Lakes Regional Collaboration set a goal of increasing the net acreage of wetlands Great Lakes basin-wide by 1.1 million by 2020. Michigan set a target acreage for its portion of the Lake Michigan basin at 89,750. Wisconsin has set a target statewide of an increase in 30,000 acres. Both states have developed programs that encourage wetlands restoration using state and private programs.

The Lake Michigan Toolbox
Milwaukee Pilot Project Offers Wetland Data Tools

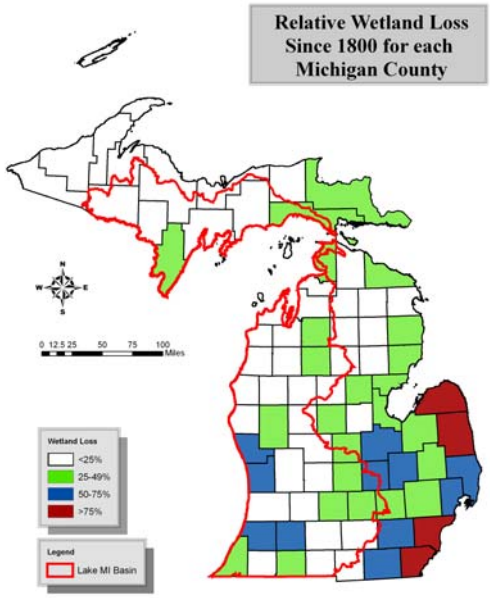
In the last few decades, scientists have confirmed the critical role wetlands play in urban as well as rural areas. Not only do they provide habitat to a wide diversity of valuable plants and animals, wetlands reduce flooding, protect surface water quality, and provide scenic beauty and open space. Many of the wetlands in the Milwaukee River Basin have been destroyed, filled in or drained to create farm fields, cities and roads. The Milwaukee River Basin Wetlands Assessment Project seeks to understand the consequences of these losses and examine options for future planning. Questions the project will consider includes: What wetland resources do we have left and how do they benefit us? Where can former wetlands be restored for the most benefit for people and wildlife in the basin?

The Milwaukee River Basin Wetlands Assessment Project is a pilot project that will develop tools to improve planning wherever wetland resources are a concern. It will provide governments, conservation organizations, and other decision makers these tools to better understand where wetland restorations are most likely to improve habitat or water quality. These tools are a way of analyzing the relative level wetlands in small catchments provide wildlife habitat and water quality treatment (through sediment trapping/ nutrient) to protect downstream waters. They relate more to "ecosystem services" than to wetland biological integrity.

The project is spearheaded by the Wisconsin Department of Natural Resources through a grant from the U.S. Environmental Protection Agency. More information is available at: http://basineducation.uwex.edu/milwaukee/df/3milwetlands.pdf

Wetland Restoration In the Michigan Portion of the Lake Michigan Watershed

The Michigan's Wetland Conservation Strategy (Michigan Department of Environmental Quality, 1997) was developed by Michigan's Wetland Advisory Committee (MWAC) to provide a framework for effective protection and management of Michigan's unique wetland resources. Michigan has experienced an estimated 50% loss of the state's wetland resources since the colonial times including an estimated 70% loss of Michigan's coastal marshes.



The Strategy established a short-term wetland restoration goal of increasing Michigan's wetland base by 50,000 acres by 2010 (one percent of historic losses); and a long-term goal to restore, create, and enhance 500,000 acres of wetlands (ten percent of historic losses). The Strategy also includes a short-term recommendation that wetland restoration efforts should, to the extent feasible, focus on geographic areas, including coastal areas, which have lost the highest percent of wetlands and wetland function. The figure titled, "Relative Wetland Loss Since 1800 for each Michigan County" identifies wetland loss percentage for Michigan counties.

The Strategy acknowledged that it was not feasible to fund the restoration of the wetlands needed to meet the established goals through a new and distinct program. Rather, implementation would occur largely by taking advantage of opportunities presented through a variety of ongoing resource management initiatives designed to enhance fish or wildlife habitat, protect or improve water quality, provide increased flood control, or for related purposes. The Strategy also acknowledged that wetland restoration was dependent upon the coordinated efforts of numerous ongoing resource management programs and on the interest of individual landowners.

The Michigan Department of Environmental Quality has estimated historical wetland acres and current vegetated wetland acres in the Michigan portion of the Lake Michigan basin as 4,412,700 and 3,515,200 acres respectively. That means a total historical loss of 897,500 acres, or 20 percent.

Michigan is on schedule to meet the 50,000 acre short term goal on or shortly after the target date of 2010. Statistics for the major federal wetland restoration programs for the years 1999 through 2003 reveal that approximately 3,800 acres of wetlands are being restored in Michigan each year. The Michigan Department of Natural Resources (MDNR), Ducks Unlimited (DU) and other conservation organizations also have wetland restoration programs

From this data, MDEQ estimated both wetlands lost and the portion of the Michigan Wetland Conservation Strategy goals that relate specifically to the Michigan portion of the Lake Michigan basin. As a result, the Lake Michigan portion of the Michigan wetland restoration goals are restoring 1% of the lost wetlands (or 8,975 acres) and in the long term, 10% (OR 89,750 acres)

Federal Agency	Program	Average Annual Acres of Wetlands Restored since 1999
USDA Natural Resource Conservation Service	Wetland Reserve Program	2,500
US Fish and Wildlife Service	Partners for Fish and Wildlife Program	700
USDA Farm Service Agency	Continuous Conservation Reserve Program	
USDA Farm Service Agency	Conservation Reserve Enhancement Program	600*
Total		3,800

As anticipated in the Strategy the State of Michigan is on course to meet its established short term wetland restoration goal in large part because of the variety of wetland restoration programs available and the cooperation and coordination between the agencies and organizations involved.

A wetland restoration project tracking database and pilot collection system maintained by NRCS, USFWS and WDNR is working to help track wetland loss. This project involves collecting a uniform set of data to track wetland restoration projects done by the major organizations responsible for wetlands. The project also involves establishing a geospatial database that contains the tracking data. The objective in this project is to plug a major gap in reporting wetland "gains" achieved through voluntary restoration projects and to resolve the problem of double and triple counting the acres involved when these players collaborate on a restoration project. Many wetland losses are not known because we have no way of accounting for illegal losses and those which do not require a permit. The project will report wetland losses and gains that are captured through the wetland permit tracking and compensatory mitigation databases to generate an overall status report on known wetland activities.

Buffer Strips

Stream bank buffer strips not only provide buffers against nonpoint pollution, they protect aquatic and stream bank habitat and provide for more natural flow of streams.

Well managed riparian buffers generally support larger populations of wildlife because the buffer provides many habitat requirements. In a stratified forest, different habitat zones exist vertically, including the soil-air interface, herbs and shrubs, intermediate height trees, and the canopy. Included with the leaf litter and rotting logs at the soil-water interface are insects, These organisms are a food source for reptiles, amphibians, small field mammals, and birds. The herbs and shrubs provide habitat for insects, birds, and mammals. The intermediate zone and the canopy serve as habitat for birds, bats, squirrels, opossums, and raccoons. Bird habitat may be highly stratified and birds generally show a preference for certain layers that differ in habitat characteristics and food sources. See Chapter 7 for information

The Great Lakes Regional Collaboration set goals for the Great lakes basin at 1.1 million new acres of buffer strips. The states are beginning to set targets for buffer strips for Lake Michigan streams.

Next Steps

- Develop process to refine targets through public discussion and promote work toward targets
- Continue to support components of lake basin biodiversity plan though watershed academy grants
- Identify species sensitive to ground and surface water interaction
- Provide GIS tools and land use models in workshops to promote knowledge of and protection of key habitat areas and trends in loss and gain
- Promote new stream buffers wetlands, and dam removals using, federal, state, local, and private resources and monitor loss and gain trends

USFWS Awards Grant to Bring Back Hegewisch Marsh

The U.S. Fish and Wildlife Service awarded a $750,000 grant to the City of Chicago to help restore Hegewisch Marsh. The money will pay for removing invasive plants and restoring wetlands back to preindustrial conditions of more than a century ago. The goal is to make the marsh more attractive to birds that nest there or use it as a stop on the migratory flyway that follows the shore of Lake Michigan. These include yellow-headed blackbirds and black-crowned night herons, both of which are on the state's endangered list. The project partners, including the State of Illinois, the City of Chicago and the Chicago Field Museum and the Conservation Fund are providing an additional $510,000 for the restoration effort.

The marsh, located in the Lake Calumet region, is part of 4,800 acres of protected wetlands and woodlands near mostly unused industrial buildings and factories. Plans for the site include trails through woods, and sedges and meadows surrounding the marsh. Observation platforms will be built for bird watchers and other tourists from the nearby Ford Calumet Environmental Center.

National Coastal Wetlands Conservation grants are awarded to states through a competitive process. The program is funded under provisions of the 1990 Coastal Wetlands Planning, Protection and Restoration Act, with money generated from excise taxes on fishing equipment and motorboat and small engine fuels. Including the 2006 grants, the Service has awarded more than $165 million in grants to states and territories since the program began. More than 200,000 acres nationwide have been protected or restored through the program. The Hegewisch Marsh project is one of three projects in the Midwest Region to receive funding from the program this year. The other two projects are in Michigan:

The Lake Michigan Toolbox
Great Lakes Basin Landscape Ecology Metric Browser

USEPA designed a Great Lakes Basin Landscape Ecology Metric Browser. The principal focus of this project is the mapping and interpretation of landscape scale (i.e., broad scale) ecological metrics among hydrologic units and within 1 km, 5 km, and 10 km regions of coastal land in the Great Lakes Basin (GLB). Much is still unknown about the ecological relationships between human activities, surface water quality, and the biological characteristics with the GLB. This browser is an important step toward understanding the distribution of these phenomena and the analyses of their interrelationships.

The browser is designed to present some key ecological metrics to the GLB public and research communities at a landscape scale and will be updated as additional analyses are completed. For additional information regarding the topic of landscape ecology, visit the following web site: www.epa.gov/nerlesd1/land-sci/intro.htm. This is the initial presentation of landscape metrics for the GLB; for current applications of these metrics and results from other related topics in the Great Lakes, visit the following web site: www.epa.gov/nerlesd1/land-sci/wetlands.htm.

The Browser is located at: www.epa.gov/nerlesd1/land-sci/glb_browser/GLB_Landscape_Ecology_Metric_Browser.htm

The Lake Michigan Toolbox
WildLink Program Helps Landowners Keep Space Open for Wildlife

The WildLink Program is overseen by the Conservation resource Alliance and assists volunteer land owners in managing private-property corridors used by wildlife for travel between one large parcel of land (such as state-owned wildlife areas) to another. Its aim is to preserve the rural character of northwestern Michigan for outdoor recreation, hunting and wildlife watching in natural surroundings.

Wild Link focuses on parcels which fall within ecological corridors, or pathways of habitat. These privately owned corridors provide the critical connections between larger protected public properties.

The program, funded by the U.S. Fish and Wildlife Service, assists land owners in outlining a five to ten-year voluntary program for developing or modifying land use in order to keep wildlife corridors open for animal movement.

www.rivercare.org/wildlink/wildlink.php

U.S. Fish and Wildlife Service Coastal Programs in the Great Lakes

Monitoring protection, and captive rearing of the Great Lakes Population of the Piping Plover

The objectives of this multi-party cooperative effort on behalf of the endangered Great Lakes piping plover population include:

- To estimate total number of nesting Piping Plover pairs, eggs laid, eggs hatched and chicks fledged.
- To document breeding distribution.
- To determine, when possible, cause of mortality of eggs, chicks and or adults.
- To determine spatial use of piping plover breeding habitat.
- To implement and evaluate protection/recovery strategies (e.g. nest exclosures, beach closure, salvage, rear and release abandoned eggs).
- To make recommendations to improve nesting success, long-term plover population persistence, and ultimately, population recovery.

Partners include University of Minnesota Coop Unit of the USGS, Zoos, and volunteers.

Managing and Monitoring the Pitcher's Dune Thistle and the Dwarf lake Iris

Under this project, the Wisconsin DNR will collect and compile updated status information for Pitcher's dune thistle and dwarf lake iris populations in Wisconsin. The goal is to:

- Develop and implement long-term dune thistle management and monitoring;
- Write management recommendations for private land.
- Continue landowner contact efforts to promote the protection of biological diversity of Great Lakes coastal ecosystems.
- Obtain voluntary protection agreements to protect dwarf lake iris at Idlewild Alvar and Sand Bay sites.

A Dune thistle and dwarf lake iris status table and photo CD was submitted to the Wisconsin Natural Heritage Inventory program and USFWS Green Bay ESFO. Management plans for at least 2 properties were prepared as outlined in Measurable Results section of application and management recommendations were completed for 2 privately owned dune thistle sites. Additionally, three outreach and education initiatives have been completed.

Great Lakes Regional Collaboration Goals and Recommendations Relevant to the Lake Michigan LaMP Subgoal 1

Habitat Goals and Recommendations

Open/Nearshore Waters

Long-term goals:

- Open and nearshore waters possess a full array of safe and healthy natural habitats required to meet the growth and reproductive needs of fish and wildlife, in accordance with the Joint Strategic Plan for the Management of Great Lakes Fisheries.
- Open and nearshore waters harbor self-sustaining fish and wildlife communities that
- Include reproducing native fish species, especially lake herring, deepwater ciscos, lake trout, yellow perch, walleye, lake whitefish, coaster brook trout, lake sturgeon, American eel, and Atlantic salmon as a significant component.
- Self-sustaining populations of non-native game fish contribute to stabilize fish communities. Competition for habitat, predation, and disruptions to the food webs from invasive species are eliminated or neutralized by preventing new introductions and managing existing invasive populations.
- Food webs are free of toxic contaminants.
- Healthy fish communities support sustainable commercial, subsistence, and recreational fisheries.

Short-term actions:

- Develop and evaluate lake trout restoration efforts through strategies such as a 40 percent increase in the number of lake trout stocked, using guidance from existing fishery management plans .
- Develop an initiative to re-establish native lake sturgeon and coregonines in five areas of the Great Lakes from which they have been extirpated.
- Refine or develop techniques or models to improve assessment and exploitation strategies and management protocols for important fish species such as yellow perch, lake whitefish, lake trout, and walleye stocks.
- Develop an understanding of factors involved in recruitment of lake trout and other important native species, and remove or mitigate major impediments to recruitment.

Wetlands

Long-term goals:

- Wetland conditions should be sufficient to provide a full range of ecosystem services including hydrologic retention, nutrient and sediment trapping, spawning, nesting, and nursery habitats, and other habitat needs of fish and wildlife.
- Fish, wildlife, and plant communities and their habitats are protected and conserved.
- Wetlands in hydrologically modified environments are maintained and improved.
- Non-native plant and animal species are managed or prevented.
- One million acres of high quality wetlands in the basin are protected or restored.
- Self-sustaining non-endangered population levels for all currently listed wetland wildlife species, as determined by the state Departments of Natural Resources.

Short-term actions:

- Restore or protect 550,000 acres of wetlands and associated uplands (1.1M acres).
- Achieve at least 1.54 million breeding pairs of waterfowl (annual breeding population under average environmental conditions).
- Update inventory and mapping of wetland habitat types in the Great Lakes basin.
- Acknowledge, develop and enhance federal and state regulations and enforcement for coastal and inland wetland protection that also facilitate and accelerate wetland restoration.

Riverine Habitats and Related Riparian Areas

Long-term goals:

- Lakes, streams, rivers, wetlands, and connecting channels are conserved or restored to ensure their connectivity to floodplains.
- Intact stream corridors sustain native and migratory fishes, other aquatic biota, and wildlife.
- Barrier-free access to cold and warm water tributary spawning and nursery habitats is sufficient to sustain migratory fishes.
- Rivers and streams are adequately buffered to reduce sedimentation and nutrient inflow.
- Natural flow regimes (including groundwater infiltration) are restored or emulated.

Short-term actions:

- Restore ten Great Lakes tributaries (five tributary barrier projects and five riparian habitat projects).
- Restore coaster brook trout and lake sturgeon in Great Lakes tributaries.
- Adopt a method to characterize or classify watersheds based on degree of altered hydrology.

26

Coastal and Upland Habitats

Long-term goals:

- Coastal shore habitats and natural processes that sustain them—such as sediment transport, lake-level fluctuation, and wetland migration—are protected, restored and/or managed.
- Coastal and upland habitats sustain long-term diverse and abundant populations of native resident and migratory fish and wildlife species, especially those that are threatened and endangered.
- Sufficiently large and connected inland habitats are protected and restored, contributing to ecosystem health and biodiversity, and providing migration corridors for species.
- Highly altered environments are managed to emulate natural ecosystems.
- New invasions of non-native species are prevented and existing non-native populations are eliminated or controlled.
- Erosion is controlled and groundwater is recharged.
- The vitality of these habitats provides a broad range of social, cultural, and economic benefits.

Short-term actions:

- Inventory and assess all Great Lakes coastal habitats and prioritize them for protection and restoration.
- Protect or restore 10,000 acres of high priority coastal and upland habitats per year across the basin.
- Conduct detailed monitoring of Areas of Concern in coastal shore areas.
- Protect and restore 1,100,000 acres of upland associated with wetlands.