Shallow Lakes

WISCONSIN'S MOST
MISUNDERSTOOD WATERS

Somewhere along the way, someone got the idea that a lake was a deep, clear blue, cool body of water with a sandy bottom and no weeds. Shallower waters that didn't fit this description needed improvements — bottoms dredged, shorelines filled and cleared of weeds, water levels raised — to make them more like "real" lakes.

Disappointment and frustration followed when the make-overs did not succeed. Like people, shallow water bodies have unique physical and biological attributes that are not easily or quickly altered.

Shallow waters account for more than one-third of the state's lake acreage, yet they remain one of the most misunderstood and abused of our natural resources. We are only beginning to understand how these amazingly productive aquatic systems function; the next step is to learn how to appreciate what shallow lakes can offer us.

LAKE MANAGEMENT TOOLS

Lake managers use a combination of techniques to guide shallow lakes toward desired ecological states. They include:

Drawdowns: Draining most of the water from a lake kills undesirable fish, allows for recolonization or rejuvenation of native aquatic plants, and helps solidify soft, loose sediments.

Biomanipulation: Managers follow nature's guide by stocking predator fish like northern pike to control carp, or by planting wild celery tubers and other aquatic plants to restore native plant populations.

Water level control: Aquatic plants benefit when water levels are adjusted to match natural fluctuations.

Watershed management: Nonpoint pollution must be greatly reduced for a shallow water to stabilize. Better land use practices keep pollutants and nutrients out of the water.

ROBERT QUIRK

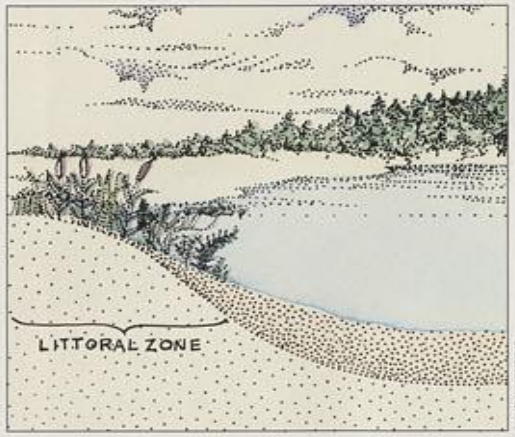
Clear or murky?

Water quality and other environmental indicators reflect the human use — and abuse — of shallow lakes.

Shallow lakes rest precariously on a kind of ecological teeter-totter. One end represents a clear-water state, with a thriving, diverse aquatic plant community; the other end is a murky, turbid-water state, with plenty of algae. Natural events and human impacts determine where a shallow lake "sits." The further a shallow lake tips toward turbidity, however, the harder it is to nudge the lake back toward clarity.

The physical qualities that make shallow lakes different from deep lakes account for their greater sensitivity to environmental and human factors. The following attributes characterize shallow waters:

The littoral zone, where water meets land. Aquatic plants thrive in the quiet water and sunlight along the gradually sloping bottom. Shallow lakes have large littoral zones.



NANCY WARNECKE

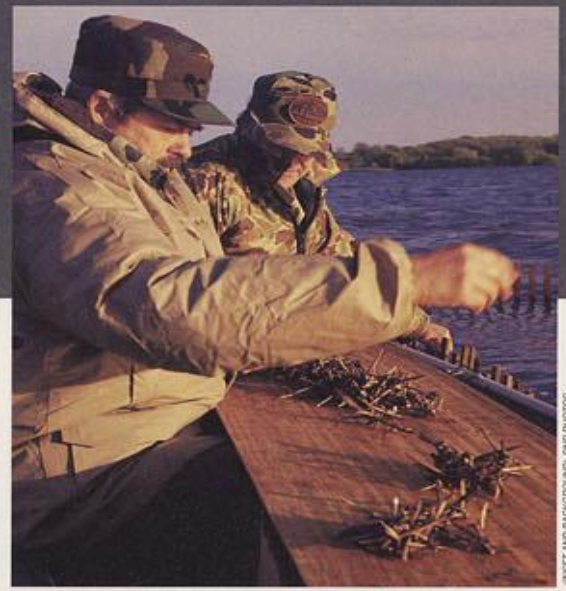
Depth: In a shallow water body, much of the water area is often less than 10 feet deep, and seldom will exceed depths of 20 feet. The **shallow water** allows **sunlight** to penetrate to most of the lake bottom, encouraging the growth of aquatic plants.

Fertility/plant life: Healthy shallow waters contain plenty of **nutrients** — the nitrogen, phosphorus and minerals essential for **aquatic plant** growth. In turn, aquatic plants provide abundant food and habitat for zooplankton, fish, insects, waterfowl, other birds and wildlife. The plants also anchor bottom sediments, helping to keep the water clear. With the abundance of plant life, many shallow lakes resemble marshes rather than lakes.

Large littoral zone: Stands of reeds, bulrush, cattails and other aquatic plants spread along the shore, or **littoral zone**, of a shallow water. Some shallow lakes have an extended littoral zone, with plants growing across the entire lake bottom.

Mixed-up water: In a deep lake in summer, the warm water at the surface doesn't mix with the cooler water below. Nutrients in the bottom sediments remain trapped in the colder water. In a shallow lake, the water is all **mixed up**. Lake sediments and nutrients move freely throughout the water, in part due to the wind. A 10 to 15-mph **wind** can kick up the waves and stir up a shallow lake's sediments inside of a few hours, yet barely rile the waters of a deeper lake.

Water-level sensitive: Water levels in



(INSET AND BACKGROUND) DNR PHOTOS

(above) Planting wild celery tubers: One way to reestablish a native aquatic plant population.
(below) Waterfowl and a rich variety of other species find shelter, nesting sites and abundant food in shallow water systems.

STEPHEN J. LANG

(INSET AND BACKGROUND) DNR PHOTOS

DON'T CALL THEM WEEDS

Wild celery, rushes, water cabbage, duck potato and lilies may look like watery weeds to the casual observer. Look again. The health of a shallow water system depends on a diverse community of aquatic plants.

Some aquatic plants, like sago pondweed, grow beneath the water's surface. Others — wild rice and bulrush, for instance — root in the lake bottom but emerge from the water so they can breathe and photosynthesize. Wherever they are in a lake, aquatic plants:

•provide habitat, shelter and food for fish, wildlife, and zooplankton, the small aquatic organisms at the base of the food web that consume algae

•improve water quality by taking up nutrients

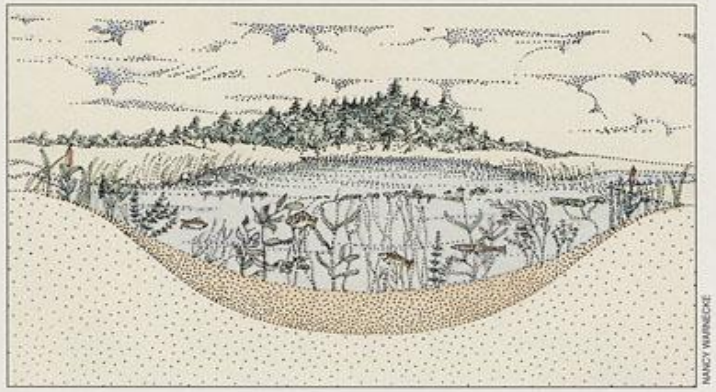
•stabilize bottom sediments, helping to keep the water clear

•slow down waves and protect shorelines from erosion

Not all aquatic greens are good for a shallow lake. Exotic plants like Eurasian watermilfoil and curly-leaf pondweed tend to take over in shallow lakes with poor water quality, forming dense stands, smothering the native vegetation, impeding the movement of fish and wildlife and decreasing the diversity of habitat. Artificial water manipulation can create a niche for exotic species by throwing native species off balance. When a lake is overly fertile, the rooted aquatic plants can't absorb all the available nutrients. Algae, a free-floating aquatic plant, takes over. Algae grows rapidly, damaging the rooted aquatic plants and shading the sunlight the plants need to thrive. The water starts to look like pea soup. Once a shallow water becomes dominated by algae, it's difficult to bring it back to a clear-water state.

ROBERT QUEEN

(top left) Aquatic plants like pickerelweed provide wildlife habitat and stabilize sediments in shallow lakes.
(top right) High water and ice uproot aquatic plants, creating floating bogs that damage shorelines and property.
(bottom) One end of the shallow water teeter-totter: A healthy shallow lake, with clear water, abundant aquatic plants and plenty of panfish and game fish.



NANCY WARNECKE

shallow lakes fluctuate naturally with the seasons and during times of drought and flood. When dams and gates are used to artificially adjust levels for navigation and flood control without regard for nature's rhythms, the balance of a shallow lake can be disturbed. For instance, water levels in shallow lakes often are kept as high as possible to accommodate boating and water sports, but many valuable aquatic plants require periodic drought conditions and substantially lower water during their growing seasons to thrive. Poorly timed changes in water level can harm the plants, and if the water level remains artificially high over many growing seasons, the plants slowly die off. With fewer aquatic plants to anchor shorelines, stabilize bottom sediments and take up nutrients, algae flourishes and the water turns murky with resuspended sediments.

High water and ice can separate large sections of aquatic plants from the lake bottom, eroding the shoreline and creating floating bogs.

Large watersheds: Many of Wisconsin's large shallow waters are **drainage systems**, meaning that streams and rivers provide the water supply. Soil, fertilizers, salt and pollutants from the land drained by the streams and rivers eventually end up in the shallow lake. Excess nutrients (mostly phosphorus and nitrogen) and other pollutants tip the biological balance of these sensitive water bodies, finally leading to an overabundance of algae — the cause of the smelly, slimy green water so common in the summer months.

Land uses in the watershed greatly influence the water quality of a shallow lake. Decades of nonpoint pollution have severely damaged many shallow water bodies, and it will take years of intensive management for the shallow lakes to recover.

Learning from lakes

Four communities reconsider their shallow waters.

We look to lakes to satisfy our desire for recreation, and it's not uncommon to find people who expect a single lake to provide everything: good fishing, great waterskiing, boating and swimming, scenic beauty, clear water, wildlife, peace and quiet. It's an unrealistic standard that few shallow lakes can meet, given the lakes' inherent physical and biological limitations, our growing population, the increased use of motorized watercraft, and the development along lake shores and within watersheds.

Communities and lake property owners have a choice: They can try to create that "fantasy lake" and be disappointed, or they can take a good hard look at their shallow lake and try to do what's best in accordance with nature, learning to enjoy the lake for the special qualities it possesses. Shallow waters can provide excellent fisheries, habitat for a vast diversity of wildlife species, and increasingly rare opportunities for quiet enjoyment of the outdoors. They cannot do all this and support the full array of motorized water recreation we typically associate with clear deep-water lakes.

The future of these complex natural resources rests with the citizens and lake users of Wisconsin. Understanding the ecological needs of shallow waters and balancing those needs with human desires is a task that requires persistence and long-range vision; there are no quick fixes for decades of damage and neglect. The Wisconsin Lakes Management and Fisheries Management programs, the Wisconsin Association of Lakes and local lake management districts and associations will be working together to restore our shallow waters to health.

It isn't easy to build consensus among diverse user interests and several layers of government, but the alternative — leaving behind a degraded natural resource for the generations to come — is simply unacceptable. Here's how a few Wisconsin communities approach shallow lake management.

Fox Lake

Location: Dodge County
Depth: 19 feet
Surface area: 2,625 acres

Fox Lake is popular for its excellent fishery — the product of adjoining marsh habitat with spawning grounds for northern pike, largemouth bass and yellow perch. It's a very fertile lake, though, and blue-green algae blooms are common in summer, curtailing swimming.

Fifty years ago the lake was much clearer, with large areas of lush aquatic plant growth. Over time, excessive nutrients running off from the watershed and artificially high water levels caused the lake to move gradually from a clear-water to a turbid-water, algae-dominated state. Areas of the lake once used for duck hunting and wildlife watching are now devoid of aquatic plants. Waterskiing and motorboating loosen sediments in these shallow areas, exacerbating turbidity.

Long-time Fox Lake property owner and lake district coordinator Mary Danoski.

ROBERT QUEEN

THE FINNED FOE OF SHALLOW WATERS

Carp. **The prolific bottom-feeders are such a familiar sight in Wisconsin's shallow waters that it seems as if they belong here. They don't. Native to Asia, the species was brought to the U.S.A in the 1830s and has been an ecological nightmare ever since.**

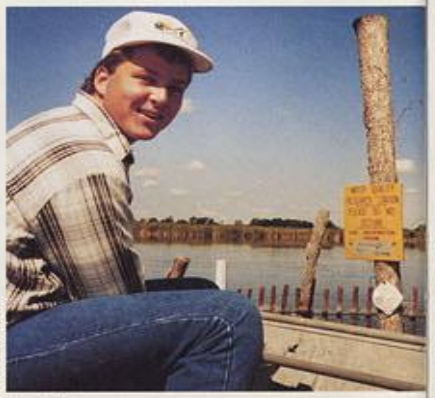
Carp can survive in a broad range of habitats, but the warm waters and soft sediments of shallow lakes suit them especially well. The fish feed by scouring the bottom, stirring up sediments and uprooting valuable aquatic plants. The dispersed sediments smother eggs of game fish, prevent sunlight from reaching aquatic plants and encourage algae blooms. With fewer aquatic plants there's less habitat for zooplankton and insects — the food supply for young game fish — and less shelter for the fish themselves. Freshwater drum, bullheads and other species similarly disrupt the balance of a shallow water body when overabundant.

There are temporary remedies, such as lake drawdowns to kill the fish and rejuvenate aquatic plants; carp barriers, which keep out carp but also prevent desirable fish from entering the lake; or commercial harvest. Predator species can be stocked, but they won't thrive if little vegetative spawning habitat and shelter exists and if the water is murky — predators like northern pike must be able to see their prey.

The best remedies? More natural water-level fluctuations to support healthy aquatic plant growth, and good land-use practices, to prevent pollution and keep sediments out of shallow waters. With better water quality and aquatic plant habitat, predator populations have a better chance of surviving and controlling carp naturally, which can help turn a shallow lake toward a clear-water state.

Danoski gets right to the point: "I don't believe in putting a Band-Aid on a problem — you have to treat the cause." Danoski and others have worked hard to educate neighbors and local government officials about shallow lake ecology and the human impact on the lake. The effort led to the creation of the Fox Lake Rehabilitation and Protection District.

Fox Lake is also part of the Beaver Dam River Priority Watershed Project. But to switch the lake back toward a clearer state, more will need to be done than just stopping pollution from the watershed. In group forums, citizens are defining goals, mapping out long-range lake management strategies and pursuing funding grants. Research on Fox Lake has proved invaluable for understanding the impact of carp on plants, the role of nutrients in lake sediments, and historical changes in water quality. "Fox Lake is part of an ecosystem that we have to understand holistically," Danoski says. "We can't simply address one problem here and think everything will be better."



MAUREEN MECOZZI

Jim Jackley.

Big Muskego/Bass Bay

Location: Waukesha County
Depth: 2.5 feet/11.5 feet
Surface area: 2,073 acres/104 acres

With two distinct lake environments, this system has the potential to offer a variety of recreational opportunities while maintaining biological diversity in a rapidly urbanizing region. The Big Muskego/Bass Bay Protection and Rehabilitation District has begun the slow process of rehabilitating this valuable shallow water system.

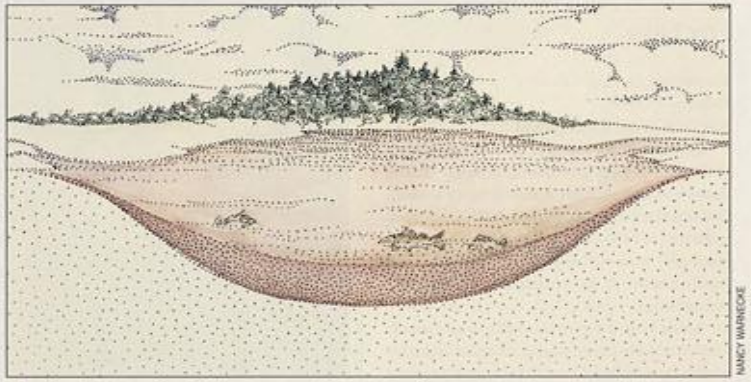
Once part of a vast marsh, Big Muskego was ditched and drained in the late 1890s for farming. Today, Big Muskego is two to three feet below its original depth, and the turbid water is surrounded by dense stands of cattails, now the dominant species in what was once a varied plant community. A thick layer of nutrient-rich silt coats the bottom of Big Muskego, the result of years of agricultural run-off and sewage dumping.

"We need to re-balance this system," says Jim Jackley, DNR water resources specialist, of the lake district's plans to draw down the lake, rejuvenate aquatic plants, remove carp and restock game fish. "That's not an easy thing to do, because of the high levels of nutrients in the sediment. The fishery may respond rapidly, but the whole system may not come around for a decade or more." Reducing run-off in the watershed will also help Big Muskego reestablish equilibrium.

Big Muskego is a prime spot for watching wildlife. Forster's terns (a Wisconsin endangered species) nest there and other species will follow as habitat and water quality improve. Boaters can take advantage of Bass Bay, a deeper but much smaller lake linked to Big Muskego by a small channel.

"Cooperation and patience, that's critical," Jackley says. With the support of Operation Comeback (a coalition of seven local conservation clubs), the lake district commissioners and area residents, Big Muskego's chances for revival are good.

The other end of the teeter-totter: A shallow lake with murky, turbid water, few or no aquatic plants, and plenty of carp and other bottom-feeding fish.



NANCY WARNECKE

Winnebago Pool Lakes

Location: East central Wisconsin
Depth: 21 feet (Lake Winnebago); 11 feet (upper lakes)
Surface area: 165,174 acres

The Winnebago Pool consists of Lake Winnebago, at 137,708 acres the largest inland lake in Wisconsin, and lakes Butte des Mort, Winneconne and Poygan. The turbid, open-water Winnebago Pool lakes have a history similar to many large shallow lakes in southern Wisconsin: They were once vast, deep-water marshes teeming with fish and wildlife, but raised water levels, excessively high nutrient levels, strong wind action and rough fish such as carp and drum eliminated most of the essential aquatic plant habitat.

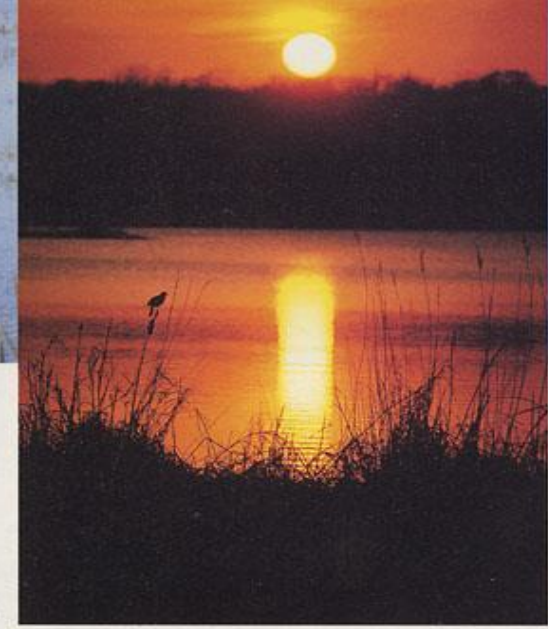
In response to decades of environmental degradation and increasing user conflicts, the Department of Natural Resources and citizens from throughout the Winnebago region developed the Winnebago Comprehensive Management Plan (WCMP) in the mid-1980s. "The plan identifies issues and problems within both the pool lakes

(top inset) Stirring up trouble. Carp and other bottom-feeding fish uproot plants and disturb sediments, clouding the water.
(below) Some shallow lakes resemble marshes more than lakes; others have vast surfaces unbroken by a single reed or cattail. The appearance and condition of a shallow lake reflect not only what is occurring in the lake in the present, but also how the lake was used in the past.

ROBERT QUEEN - (TOP INSET AND BACKGROUND) DNR PHOTOS

LAKE MANAGEMENT GRANTS

The DNR Lakes Management Program offers grants to local governments and associations to gather data, conduct surveys, develop information campaigns, purchase shoreline and watershed habitat, restore wetlands, develop effective land-use regulations and undertake other lake improvements. Contact a lake management specialist at a DNR district office (look in the phone book under "government") or the University of Wisconsin Extension office in Stevens Point at 715/346-2116 for details.



(INSET AND BACKGROUND) DNR PHOTOS

Look to a shallow lake for quiet outdoor recreation.

and the surrounding 6,100 square-mile watershed of the Upper Fox and Wolf rivers," says Art Techlow, Winnebago system biologist and WCMP coordinator for DNR. "It contains management strategies designed to correct problems, resolve conflicts and bring us toward our goal of maintaining and improving the fish, wildlife and water resources of the entire Winnebago system."

Since 1989, a number of projects dealing with habitat improvement, navigation, public access and user conflicts have been completed successfully, largely as a result of hands-on involvement by concerned individuals, groups and local units of government. Techlow notes that coalitions representing a broad range of user interests, such as the Lake Winnebago Citizens Alliance, help educate the public and organize the support needed to deal with nonpoint source pollution and other major problems in the large watershed.

ROBERT QUEEN

Frank Micale.

Lake Koshkonong

Location: Jefferson, Rock, Dane counties
Depth: 7 feet
Surface area: 10,460 acres

Once a deep-water marsh with wild rice and a thriving duck population, Lake Koshkonong is now virtually devoid of aquatic plants. Without plants to soften battering waves, the lake's shoreline erodes easily. Prolific carp are kept somewhat in check with regular seining (the annual harvest usually tops a million pounds). If the carp population remains at a low density, some aquatic plants return, along with bluegills, bass and perch. With such a large watershed, however, it's difficult to control the influx of carp into the lake. "Carp grow to be a foot long inside of a year," says Don Bush, DNR fish manager, "and once they're that big, the only predator that can handle them is a great blue heron or the seiner."

There's no lake district for Koshkonong, in part because it stretches across three counties, 21 townships, and countless opinions on how and for what uses the lake should be managed. Frank Micale, president of the Rock River/Koshkonong Association, says bringing the overlapping jurisdictions together is "a full-time job." Micale and the RRKA volunteers concentrate on fundraising for lake improvement projects. "We've put in boat launches and navigational beacons, and we've planted sago pondweed tubers and assisted with the construction of a small fish hatchery," he says. He's pleased with the progress, but Micale recognizes the need for long-term planning for Koshkonong. "I'd like to see people come together to apply for a Lakes Planning Grant," he says. "This lake needs major improvements and we need funding from state and federal sources. We can't do it alone."

WHAT YOU CAN DO

Volunteers in Wisconsin's Self-Help Lake Monitoring Program track water clarity, water chemistry, native aquatic plants and animals, and exotic species on lakes across the state. To participate, call (608) 266-8117.

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