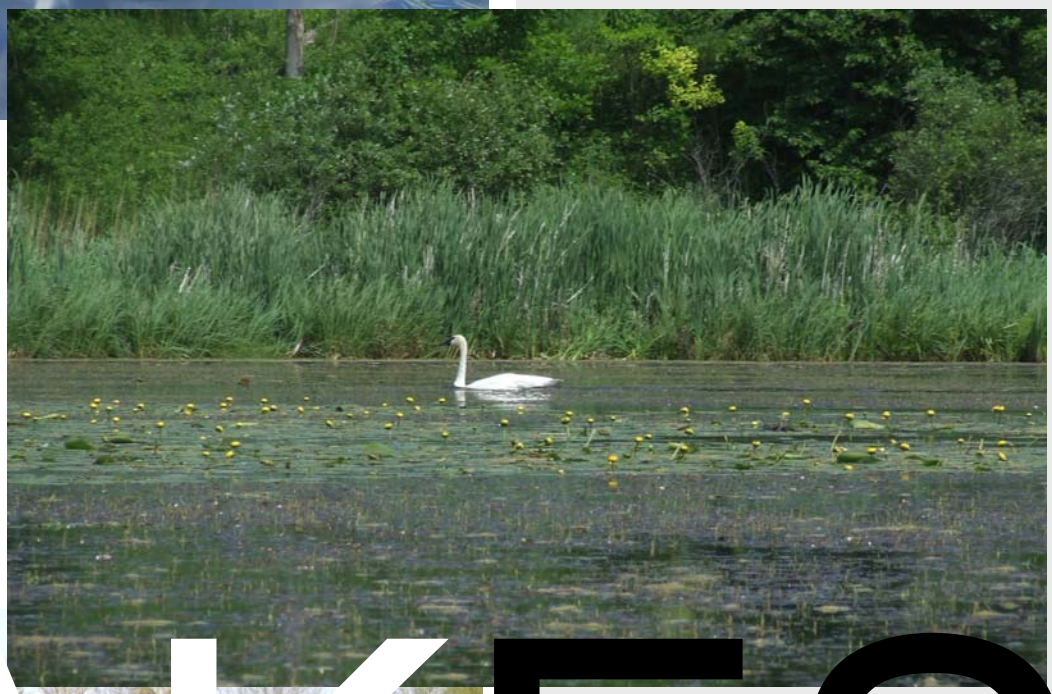
SHALLOW LAKES



"These lakes are not generally beautiful but they are rich in game, in wild rice and other useful plants." *– Joseph Nicollet on August 7, 1838 in the Minnesota River Valley near the Hawk Creek and Yellow Medicine confluence*

MINNESOTA'S NATURAL HERITAGE

SHALLOW LAKES; DEEP HERITAGE

Echoing across the calm surface of water, the gurgling "oak-a-lee" of a red-winged blackbird broadcasts its irritation at someone invading his territory. This medium-sized songbird with a bright red patch flies between cattails fiercely challenging all outsiders.

A group of diving ducks with rusty heads, white bodies, black chests and rear ends, float among the emerging vegetation. Canvasbacks, or known by their nickname "cans," feed on sago pondweed and aquatic insects to gather strength for a long flight south to their winter home.

Sago pondweed and other aquatic plants (macrophytes) spread throughout the water column holding together the entire shallow lake's ecosystem. With its abundant fruit and tubers, sago pondweed is one of the important food sources for waterfowl and great fish habitat.

Aquatic insects like the water fleas and scuds dart here and there among the macrophytes providing a tasty meal for both waterfowl and fish. A healthy population of game fish like northern pike gives people a chance to enjoy shallow lakes. Waterfowl hunting on Minnesota's shallow lakes has long been part of the state's natural heritage. Lakes like Christina, Swan, Big Rice, and Thief provide premier waterfowl migration habitat and support a rich hunting tradition.

A complex system

Shallow lakes account for about one third of the 11,000 plus lakes found in Minnesota. Many shallow lakes have been lost to drainage prior to the 1970s. They also don't get the respect or attention as the deeper ones found up north. This is unfortunate because shallow lakes are a rich resource providing wildlife habitat, water quality benefits and recreation opportunities.

A healthy shallow lake is characterized by water clear enough to see to the bottom, with fairly thick weed beds with fish and other aquatic organisms using the plants for both food and protection. Everything is connected as the aquatic plants use nutrients to grow, hold sediment on the bottom, and provide a place for zooplankton to hide from predators.

Shallow lakes have been impacted by the changing landscape as agriculture and urban development transform the natural environment by eating up prairie, wetlands and forests. Many of our shallow lakes have become impaired as the water clarity turns murky from blooming algae and suspended sediment particles. Submerged plants disappear without adequate sunlight reaching them and it becomes a snowball effect as fish, aquatic insects and other animals suffer.

Here in Minnesota, professionals and citizens are coming together to help save some of our most beloved shallow lakes hit hard from increased nutrient loading, too much water, and the invasion of undesirable species like carp. Over the last decade or two, an increased effort to protect and restore this valuable resource has seen success in places like Lake Christina and Swan Lake. Ultimately, it will take strong partnerships, more funding, and patience to make sure shallow lakes have a bright future.

SHALLOW LAKES REFLECT THEIR LANDSCAPE

Minnesota has approximately 4,000 shallow lakes pretty evenly spread across the state's three ecological zones:

- Laurentian mixed forest (forest),
- Eastern broadleaf forest (transition), and
- Tall-grass prairie (prairie).

Shallow lakes reflect these overall differences in the landscape. As one might expect, a shallow lake found in a northeastern forest of Minnesota looks different than one found on the former prairie in the state's southwest corner.

Typically, shallow lakes of the forest zone support an abundance of aquatic plants and have clear water. One of the key aquatic plants is wild rice, found in many of these forested lakes. This aquatic grass is high in protein and is an important food for many birds including waterfowl and the red-winged blackbird.

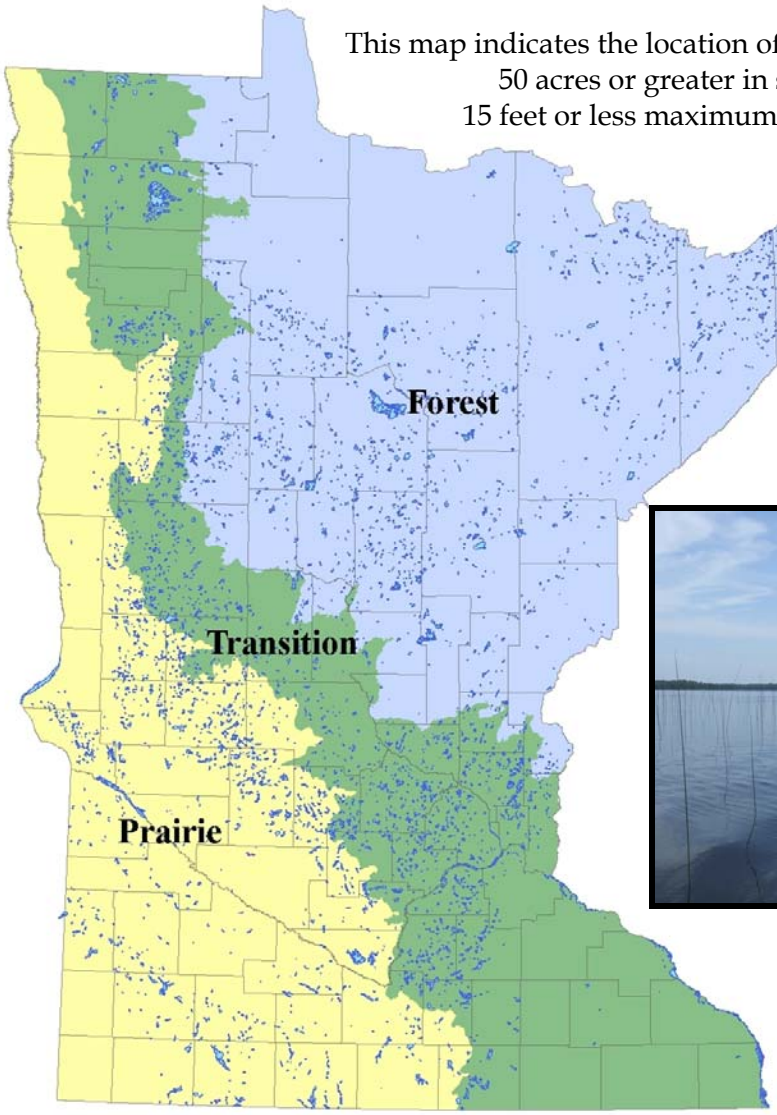
Water quality on most of these northern lakes hasn't suffered because many wetlands are still intact in the surrounding water-shed and few nutrients are found in the soil. Dam construction and the stabilization of water levels have caused some negative impacts on these shallow lakes, especially on wild rice.

In the transition zone, shallow lakes vary in condition with some in good shape, while others suffer from environmental degradation. Here we see variable conditions in the watershed and as a result, more issues for these lakes to contend with. Wetland drainage for agricultural production has been more common along with other land-use changes.

Shallow lakes in the prairie zone have seen the biggest transformation. Many of these lakes are in poor ecological condition because of high nutrient levels, low water clarity and few aquatic plants. There have been more impacts here on wildlife, especially migrating waterfowl.

Distribution of Shallow Lakes

This map indicates the location of shallow lakes
50 acres or greater in size
15 feet or less maximum depth



Shallow Lake Types

There is a great deal of variation among all lakes, including shallow ones, in Minnesota due to differences in geology, soils and precipitation patterns across the state.

Found in northern Minnesota and characterized as low nutrient, often with wild rice.

Found in central Minnesota and characterized by shallower basins with a less jagged landscape, and moderate nutrient levels.

Found in western and southwestern Minnesota and characterized by shallower depths and greater nutrient-enrichment. A major factor for these lakes is land erosion, contributing additional nutrients and sediment.

Shallow Lake Ecology

As a resource, shallow lakes tend to get ignored by the public and short changed when it comes to appreciating their value. Even though they will never be confused with the deeper and clearer lakes found in northern Minnesota, this shouldn't stop people from enjoying what shallow lakes have to offer.

Typically, shallow lakes fall on a spectrum between deep lakes and wetlands. Sunlight reaches the bottom of shallow lakes allowing aquatic plants to grow over most of the lake bed, rather than a ring around the shoreline commonly seen in deep lakes.

A big difference between shallow and deep lakes has to do with thermal stratification during the summer months. Water in shallow lakes doesn't stratify, meaning the water mixes with the bottom sediments throughout the summer. These sediments can be rich in nutrients, especially from the water flowing off the surrounding landscape into the lakes.

Wetlands have more emergent vegetation and dry out more frequently than shallow lakes. Sometimes wetlands don't even have standing water, where shallow lakes do. Shallow lakes can have emergent vegetation like cattail and bulrush, but usually not as much as wetlands. Submerged aquatic plant growth (plants growing under the surface of the water) can be lush and widespread in shallow lakes.

Many shallow lakes support a lush growth of aquatic plants due to an abundant level of sunlight and nutrients. Healthy shallow lakes can be characterized by a diverse community of aquatic plants and clear water. An absence of these plants often results in green water thick with algae. A shallow lake featuring both clear water and few aquatic plants is very rare. Shallow lakes dominated by algae and few aquatic plants are "turbid," suffering from poor water quality.

Aquatic plants protect the bottom sediments from wind re-suspension, compete for nutrients with algae, and provide food and habitat for fish and wildlife. The littoral or shoreline zone will be dominated by cattails, bulrush and reeds, or stands of emergent aquatic plants. A healthy shallow lake has vegetation covering much of the area including submerged plants like wild celery and sago pondweed. The plants are also used for habitat by invertebrates or aquatic insects, an important food source for waterfowl and fish.

Due to their shallow nature, these lakes tend to have winterkill of fish on a fairly regular basis. As a result, the fish communities are usually dominated by species tolerant of low dissolved oxygen levels like northern pike and bullheads. Shallow lakes can serve as northern pike spawning areas as well as providing a sport fishery on a boom and bust basis. Fish populations can also have impacts on water clarity by affecting invertebrate populations and the rate of nutrient cycling in shallow lakes.

Water quality is another important benefit of shallow lakes. This nutrient-rich environment full of plants helps lower nitrogen and phosphorus levels found in some of our impaired waters, along with allowing sediment to drop out of the water column. Shallow lakes can also lessen the damage of flooding by storing water and slowly releasing it throughout the year.

Finally, shallow lakes are important to people who live along them and also the general public. They have a beauty and a value that other waterbodies can't begin to duplicate. One value is the diversity of plants found in the water and surrounding shoreline, creating a flowering bonanza throughout the growing season. Shallow lakes are also a great place to enjoy wildlife all year round. Communities and sportsmen clubs have discovered the economic impact of this important resource for a variety of recreational opportunities.

As with any resource, not all shallow lakes are created equal, however they do share some of the same characteristics. Most shallow lakes are eutrophic or richer in nutrients. Shallow lakes are different too because of variables like the surrounding landscape, land-use practices, local ordinances, and how the lake is used by the general public, sportsmen clubs and resource managers.

Wild Rice & Shallow Lakes

Harvested for centuries by American Indian tribes in the Great Lakes Region, wild rice has played an important cultural role and also as a food source. Wild rice or "Manomin" has a high protein content, and is easy to store with an indefinite shelf life.

Wild rice also provides food and shelter for many fish and wildlife species. More than 17 wildlife species of greatest conservation need in Minnesota use wild rice lakes as habitat for reproduction and foraging.

- One acre of natural wild rice can produce more than 500 pounds of seed.
- It is recognized as an important source of food for waterfowl during fall migration.
- Stems of wild rice provide nesting material for many birds and wildlife species.

IMPACTS ON SHALLOW LAKES

Watershed modifications, introduction of exotic species, and climatic conditions are some of the factors affecting the health of our shallow lakes in Minnesota. Degradation of these lakes causes them to switch from the clear-water state to a turbid-state. Unfortunately, a lake in this condition offers very little, if any, fish and wildlife value.

Water levels on many of the state's shallow lakes have risen because of increased precipitation and runoff over the last two decades. Today, it's common to see many of these lakes surrounded by large dead trees standing in four or more feet of water. An increase in water depth can contribute to dramatic changes in lake ecology. Deeper water decreases the frequency and severity of winterkill as fish communities become dominated by bullheads and carp. Increased water depths can also contribute to the decline or total disappearance of rooted aquatic plants.

Ditching and drainage of wetlands has had dire consequences for many lakes in the agricultural regions of Minnesota. Usually the water drained from these wetlands is diverted into waterbodies too difficult to drain – like a shallow lake. Now these lakes receive more water than in the past and at a faster rate due to "drainage improvements" of the watershed. Some areas of the state have seen over 99 percent of the wetlands drained (*i.e.* Heron Lake).

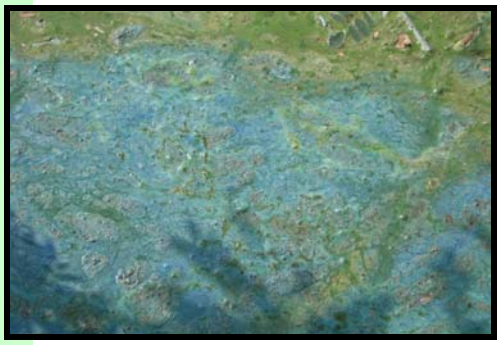
Conversion of grasslands to row crops has also impacted shallow lakes by increasing the amount of nutrient-rich sediment erosion entering the shallow lakes due to erosion. Wetlands that once surrounded these lakes used to retain water, nutrients and sediment that now flows directly into the waterbody through drainage networks.

The biggest impacts on the health of shallow lakes are taking place in the prairie zone, and to some extent, those found in the transition zone. A combination of several factors have degraded these lakes, resulting in poor water quality, abundant algae and lack of wildlife.

These impacts can be divided into two general categories:

- External nutrient loading and
- Internal nutrient loading.

Nutrients flowing into lakes from their watersheds are referred to as external loads. The landscape around these lakes has been transformed with the loss of the prairie and drainage of wetlands. The current landscape is intensively cropped. These changes have negatively impacted shallow lakes.



Blue-green algae, or cyanobacteria, is found throughout the state and thrives in warm, shallow, nutrient-rich lakes of central and southern Minnesota.

Internal nutrient loading has also caused problems for shallow lakes, in addition to the extra water flow and external nutrients. Over the last twenty years, scientists and managers have begun to understand how fish affect internal loading, in particular invasive species like carp.

The feeding and metabolic activities of carp, and other fish, exacerbates the nutrient problems in these prairie shallow lakes by increasing internal nutrient loading. By stirring up the bottom as they feed, these fish move nutrients from the sediments into the water column, along with feeding on invertebrates found in the bottom sediment layer.

Once fish eat something from the sediment layer, they also excrete nutrients into the water. Nutrients released into the water spur the growth of algae, particularly the harmful blue-green algae. Under certain conditions, blue-green algae can turn toxic and has caused the death of dogs, cattle and other animals. For humans, it can result in a variety of reactions depending on whether it is by skin contact or ingesting water.

Invasive Species and other Emerging Threats to Shallow Lakes

Carp, curly-leaf pondweed, and hybrid cattail are all invasive exotic species and have been found in shallow lakes in Minnesota. Each poses current and future threats to these lakes along with other emerging threats, like the increase in shoreland development around shallow lakes.

Carp

The common carp has been contributing to habitat degradation to lakes in southern Minnesota for decades, but now this threat may be getting worse. Carp and other undesirable fish are becoming more common in shallow lakes because they are able to move from lake to lake through a complex drainage network created by intensive tiling and ditching. They also continue to exist in many of these waters because of the lack of winterkill.

Removing carp is a strategy for managing shallow lakes. One way to remove them is by temporarily de-watering a lake, commonly called a drawdown. Another method to remove fish is to apply rotenone to the water. This is a natural chemical derived from tropical plants that is toxic to fish. Rotenone applications are becoming more common in Minnesota and elsewhere, including Iowa, Wisconsin, Florida and Europe.

Curly-leaf pondweed

As an invasive exotic plant, curly-leaf pondweed impacts a shallow lake by reducing native plant diversity and contributing to internal nutrient loading. Growing under a different lifecycle than native aquatic plants, it begins growing early - even under the ice. Native plants start to grow later in the spring but are shaded out by the taller curly-leaf pondweed. This plant also dies off earlier in the summer and as it decays, nutrients are released into the water causing algae blooms.

Curly-leaf pondweed (also known as curly cabbage) grows from the shore to depths of up to 15 feet. To manage this plant, professionals apply herbicides or mechanically harvest the plant. The Minnesota DNR offers grants for control efforts in some lakes.

Hybrid Cattail

Minnesota has one native species of cattail – broad-leaved. Narrow leaf cattail is not native, but spread from the east coast and hybridized with broadleaf cattail. Both cause problems by dominating native plants and reducing open-water areas in shallow lakes. This aggressive plant can also clog a lake's outlet, contributing to higher water levels.

Invasive cattails can be managed through a variety of mechanisms, including biological, physical and chemical controls (permits required). Muskrats provide a natural and efficient biological control by creating openings in cattail stands for waterfowl. Cattail can also provide some benefits such as filtering out nutrients and protecting shoreline from erosion.

Other Invasive Species

Several other invasive species – hydrilla, zebra mussels, phragmites, silver and big head carp – are potential threats. While no one knows how these species will exactly impact shallow lakes, they have negatively affected other areas of North America.

- Hydrilla is an invasive aquatic species that has similar impacts as Eurasian watermilfoil.
- Zebra mussels, first established in Lake Superior, have smothered native mussels and been linked to die-offs of both fish and wildlife.
- The common reed or phragmites is another exotic plant that can dominate native plants.
- Silver and big head carp haven't established a population in Minnesota but could have a similar or greater impact as the common carp.

Climate Change

Climate change is another potential threat to shallow lakes found in Minnesota. At this time, no one knows exactly what kind of long term impact it will have on the resource. Research has identified that winterkills will no longer be as common. Fewer and less severe winterkills have already been noted as a concern by experts in the shallow lakes field.

Shoreline Development

The development of shallow lake shoreline has been increasing as a result of fewer acres being available on deeper lakes for cabins and homes. In the past, people overlooked the shallower lakes because of their desire to live on a lake where you could swim, boat and fish.

Demand for lakeshore hasn't diminished even though there are fewer places to be found on deeper lakes. As a result people have begun to look at shallow lakes. In turn, this has the potential for water quality impacts including increased nutrient loading, loss of shoreline vegetation that filters runoff and loss of aquatic plants.

Sometimes people moving onto these lakes may not realize shallow lakes are different than deep lakes. They may have "deep lake" expectations and desire less vegetation, deeper water and more fish. At times this can be achieved through intensive fish management, winter aeration, and macrophyte control; however, shallow lakes are not going to fully mimic "up north" lakes. Usually, some of these activities such as removing aquatic plants may be harmful to water quality in shallower lakes.

Managing Shallow Lakes: Mitigating Impacts

Like most of Minnesota's natural resources, shallow lakes may need to be managed in order to achieve or maintain good water quality and habitat. However, such management needs to be consistent with the condition of the resource. A logical management goal for lakes in good condition is to maintain the ecosystem by preventing water quality degradation. Those in poor condition will likely require some action if the resource can be improved.

Research and on the ground projects have shown that lake watersheds can be restored and managed to reduce external nutrient loading into lakes. Deep lakes often show improved water quality soon after completion of watershed management initiatives.

Unfortunately, shallow lakes don't respond with a dramatic improvement in water quality from watershed management. In addition to working on the watershed, it is often necessary to manage the internal nutrient loads in shallow lakes. Fish through their feeding behavior can move nutrients from the sediments into the water column. If fish, as the cause of internal nutrient loading, are not removed or reduced, the lake will show little if any improvement in water clarity.

Reducing or managing excessive nutrient inputs from the watershed is important for a healthy shallow lake. Changes in the watershed contribute many of the nutrients that are being internally cycled. Watershed management has a major impact on the long-term maintenance of a properly functioning shallow lake. In many cases, watershed management needs to be combined with in-lake management to reduce internal nutrient cycling.

Shallow Lakes Case Study: Lake Christina

Lake Christina has been referred to as a 4,000-acre duck pasture. The abundance of waterfowl have made this a hunting Mecca since the beginning of the last century. Tens of thousands of ducks and hundreds of thousands of coots can be found on the lake when it is in good condition.

This is one of the most studied and intensively managed shallow lakes in North America. Located in west-central Minnesota, it sits at the junction of the transition and prairie ecological zones. The lake has long been a favorite place for migrating waterfowl, especially canvasbacks to stop, rest, and eat.

Situated on the rolling prairie, much of the surrounding landscape was too steep for breaking the soil and the intensive crop practices found in other places with shallow lakes. As a result large patches of native prairie and wetlands still exist in Lake Christina's watershed.

Despite the relatively healthy condition of the watershed, this lake can become turbid and lose its aquatic plants. Another water quality issue has to do with a lightly deeper portion of the lake allowing undesirable fish like carp and bullheads to survive through the winter. Finally, water levels are more likely to be kept stable than in the past because of dams at the outlet and downstream, also reducing the frequency of water level fluctuations and potential for severe winterkills.

Lake Management

The lake is managed in an effort to keep the lake water clear and growth of aquatic vegetation abundant. Resource managers would prefer to manage Lake Christina through the use of temporary drawdowns to reduce fish numbers, but drawdowns haven't been possible because of the downstream dams and other factors including increased precipitation.

Instead, the lake's fish population is managed through the use of chemical treatments to kill off fish along with the installation of fish barriers and water control structures to reduce the reinvasion of fish from nearby waterbodies. The amount of water entering the lake is also managed through the use of water control structures.

Today, the DNR, local lake association, Ducks Unlimited and other partners are exploring alternative methods of lake management in an effort to reduce the cost associated with repeated chemical applications. One proposed method is the use of a permanent pump structure to allow for periodic drawdowns of the water level.

A Brief History

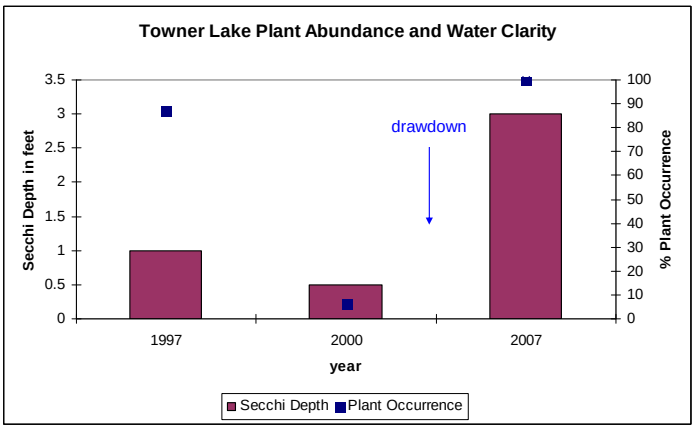
- Prior to the 1950s, this large shallow lake had been one of the most important feeding and staging areas for diving ducks in the Mississippi flyway. It supported lush beds of aquatic plants with clear water.
- By 1959, water clarity had suddenly declined with vegetation becoming sparse along with a drop in waterfowl numbers.
- In 1965, biologists eliminated part of the fish population using toxaphene as water clarity, macrophytes and duck numbers rebound.
- By the mid-1970s, there was another decline in water transparency and vegetation.
- In 1977, waterfowl numbers reached a peak of 130,000 before falling to less than 5,000 over the following years.
- In autumn of 1987, an aerial spraying of rotenone kills nearly all the fish in the lake. Water clarity increased the next year.
- For the next 12 years, waterfowl numbers stay fairly consistent as water clarity gradually declines. Fish populations increase due to the lack of winterkills and increased precipitation.
- An aerial treatment of rotenone in the fall of 2003 results in the dramatic increase of waterfowl and other aquatic bird numbers due to the improvement of water clarity and growth of aquatic plants.

SHALLOW LAKES CASE STUDY: TOWNER LAKE

Towner Lake provides an example of an approach that has focused both on watershed management and in-lake management to improve water quality and wildlife habitat. Towner Lake is located in the Niemackl Watershed set in a rural agricultural landscape in western Minnesota. In the past, local citizens, the Bois de Sioux Watershed District, Grant and Stevens County, U.S. Fish & Wildlife Service, Minnesota Pollution Control Agency and the MN DNR have worked together to implement best management practices in the watershed in an effort to improve water quality. Recent management efforts have started to focus on implementing in-lake strategies to further improve water quality and habitat conditions in the area. Management of Towner Lake has been a part of this effort.

In the past, Towner Lake had thick stands of bulrush that provided ideal waterfowl habitat. However, due to high water, poor water quality, and abundant carp, these aquatic plants have been lost. Through an easement with City of Herman and Wildlife Lake Designation, the Department of Natural Resources and Ducks Unlimited were able to install this new outlet structure to allow drawdowns. This area has a flat topography so the outlet structure included a pump to draw the lake down. Periodic drawdowns will reduce carp and bullhead populations and restore aquatic plants in the basin.

The initial drawdown was started the summer of 2005. The lake remained dry for nearly two summers to allow emergent vegetation to establish and to reduce the numbers of carp and bullheads in the lake. Towner Lake has refilled and aquatic plants are abundant, water is clear and waterfowl use has increased. Habitat will continue to be monitored and drawdowns may need to be repeated in the future, but for now, Towner remains in good shape, and attention can turn to other basins with poor water quality and habitat in the area.



CASE STUDY - FULDA LAKE

This shallow lake in Murray County is an example of how citizens, local organizations and government agencies came together to help improve water quality and recreational opportunities. Fulda Lake had been declining since 2001 when a wide range of partners came together to work on solving a water quality problem.

The cooperative project replaced a fixed-crest dam with a variable crest structure, installed an electric fish barrier, did a drawdown of the lake level, and treated the water with rotenone to remove fish populations dominated by carp and black bullheads. In addition, the MN DNR restocked game fish.

Partners in the project included the MN DNR, MN Department of Transportation, MN Environment and Natural Resources Trust Fund (LCCMR), Murray County and its county commissioners, City of Fulda, Fulda Fish and Game Club, Deb Peterson family, Fulda lakeshore property owners, Heron Lake Watershed District, North Heron Lake Game Producers, and Ducks Unlimited.

FUTURE OF SHALLOW LAKES

Shallow lakes are like any other natural resource found in Minnesota. They are under constant threat from a variety of factors including changes in the landscape, climate and hydrology. In order to restore and protect these shallow lakes, it takes the efforts of government agencies, nonprofit organizations, local groups, landowners, recreational users and citizens.

We need to remember the importance of shallow lakes and their value to our society. Shallow Lakes can:

- Benefit water quality of our rivers and other waterbodies,
- Provide natural flood control by storing runoff and slowly releasing the water over time,
- Provide habitat and food source for many types of wildlife including waterfowl, amphibians, aquatic insects and other animals,
- Attract hunters and wildlife watchers that results in additional revenue for restaurants, motels and other businesses in local communities,
- Increase lakeshore property values because of good water quality, and
- Develop a scenic value as people enjoy the wildlife, water, vegetation and other natural aspects of shallow lakes.

WHAT CAN YOU DO?

The most important action is to get involved by learning about shallow lakes. Learn about local efforts to protect this resource and how you can help.

Education

Learn about shallow lake ecosystems by talking to experts from Minnesota DNR, Ducks Unlimited and other natural resource organizations. Attend the annual Minnesota Shallow Lakes Forum (http://www.shallowlakes.info/) held in the spring. Participate in a workshop or training session on shoreline conservation practices while networking with other people interested in restoring and preserving shallow lakes.

Shoreline and Watershed Management Practices

If you own land along a shallow lake or in its watershed, think about utilizing conservation or best management practices that will benefit water quality. This could be as simple as planting native plants along a shoreline to installing rain gardens to filter runoff from your home. Numerous organizations including Soil and Water Conservation Districts, Watershed Projects and Lake Associations can provide funding and technical assistance.

Clean off your Boat and Trailer

Invasive species like curly-leaf pondweed, zebra mussels, and other organisms can travel between waterbodies on your boat and trailer. Minnesota State Law requires boaters clean off all plant fragments and other materials from their boat and trailers along with draining all water from the boat before leaving the landing and disposing of unused minnows.

Become active in Local Government

Planning and zoning rules and actions are mostly handled on the local level. Contact your county courthouse for information on the planning and zoning process. Check out: "A Citizen's Guide to Influencing Local Land-Use Decisions" www.minnesotawaters.org/documents/CIT%20Guidebook.pdf. Developed by MN Waters, this booklet helps citizens make wise decisions.

Resources and Contacts

Here are some resources and contacts for anyone going to work with shallow lakes or wetlands in Minnesota.

MN DEPARTMENT OF NATURAL RESOURCES (DNR)

- In addition to regulating alterations of public waters, the DNR offers technical assistance and grants for improving and restoring shallow lakes.
- www.dnr.state.mn.us/index.html

MN POLLUTION CONTROL AGENCY (MPCA)

- MPCA manages the Citizen Lake Monitoring Program, sets water quality standards for all lakes, and provides funding through a number grant programs.
- www.pca.state.mn.us/

MINNESOTA WATERS

- This nonprofit organization works with citizens across Minnesota through its lake association and water quality monitoring programs.
- www.minnesotawaters.org

MN BOARD OF WATER AND SOIL RESOURCES (BWSR)

- BWSR works with local government entities including water planners and watershed districts to assist with conservation and education projects.
- www.bwsr.state.mn.us/

DUCKS UNLIMITED

- As a national conservation organization, Ducks Unlimited works with local groups and government agencies to bring life back to shallow lakes and marshes.
- www.ducks.org/

MN CHAPTER OF THE AMERICAN FISHERIES SOCIETY

- This chapter provides a communication forum for people working in the fisheries field to help advance scientific management of the state's aquatic resources.
- www.mnafs.org/

WATER RESOURCES CENTER at MSUM (WRC)

- The WRC gathers, interprets and distributes data of environmental significance to help citizens enhance quality of regional lakes, rivers, wetlands and groundwater.
- http://cset.mnsu.edu/wrc/

MN SHALLOW LAKES FORUM

- This forum brings together diverse interests in a collaborative setting to inform, educate and provoke positive discourse. It has been held across Minnesota since 2004.
- www.shallowlakes.info/

CREDITS

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- Minnesota River Board
- Ducks Unlimited
- Minnesota Department of Natural Resources
- Minnesota Waters
- Minnesota Pollution Control Agency
- Minnesota Chapter, American Fisheries Society
- Minnesota Board of Water and Soil Resources
- The Wildlife Society (Minnesota Chapter)
- Soil and Water Conservation Society