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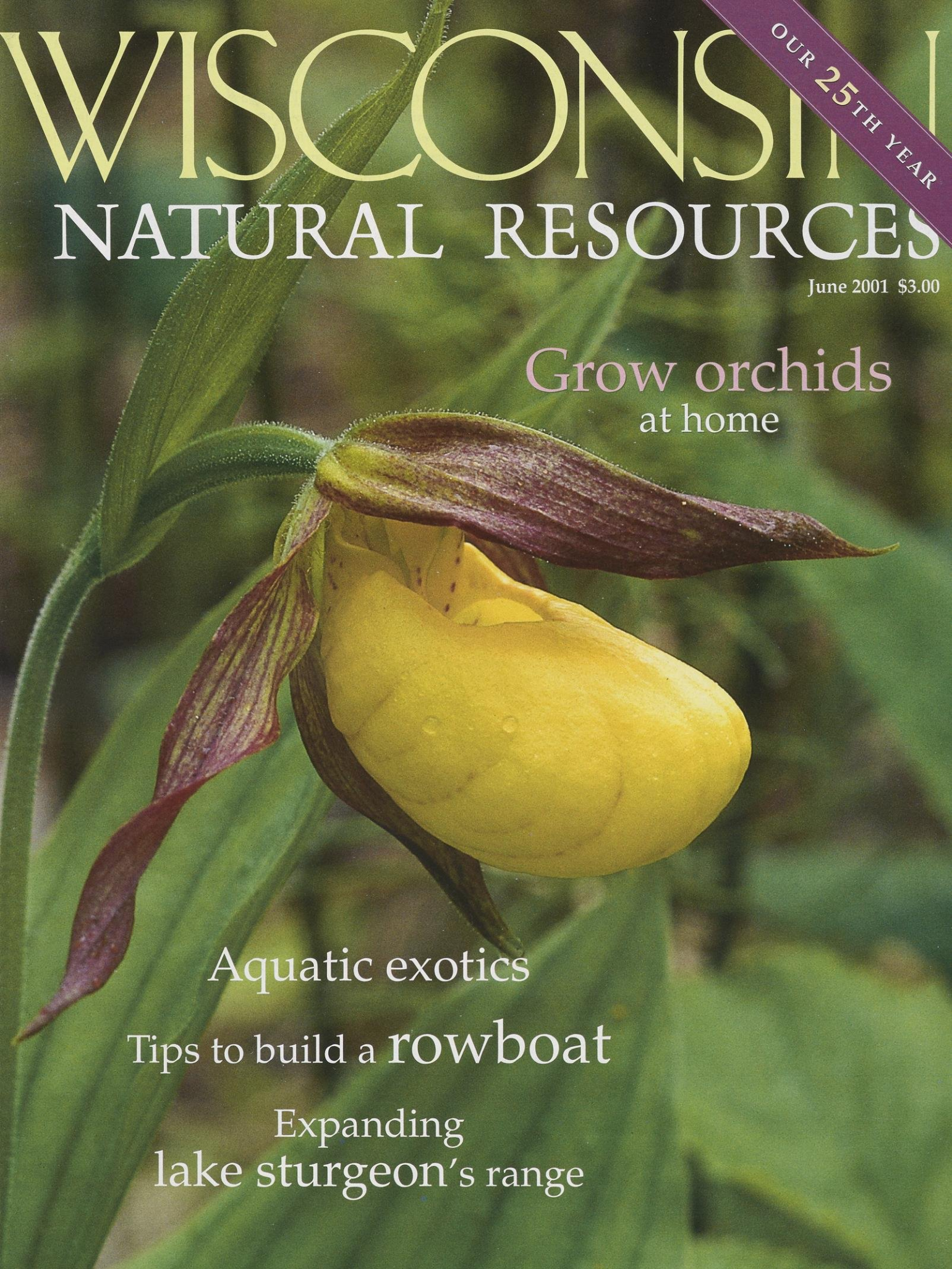
WISCONSIN
NATURAL RESOURCES
OUR 25TH YEAR
June 2001 $3.00
Grow orchids
at home
Aquatic exotics
Tips to build a rowboat
Expanding
lake sturgeon's range

Time of the turtles

The "smiling" Blanding's turtles hide out in the duckweed and disappear a good part of the year.

ANITA CARPENTER

In the midday heat of a lazy, summer day, I poke along the shoreline of a small central Wisconsin lake. Watching swooping tree swallows, darting dragonflies and basking painted turtles, a splash of yellow catches my eye. I discover a Blanding's turtle resting in the green duckweed soup — an individual only detected by its bright yellow chin and throat sticking above the water line.

The Blanding's are timid turtles, quick to retreat and disappear. The six- to ten-inch turtles inhabit ponds, small lakes, marshes or some northern bogs. No other turtles have such bright colored chins and throats. Their heads are rather flat with a short, rounded snout, and the upper jaw is notched in the front so the turtles appear to be smiling. The top side of their head, long neck, legs, tail and smooth upper shell (carapace) are blue-black spotted with yellow flecks, a color pattern that blends in perfectly with dark water, floating vegetation and shadows.

Blanding's turtles don't spend all the time in their chosen ponds. They forage in adjacent grassy marshes and wet meadows. Since they spend time out of the water for reasons other than nesting, they are called semi-aquatic turtles. On land, another prominent feature, the domed carapace, resembles a World War I soldier's helmet. The bottom shell or plastron is yellow, marked with dark brown blotches along its margins. It's hinged across the upper third and if the turtles are threatened, they pull in their head, feet and tail, compressing the plastron for protection.

continued on page 28

WISCONSIN NATURAL RESOURCES

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DNR FILE PHOTO

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RONALD M. BRUCH

FRONT COVER: The native yellow lady's-slipper is hearty enough to be raised and transplanted for garden or patio enjoyment. Other native orchids are more finicky.
SCOTT NIELSEN, Superior, Wis.

BACK COVER: Stabilized sand dunes along Lake Michigan at Point Beach Ridges State Natural Area, Manitowoc County.
©THOMAS A. MEYER, Mount Horeb, Wis.

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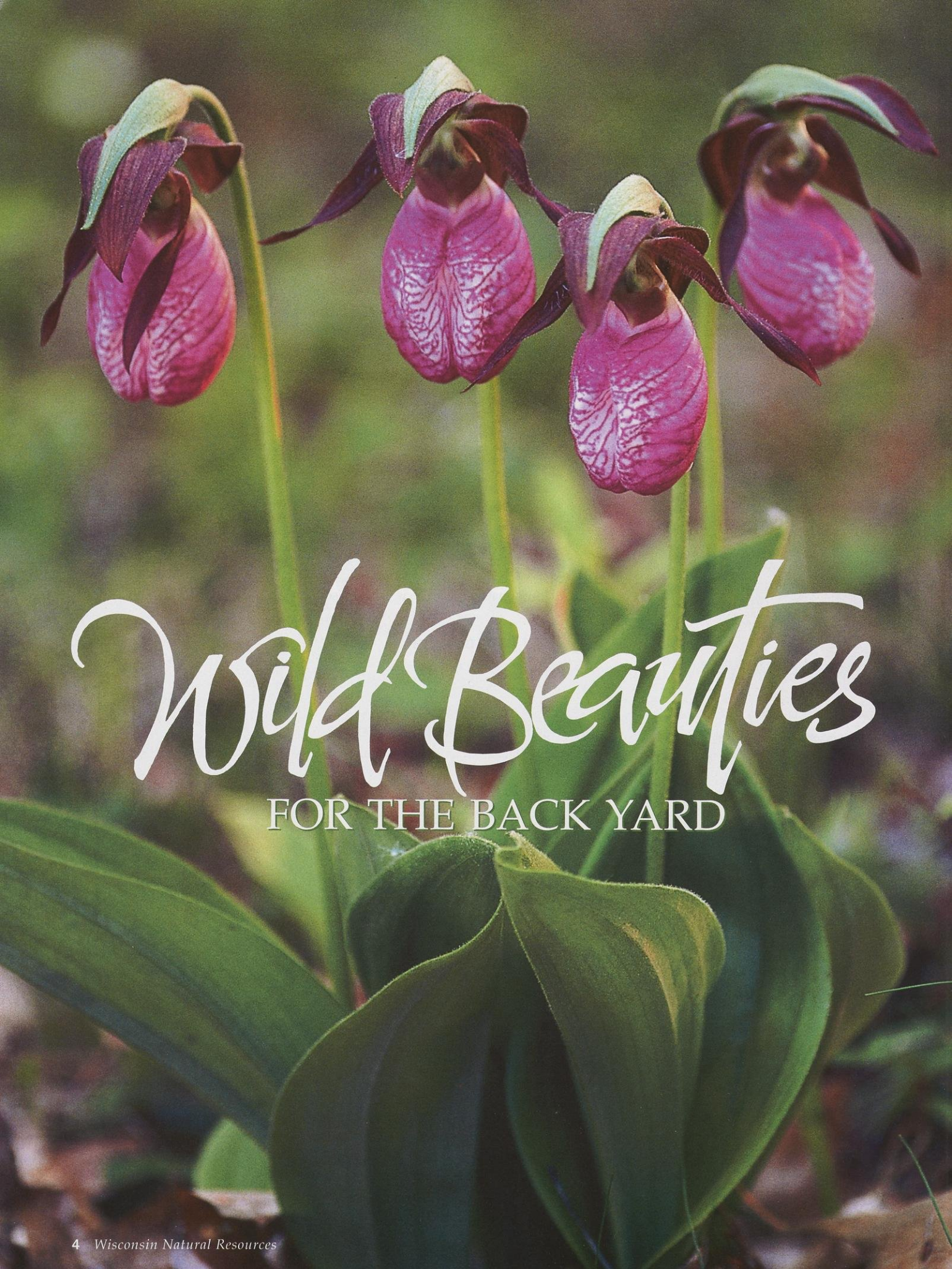


Wild Beauties

FOR THE BACK YARD

A few native orchids are easy to grow in your garden, but most take coaxing, patience and a spirit of experimentation.

I.E. Sadowski

Ever been charmed by lady's-slippers or grass-pinks on a spring hike and wish they could add a grace note to your garden's symphony of colors and shapes? It's only natural for native plant enthusiasts to wonder if it's possible to grow these beguiling wild orchids back home.

The good news is, it can be done — provided you select the right species. Given the proper conditions, some orchids will flourish like burdock in a burnt field. Others will demand nothing less than years of complete subservience and total devotion in return for a brief but stunning appearance.

Creating orchid habitat

Reputed as rarities, orchids actually comprise the second biggest family among the flowering plants, boasting 725 genera and 20,000 to 25,000 different species. Representatives from 18 genera can be found in Wisconsin. Their leaves can resemble blades of grass or the foliage of lilies and irises, to which orchids are related.

Observing wild habitat and fostering similar conditions in the back yard is the key to growing orchids at home. Wisconsin orchid habitat varies from the rich oak forests of the south to acidic cedar bogs up north to the limestone swales of Door County.

"I usually say there's an orchid for every habitat in Wisconsin," says Scott Weber of Bluestem Farms, a native plant nursery in Baraboo. Many orchids choose to bloom in humid spots,

DONNA AND TOM KRISCHAN

SCOTT NIELSEN

DONNA AND TOM KRISCHAN

(left) The pink lady's-slipper or pink moccasin-flower is native to northern pine forests. Be wary of buying these for a cheap price at roadside markets – they may have been removed illegally.
(right top) Nodding ladies'-tresses need moist, swamp-like conditions.
(right below) The showy lady's-slipper shows promise as a houseplant.

Get acquainted with Wisconsin's orchids

Orchid	Common name	Habitat	Blooms
Calopogon tuberosus	grass-pink	acidic bogs	June 20–Aug. 10
Cypripedium candidum	white lady's-slipper	rich, wet prairies and calcareous fens	May 10–July 15
Cypripedium acaule	pink lady's-slipper	acidic bogs and woods	May 10–July 15
Cypripedium reginae	showy or queen's lady's-slipper	calcareous wetlands	May 10–July 15
C. calceolus var. *pubescens*	large yellow lady's-slipper	rich, moist woods on limestone	May 10–July 15
C. calceolus var. *parviflorum*	small yellow lady's-slipper	fens, bogs, moist meadows	May 10–July 15
Goodyera pubescens	rattlesnake plantain	sandy acidic soil	July 15–Sept. 5
Liparis lilifolia	lily-leaved twayblade	rich, mesic woods	May 25–June 25
Plantanthera leucophaea	Eastern prairie white-fringed orchid	moist prairie	July 5–Aug. 1
Spiranthes cernua	nodding ladies'-tresses	moist sandy soils, recently disturbed	Aug. 10–Sept. 20

Resources

"Orchids of the Western Great Lakes," Frederick W. Case, Cranbrook Institute of Science, 1987
"Orchids of Minnesota," Welby R. Smith, University of Minnesota Press, 1993
"Orchids of Indiana," Michael A. Homoya, Indiana University Press, 1993
"Wild Orchids Across North America," Philip E. Keenan, Timber Press, 1998
Orchids of Wisconsin website — http://www.wisc.edu/botany/Orchids/

with moisture aplenty. Several other species of Wisconsin orchids grow in dry habitats: autumn coral root, moccasin flower, rattlesnake plantain and some of the ladies'-tresses, for instance. Ram's head lady's-slipper, for example, grows in wet or dry habitat — it's the pH and other soil conditions that are critical for its growth.

The seeds of orchid species lie dormant for years, just waiting for prime conditions. Weber says that even former pasture can yield surprises. He saw clumps of yellow lady's-slippers return to a Columbia County field once drain tiles were broken and groundwater levels rose.

Although orchids have a dainty reputation, some are opportunists that thrive in disturbed environments. Perky grass-pinks, for instance, may carpet ditches scraped by highway crews to keep the weeds down. Until conditions are right, some orchids lie dormant and may not bloom for 5 to 15 years, notes Thomas Meyer, DNR conservation biologist with the State Natural Areas program.

THOMAS A. MEYER

Grass-pinks are not fussy and can be raised and transplanted as container plants.

"Grass-pinks are actually fairly common in wet, acid sands in central Wisconsin, " Meyer says. "If you see roadsides where it's really low, it's the old glacial lakebed. Some of the roadside maintenance done by town and county crews may actually improve habitat for a species like that by exposing the wet, sandy soil and reducing the competition from other plants."

Given a chance, some orchids will grow like weeds. Weber says twayblade corms (the underground stem that bears new plants) seem to pop up whenever

THOMAS A. MEYER

THOMAS A. MEYER

ground is turned to expand his garden beds. The nodding ladies'-tresses orchid, a fringy affair when fully grown, sows itself into flats in his greenhouses.

Fire helps orchids thrive against the competition. Weber notes ladies'-tresses, grass-pinks, and lady's-slippers respond well to fire, while evergreen species like rattlesnake plantain do not. "The biggest problem may be encroaching brush," Weber explains. "Fire seems to stimulate most orchids. So some kind of prescribed burn program on a large area helps."

Both grass-pinks and yellow lady's-slippers are pretty and tough enough to transplant for the garden or patio. Weber would like to see grass-pinks catch on as container plants. The corms are easy to grow in sandy, acidic soils and will bloom yearly if cooled in a fridge during the winter months.

Gene Smalley, orchid enthusiast and professor emeritus of plant pathology at the University of Wisconsin-Madison, agrees that the grass-pink is reliable. He also recommends rattlesnake plantain for the garden.

"I've had big success with *Goodyera*," he says. "It's a very pretty plant with variegated leaves that looks good even without blooms."

Smalley points out that providing the right habitat is essential to success. "To keep plants going, I locate places where I can satisfy most of their requirements," he says. Sometimes Smalley will do a little site preparation before transplanting. To accommodate a showy lady's-slipper, he worked in a lot of fine silica blasting sand before planting the orchid near a downspout in his front yard.

"Up in Door County they grow along the beaches," he says. "There's hardly any organic material in that stuff. But their feet are sort of right at the water table." Other orchids, like the pink and yellow lady's-slippers, can handle drier locations with a bit of sun and good humus.

Smalley's experiments in propagation focus mainly on lady's-slippers,

(top) **Rattlesnake plantain's silvery veined leaves look good all year.**
(left) **The Eastern prairie white-fringed orchid naturally grows in moist prairie soils. Its growing conditions would be difficult to mimic at home.**

ROBERT QUEEN

Growing orchids artificially takes a lot of time and patience. This lady's-slipper root took more than a year to germinate under refrigeration and another year to start forming roots on a rhizome.

especially *Cypripedium reginae*. "The showy lady's-slippers are the easiest to work with," he says. With puffy blows blushing with colored veins to attract pollinating insects, these flowers certainly live up to their name. They also hybridize readily. Smalley has crossed species of *Cypripedium* with their subtropical cousins that are gaining popularity as houseplants.

While orchids can be particular about growing conditions or pollinators, loss of habitat is often the engine driving their scarcity. The federally-threatened Eastern prairie white-fringed orchid became rare because the moist prairie it calls home has almost disappeared from the Wisconsin landscape. The state-threatened white lady's-slipper frequents the fens and wet prairies that used to ring the southern end of Lake Michigan. The rich, tillable soils of mesic prairies, an incredible 10-feet deep in places, was simply too alluring to settlers as agricultural land, not to mention as residential and industrial property. Plentiful at the turn of the 1900s, merchants loaded up wagonfuls of blooming orchids to sell for a penny a piece in Milwaukee and Chicago.

Events

Orchid Quest 2002 Feb. 2–3, 2002 at the Alliant Energy Center in Madison. Call (608) 246-0347 for details.

Wildflower Pilgrimage at the Ridges Sanctuary in Door County. Call (800) 52-RELAX or (920) 839-2802 for tour information.

Growing your own at home

To begin propagating orchids at home, you can raise them from seed, transplant existing plants, or purchase plants from a nursery. Collecting plants or seed requires the owner's permission on private land and is illegal on public land without a permit. One seedpod can offer a million chances for germination, so growers trade seed among themselves using networks like the Orchid Growers Guild. Joining the guild could also offer some guidance when embarking on growing orchids from seed.

In general, overseeing germination and the early years of a plant's life is not for the faint of heart. Balancing sterile growing media with nutritional requirements, keeping the plant on its normal life cycle complete with cold periods, and maintaining humidity are some of the rigors involved.

ROBERT QUEEN

Mature orchid roots are potted in a special soil mix, mulched, protected in cold frames and shaded before blooming plants start to grow.
(top) Eugene Smalley shows trays of orchid rhizome roots that develop very slowly. The potted plants on the top shelf contain roots that are at least two years old.

Orchid clumps may be rescued — with permission from property owners — from sites that are about to be disturbed by roadwork or construction. Realistically though, few survive transplanting to a garden for even a few years because the transplant site often can't meet the orchids exacting habitat requirements for soil, fungi, light and moisture. Frankly, the Department of Natural Resources doesn't encourage

(BOTH PHOTOS) ROBERT QUEEN

These roots grow for five years before they are ready for potting.

Smalley's orchid greenhouse is equipped with fluorescent lights of varying temperature, plastic sheets and fans to maintain air, light, temperature and moisture that promotes orchid growth. Note that the tropical orchids to the right are less challenging to grow than the native varieties.

orchid transplanting because the buyer has little way to discern if the orchid clump was legitimately obtained or illegally poached from a wild population. Most gardeners are better off trying to propagate native orchids and protect them in their native habitat.

A number of orchid species are available through nurseries. But Weber cautions buyers to beware of bargain prices, especially for the pink lady's-slipper. A cheap price may also mean the plant was poached from the wild. "We have to germinate these in the flask, and there's no way anyone can grow one for $1.99 and have it close to blooming size," he says.

A quest for beauty

Orchid growers invest years to get plants to blooming size, starting with the trials and tribulations of germination.

"In the wild, most orchids require very narrow environmental conditions to get started because their seeds are spore-like," says Meyer. "They're just these incredibly tiny, dust-like particles. So what orchid seeds have to do is form a relationship with a fungus when they hit the soil, and the soil must have the proper temperature, chemistry and moisture. That's not something you can easily encourage your backyard soil to do. I mean, either you have the stuff or you don't."

This symbiotic relationship between fungi and plant roots, known as mycorrhiza, provides the plants with most of their nutritional needs. Orchids like autumn coral root can depend entirely on mycorrhizae for nourishment; it doesn't even bother with leaves to make food or flowers.

Navigating the union between spore and fungus can be arduous. Growers maintain rigorously sterile conditions in their nurseries, and Smalley even dons a dust mask to keep the yeasts in human saliva at bay. "We live in a zoo of spores and stuff," he says.

Smalley starts seeds in Petri dishes with a tissue culture medium called Phytamax. Developed by Sigma Chemical Co., this gelatinous growth medium is behind the popularization of tropical orchids as houseplants. *Cypripedium reginae,* for instance, will spend three to four months in a Petri dish in the fridge held at 2–5° C, then a year in darkness. During year two, the rooty mass is moved into a sterile mixture of perlite, vermiculite, rock wool and a little charcoal, where it will spend the next few years growing up in the greenhouse, or outside in a cage (to ward off rodents).

Keeping orchids alive during the early years is not for the novice. Decomposing organic matter can cause crown rot, while managing nutrition in a sterile environment can also be touchy. Orchids are particularly sensitive to saline conditions, which Smalley addresses by using rainwater or water purified by reverse osmosis, and by leaving peat out of the growing mix.

"Foolproof materials for potting are still a problem," he says. "How to start them [orchids] in terms of fertility is a problem. But I sort of approach this like they're all experiments."

Adventurous gardeners attempting to raise orchids will need patience, diligence, and an appreciation that these perennials set their own schedule.

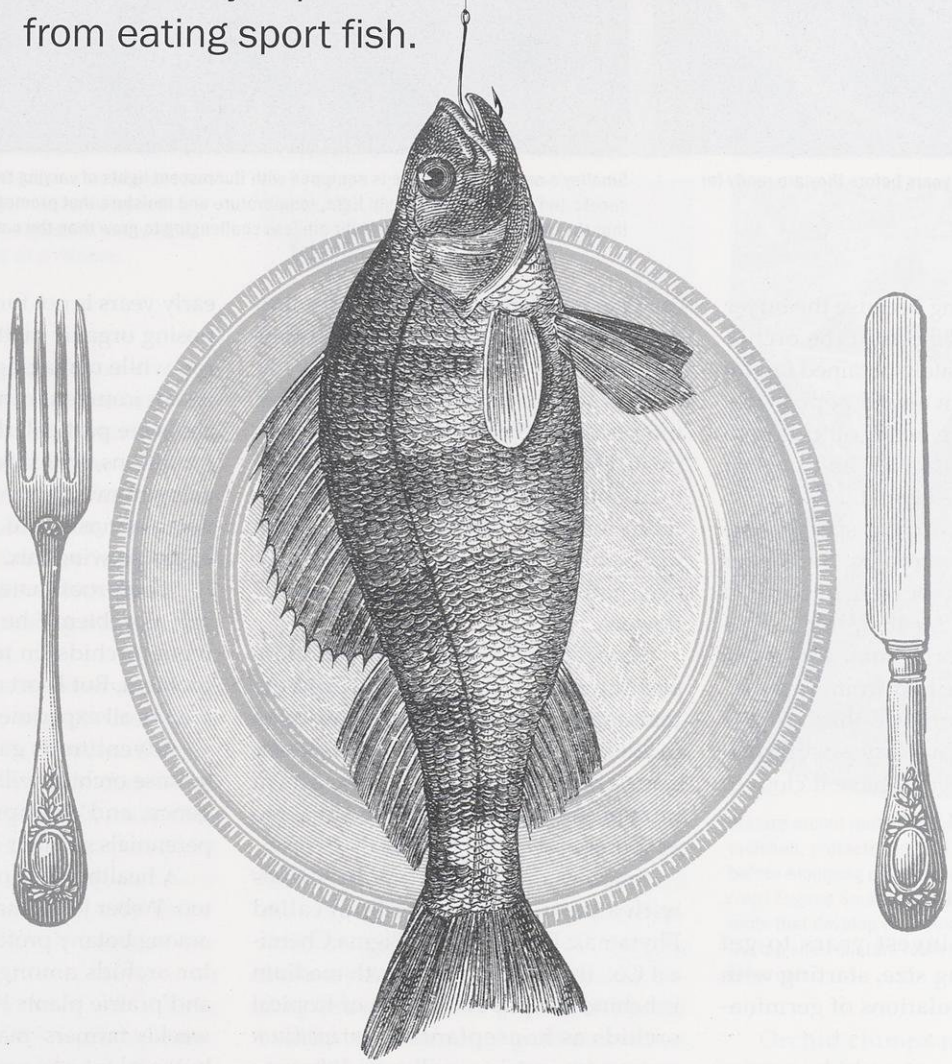
A healthy dose of egotism may help, too. Weber jokes that neighborly rivalry among botany professors creates a niche for orchids among the shooting stars and prairie plants he sells at Madison's weekly farmers' market. A botanist will buy a plant one week, then a neighbor will inquire about it the next in a race to see who can keep these exotic natives alive and thriving at home. "They're the Holy Grail of the horticultural world," Weber says of orchids. Raising them is a worthy quest in this (or any) century.

I.E. Sadowski writes from Madison.

LIMITING THE HITCH IN A DAY'S CATCH

The bad news? Mercury remains a metal on the move that is more widespread than we realized.

It's easier than ever to minimize the risk of mercury exposure from eating sport fish.



Jennifer Pelej

Inside the walls of the State Lab of Hygiene, it's an eclectic assortment of rubber boots, white lab coats, fish guts and country music. At this office "getaway," Jim Amrhein, DNR fish contaminant specialist, performs his studies on Wisconsin fish. Like most anglers, he'd rather be catching tonight's supper instead of working, but Amrhein's proud of his role in protecting the health of Wisconsin's visitors and residents for the past 16 years.

Long-term studies by the Department of Natural Resources, the Division of Health and the State Lab on mercury levels in fish led to changes in the advice that Amrhein and his colleagues offer people about eating sport fish during the 2001 fishing season. First, the annual fish advisories now cover all Wisconsin inland lakes and rivers. Second, the guidelines on consuming fish are much easier to interpret.

Mercury levels haven't changed much in fish. In fact, lev-

els have remained remarkably constant in waters where fish are sampled.

"What's changed is we're learning that mercury is more widespread in the environment, and we're concerned about exposure to smaller amounts of this contaminant," Amrhein explained. Fetuses and young children are especially susceptible to neurological changes and possible learning disabilities from continued exposure to even the small amounts of mercury in sport fish.

Our aim is giving people reasonable guidelines to continue enjoying the many benefits of eating fish while minimizing health risks throughout their lifetime, said Dr. Henry A. Anderson, chief medical officer for the Wisconsin Division of Public Health. To reduce mercury exposure, it's time to get a little more cautious by spreading out the number of meals of fish eaten during a week or month, particularly for pregnant women and young children, Anderson said.

"It's not a 'don't eat fish' advisory, but instead a guideline on how much to eat," said Amrhein.

The mercury guidelines this year suggest that:

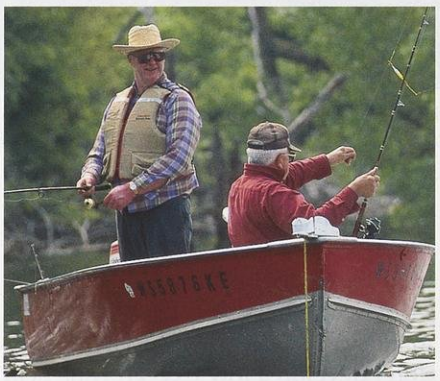
- Women of childbearing years, nursing mothers and children younger than 15 eat only one meal per week of panfish, such as bluegill and perch, and one meal per month of predator species like walleye, northern, bass, catfish and bottom feeders like carp.
- Women beyond their childbearing years and men may eat unlimited amounts of panfish and one meal per week of large predator fish mentioned above.

The science behind the advisory

In the past, mercury advisory levels were set one lake at a time following fish sampling by DNR, analysis by the State Lab and interpretation by the Division of Health.

Each year Amrhein sends fish managers a list of lakes that will be sampled. Using fyke nets or boom shockers, fisheries crews collect about 10 top-level fish, such as walleye and northern pike, of varying sizes from each lake on the list. It's safe to assume that if predators have low levels of mercury then other fish down the food chain, like panfish, will also have low levels.

The collected fish are frozen and shipped on ice to Madison. What looks like the preparation for a Friday night fish fry is actually the beginning of the contaminant research. Each fish is thawed and filleted.



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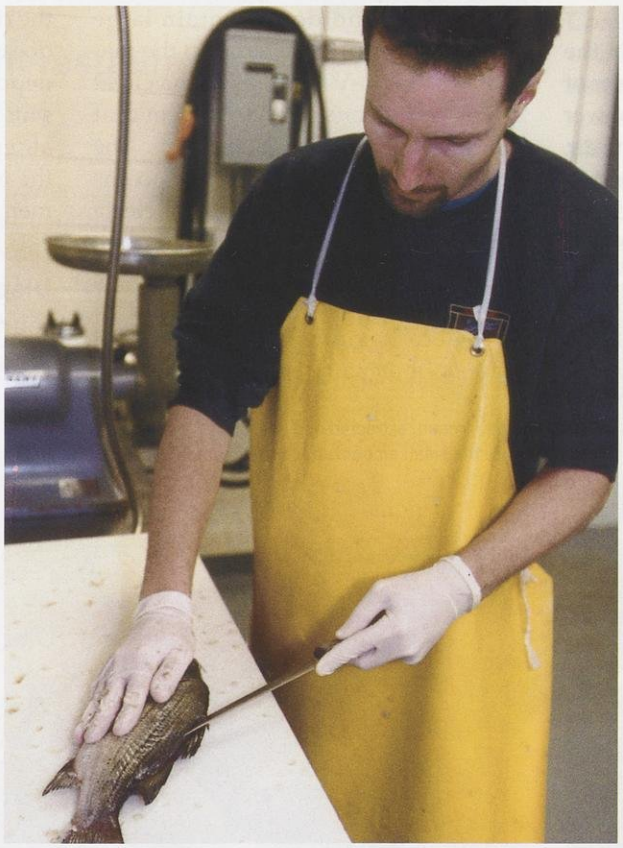


ROBERT QUEEN

Jim Amrhein fillets a fish for analysis. Only skin-on edible fillets are tested for mercury content.

(top) Fish advisories help anglers choose which of their catch to bring home for eating.

Amrhein also records the sex of each fish, examines its stomach contents and includes the information in notes about each sample. Since mercury accumulates up the food chain, there is a direct correlation between what the fish eats and its mercury level. Unlike the contaminant PCB (polychlorinated biphenyl), mercury is stored in muscle. You can't trim away the skin and fatty portions of fish to reduce mercury concentrations.

"Since the studies are done to conclude how much fish a person can safely eat, we fillet each fish as if it was going to be eaten," Amrhein said. "The idea that we use the whole fish to test for fish contaminants is a huge myth. We only test edible skin-on fillets for signs of mercury."

Next, instead of battering and frying the fillet, Amrhein feeds the fillets into a meat grinder until the fish sample is well blended and the consistency of ground hamburger. Ground samples are sealed in a container, frozen, and sent to the lab where other scientists read the mercury levels using a high-tech computerized machine called an atomic absorption spectrophotometer.

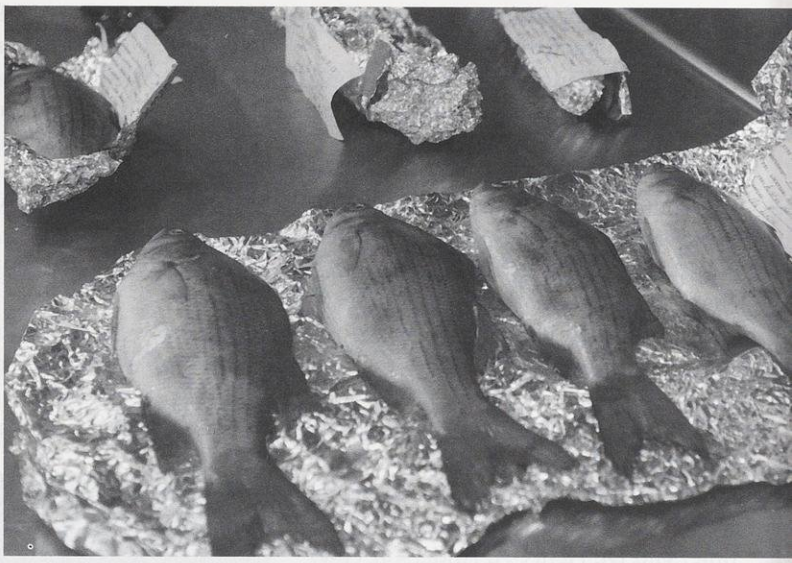
"This testing process is unbelievably methodical," Amrhein said. "We go through a lot of steps in order to get consistent, reliable analyses." About $200,000 is spent each year collecting fish, preparing samples and analyzing them for signs of mercury, PCBs, dioxins and pesticides. Federal grants and the general state tax funds pay for that testing.

Where does mercury come from?

Research during the last 20 years has started to piece together a picture of how the contaminant spreads through the environment. Mercury is a naturally occurring element, released when volcanoes erupt,

STEVE KRAMER

DNR fisheries crews conduct population studies each spring and also collect fish samples to be tested for signs of environmental contaminants.



The sex, age and stomach contents of each fish that is tested is recorded so researchers can correlate factors that might explain how and why certain species accumulate mercury.

when rocks erode and when fossil fuels are burned. Manmade sources in Wisconsin include a chlor-alkali factory, power utilities, home heating fuels, waste incinerators, fluorescent lights, mercury electrical switches and home appliances that contain mercury.

The main source of mercury in the water is actually the air. Fine particles of mercury released from coal-fired power plants and other sources drift in the air, attach to fine water droplets and fall into lakes and rivers. The particles are so light that they can travel across several states before rain and snow wash them from the sky onto land and into lakes, rivers and streams. Some of the emissions falling in Wisconsin come from sources within the state, some from regional emissions; just as some of our emissions drift to other states and provinces.

Not all waters are equally susceptible to the damaging effects of mercury. In shallower waters with soft bottoms that become depleted of oxygen, mercury particles settle and are digested by bacteria that thrive in these low-oxygen conditions (anoxia). The mercury is converted to methylmercury that moves more readily into tiny plants and animals that fish feed on. It's this form of methylmercury that accumulates in food chains, fish and people.

Mercury is much more of a concern in inland lakes because the Great Lakes don't develop a low-oxygen zone near the lakebed and don't contain large numbers of anoxic bacteria. So the majority of mercury that falls in the Great Lakes is not converted to a form that would move through food chains. The same holds for ocean water. The oceans don't contain as many of the bacteria that could readily convert mercury into a form that is easily absorbed by living organisms.

"There has always been a small amount of mercury entering waterbodies and fish," Amrhein said, "but we're concerned that manmade sources add more mercury more quickly to the environment."

Under the Clean Air Act, utilities are required to meet standards to reduce the risks of inhaling mercury, but the act doesn't address the problem of mercury deposition on lakes. In response, DNR staff is drafting a rule to reduce mercury air emissions that will be presented to the Natural Resources Board this summer.

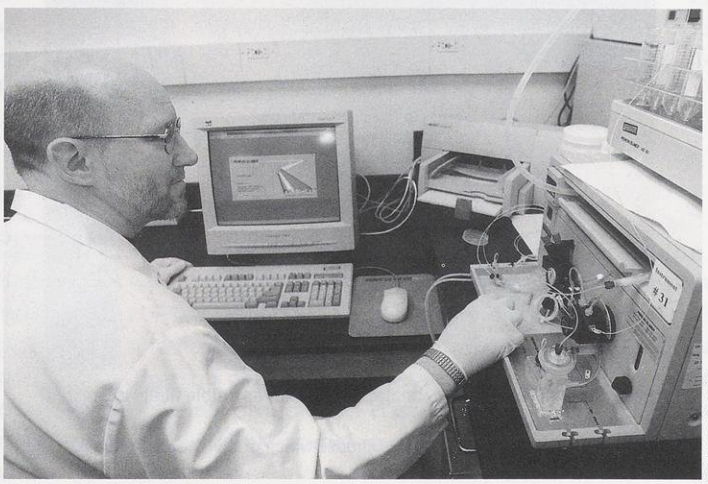
Dispelling mercury myths and fears

Amrhein is the first to see how mercury can accumulate in fish. So how come he is not afraid to catch and eat them? He knows the nutritional benefits of eating fish outweigh the risks when the guidelines are followed.

"When people put into perspective how much fish they eat per year, they will realize they probably don't have much to worry about," Amrhein said. "Most people already follow the advice without trying."

Eating a meal a week of panfish or a meal a month of game fish gives mercury

Each fillet is handled, ground, extracted and analyzed in a consistent manner to consistently measure the small amounts of contaminants typically found in fish.

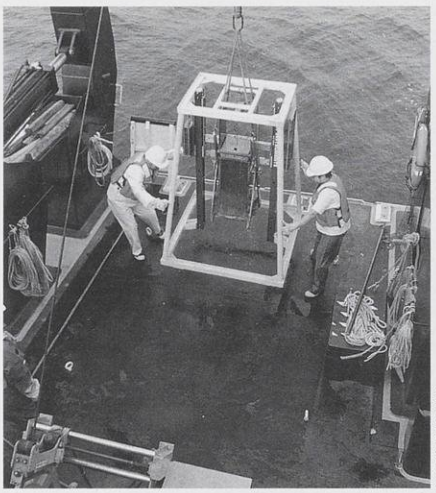


ROBERT QUEEN

a chance to get out of the body. Unlike PCBs, which accumulate over a lifetime, mercury is water-soluble and half the amount ingested will be expelled from the body within 70 days. Amrhein calls it the "everything in moderation advice." If fish are eaten in moderation, mercury in the blood will not reach harmful levels.

"Most of us know from our upbringing that too much of anything can be harmful," Amrhein said. Since 1971, DNR and the Division of Health have partnered to offer the angling public advise on which fish could be eaten freely, which should be eaten in moderation and which should be avoided to reduce the risks of the environmental contaminants mercury and PCBs. Even though updated advisories were produced and publicized every year, "we want to create awareness, but we don't want people to misinterpret the advice and stop eating fish," Amrhein said.

Although Wisconsin took greater efforts than other states did to alert its anglers, only a third of people in angling households, and fewer immigrants knew about the advisory. Clearly, the annual publicity wasn't enough and the information was difficult to interpret for many people.



DOUG KNAUER

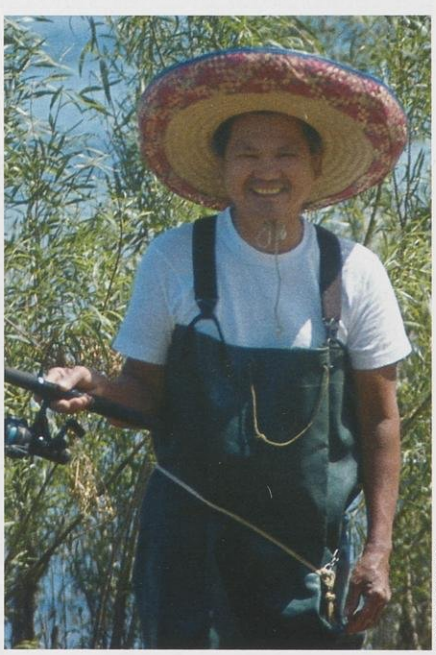
Water and sediment cores collected from Lake Superior on the Research Vessel *Lake Guardian* help unravel how mercury moves through the environment.

Now, the Department of Natural Resources has partnered with the Division of Health to create a campaign called "Hook into Healthy Fish." Funded by grant money, the campaign aims to promote awareness of mercury issues without creating undue alarm.

The DNR is taking the "Hook into Healthy Fish" campaign to Women, Infant and Children (WIC) groups, minority groups, especially those that don't speak English as their primary language, tribes, and angling associations. Instead of just relying on information in written advisories, the healthy fishing message will be printed on coffee cups, T-shirts, posters, magnets, perhaps children's sippy cups, bibs and other props. It is hoped that the promotional items will make their way into doctors' offices so people can get advice from their physician in addition to contacting the Department of Natural Resources.

The team also plans to work with the Great Lakes Indian Fish and Wildlife Commission, tourism outlets, electric utilities, fishing guides, physicians and health maintenance organizations to spread the word wider about the simpler health advice for the fish-eating public.

Health advice to minimize the risks of eating sport fish will target all anglers, including groups like the Hmong who hunt and fish extensively.



ROBERT QUEEN

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What about fish from restaurants and grocery stores?

ROBERT QUEEN

Restaurants and grocery stores sell fish that is commercially raised in fish farms or commercially netted from rivers and the ocean. Some kinds of ocean fish have mercury levels on a par with walleyes, northerns and bass. Other species have even higher mercury levels. In fact, the U.S. Food and Drug Administration (FDA) has warned pregnant and nursing women not to eat shark, swordfish, king mackerel and tilefish because they contain higher levels of mercury (above one part per million). On the other hand, ocean species that are the staple of Friday night fish fries — cod, ocean perch and haddock — are relatively lower in mercury, on a par with our panfish. These fish are unlikely to concentrate as much mercury because natural conditions in the oceans are less conducive to forming methylmercury that moves through food chains.

Farm-raised fish are also less likely to accumulate mercury unless the controlled pellet diet they receive contains high levels of mercury.

Commercially raised and harvested fish are inspected and regulated by the FDA. News accounts suggest that bacterial contamination in handling fresh fish and moving them to market is a larger issue for commercial fish than mercury contamination.

STEPHEN J. LANG

Sampling loon feathers and blood provides a particularly good indicator of how mercury spreads through aquatic food chains.

Another fine reason not to eat loons

Loons, of course, are a protected species, are not eaten by people, and are a true joy to watch on the water. According to DNR mercury researcher Mike Meyer, loons may also be the ideal animals to study to measure the spread of mercury through animal food chains. Loons accumulate more mercury than most fish or other animals for several reasons:

- Loons solely eat fish, and lots of it. Meyer estimates that a loon family of two adults and two chicks can pound down about 1,200 perch and bluegills a year. If panfish have been accumulating mercury, researchers will certainly find signs of it in loons.
- Loons live for 20–25 years and may be exposed to low levels of mercury in their food over a long period of time.
- Of the fish-eating animals like mink, eagles, osprey, otters and others, loons eat more fish over a longer period of time. The other animals eat a wider variety of foods that may include carrion, plants and insects.
- Loons choose to nest on the same kinds of lakes where mercury is most likely to be converted to methylmercury that accumulates in food chains — lakes with vegetation and shallower bottoms and bays.
- Loons are easy to test for signs of mercury contamination. Mercury levels can be measured by drawing blood and feather samples.
- Loons stay together in family groups. They return to the same territories each year and their behavior can be watched by researchers during the day.

One partner, Richard "Moose" Speros, secretary of the Wisconsin Department of Tourism, has already commended the streamlined approach for being honest and straightforward.

"That's quite an endorsement given that Mr. Speros is not only the head of tourism, but owns and operates a resort and is a lifelong angler," Amrhein said. "We understand, as he does, that discriminating anglers want advice on which fish in their catch are safest to keep and eat."

The DNR also published a revised advisory booklet this spring that included the new guidelines about mercury in fish and continued PCB advisories that are still listed for individual waters that have been tested. These booklets can be picked up at DNR service centers and ranger stations. All of the information is also listed on the DNR website at www.dnr.state.wi.us.

ROBERT QUEEN

Health officials and DNR staff will distribute cups, key chains, buttons, posters and other handouts at health clinics to make people more aware of the Hook into Healthy Fish campaign.

Jennifer Pelej writes about emerging environmental policies and issues for DNR's Bureau of Communication and Education.

Weeding wild places

Communities and land managers are coming together to take invasive weed control into their own hands.

S. Kelly Kearns

It is a beautiful late spring day as we hike through a friend's woodland, my children asking the names of the wildflowers they spot along the way. Suddenly they cry out and start pulling bright green leafy plants out of the ground. Before I can even call to them to stop, I smell the problem! The strong garlic-like odor verifies that my young botanists have spotted another patch of garlic mustard. We are fortunate that this patch and several like it in this woods are still small — small enough to pull all the plants by hand.

My son unpacks the plastic bag we brought just in case we spotted this European invader. He warns his sister and me not to leave any of the flowering plants on the ground, or they may produce seed. As we pull the hundreds of plants, we notice that in this patch the

The volunteers who remove the invasive garlic mustard learn to identify the plant by its pungent fragrance, flower, long taproot and its sculpted young leaves.

DICK BAUER

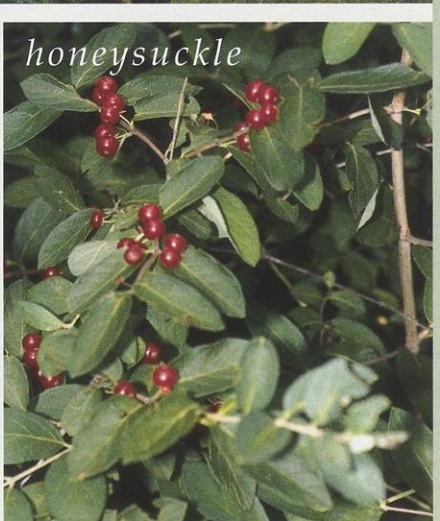
S. KELLY KEARNS

S. KELLY KEARNS

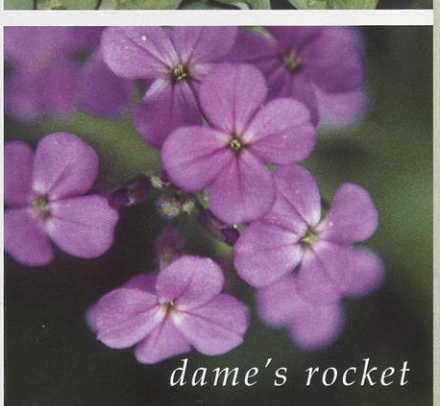
DICK BAUER

DICK BAUER

DICK BAUER



S. KELLY KEARNS



DICK BAUER

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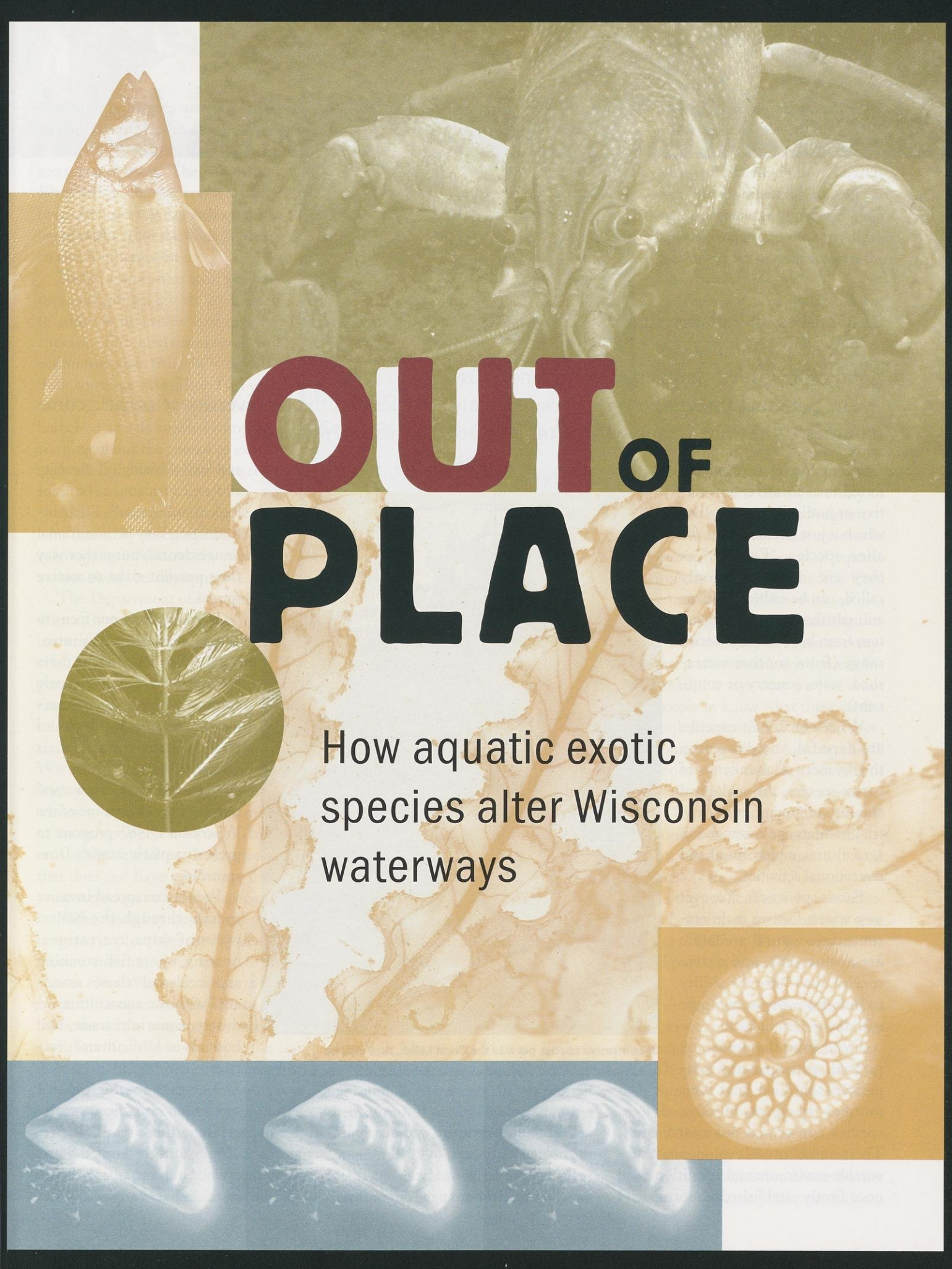


OUT OF PLACE

How aquatic exotic species alter Wisconsin waterways

CLEAN BOATS, CLEAN WATERS

Ron Martin

Like bullies on a playground they can be pushy.

They can be nuisances.

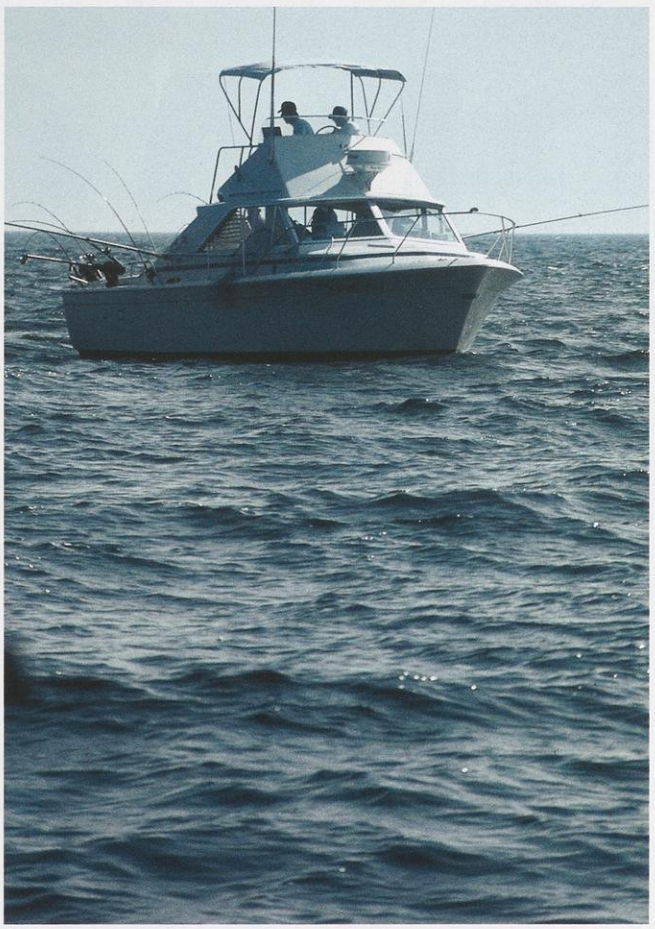
And sometimes, they can even be dangerous.

The potential threat of exotic species to native species and the biodiversity of aquatic communities nationwide is, and will continue to be, a significant problem.

Exotic species are often referred to as invasive, non-native or nonindigenous, all of which is just another name for alien species. "Exotics," as they are most commonly called, can be either plants or animals that enter an ecosystem from beyond their native range (from another watershed, state, country or continent).

While not all exotic species are harmful, some threaten the diversity or abundance of native species, the ecological stability of aquatic or terrestrial habitats, or commercial, agricultural, aquacultural and recreational activities.

Exotic species can take over new waters for two main reasons: their natural predators are not present, and native species don't have the ability to hide from them, compete with them or fight back.



ROBERT QUEEN

Once invasive species get into the Great Lakes, they may be transported to inland waters on recreational and fishing boats.

Freed from the predators, parasites, pathogens and competitors that have kept their numbers in check, invasive species can crowd out native ones. Their numbers can explode under favorable environmental conditions and once firmly established, exotic species are difficult to manage and nearly impossible to eliminate.

In fact, invasive species are a major cause of habitat change, degradation and loss of biological diversity and are considered to be "biological pollutants." Their introduction may be intentional or accidental, but either way they present risks to native species.

Here, we limit our focus to aquatic organisms. We introduce you to some of the more troublesome aquatic exotic species in Wisconsin waterways so you can understand how to help control their spread.

"Clean boats, clean waters" remains the cornerstone of the Wisconsin DNR's program to prevent aquatic exotics from spreading.

People can spread invasive species through the ballast water of ships, recreational boating, sport fish stocking and accidental releases associated with the aquaculture industry, aquarium trade, bait business or horticultural practices.

The rate at which exotic species are introduced continues to increase in the Great Lakes region and throughout the United States as humans assist in transporting them.

The situation has worsened. Once

new invasive species are introduced to the Great Lakes they can be transported to inland waters on recreational boats. The Mississippi River acts as another conduit where invasive species are released via barge traffic from the Gulf of Mexico and southern states.

Today, more than ever, prevention and control efforts are needed to address the problem of invasive species. The environmental and economic costs from new infestations continue to escalate. Last year, the U.S. Fish and Wildlife Service launched an educational campaign warning about the spread of exotics and called the watch list: America's Least Wanted.

Although an awareness of problems caused by exotic aquatic species is emerging in Wisconsin, solutions are not always readily apparent.

The Department of Natural Resources is primarily responsible for investigating aquatic invasive species. Because of the rapid emergence of exotics as a problem, new funding has not kept pace with the need to protect our aquatic resources from biological pollutants. Without adequate resources, the state is at a disadvantage when it comes to control and management of invasive species. Wisconsin is one of the few Great Lakes states that does not have a full-time director to manage aquatic invasive species.

Minnesota has had an exemplary program in place over the last decade to prevent and control the spread of exotic species. The Wisconsin Department of Natural Resources would like to establish some of the same programs here.

Efforts in Minnesota over the last decade include slowing the spread of Eurasian water milfoil, an aquatic plant known for its propensity for explosive growth and its ability to regenerate, and out-compete important native plants.

Minnesota's prevention program includes watercraft inspections at boat landings, enforcement efforts and a comprehensive public awareness campaign that includes television and radio messages to reach a large audience.

It's working.

Research shows that fewer lakes are becoming infested with Eurasian water milfoil in Minnesota because boaters and other water recreationists are taking action at boat access sites to prevent their spread. A survey conducted by the University of Minnesota Sea Grant Program in 1994 found that 91 percent of Minnesota boaters thought it was very important to prevent the spread of water milfoil compared to Wisconsin (54 percent) and Ohio (29 percent). Overall, survey results indicate that Minnesota boaters are more knowledgeable about exotic species and have changed their behavior to prevent the spread to a greater extent than boaters in the other two states.

"From our experience in Minnesota, Wisconsin would greatly benefit from a similar aquatic nuisance species (ANS) program that focuses on prevention through education, containment, management, monitoring and research," notes Doug Jensen, the Exotic Species Information Center Coordinator for the University of Minnesota Sea Grant Program.

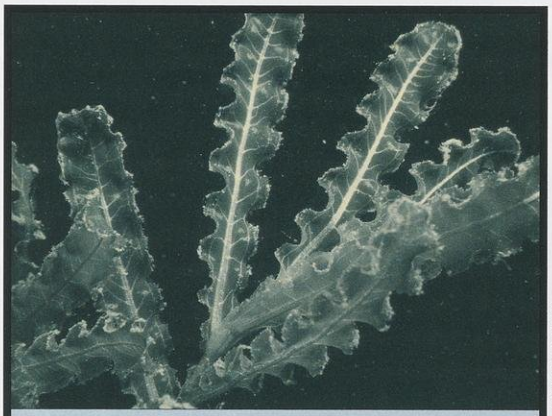
Jensen believes that success in preventing the spread of aquatic nuisance species will come from education, collaborative efforts and long-term stable funding.

We don't expect to make everyone a taxonomist, says Jensen. Instead, he says that we just want people to know what these exotics look like so that if they discover something strange looking, they'll report it to the Department of Natural Resources or Sea Grant.

"We are glad when people contact us about a potential sighting because this means their awareness is heightened," Jensen says. "Often, the public discovers new infestations before they are found by a state or federal agency. That's why an informed public is critical for early detection."

Jensen points to zebra mussels as another example where Minnesota has successfully slowed the spread of an exotic. Despite infestations in the Duluth-Superior harbor and the Mississippi River for about a decade, only one lake in Minnesota is infested.

"We've been able to hold off the zebra mussel infestation at our border because we've made public education a



DAVE MARSHALL

Curly-leaf pondweed has made the Wisconsin exotic species watch list.

Some aquatic exotic species in Wisconsin

- **Round goby** *(Neogobius melanostomus)*
- **Sea lamprey** *(Petromyzon marinus)*
- **Rusty crayfish** *(Orconectes rusticus)*
- **White perch** *(Morone americana)*
- **Flowering rush** *(Botumus umbellatus)*
- **Curly-leaf pondweed** *(Potamogeton crispus)*
- **Zebra mussel** *(Dreissena polymorpha)*
- **Ruffe** *(Gymnocephalus cernuus)*
- **Spiny water flea** *(Bythotrephes cederstoemi)*
- **Eurasian water milfoil** *(Myriophyllum spicatum)*
- **Purple loosestrife** *(Lythrum salicaria)*
- **Common carp** *(Cyprinus carpio)*
- **Rainbow smelt** *(Osmerus mordax)*
- **Alewife** *(Alosa pseudoharengus)*

LADD JOHNSON

Aquatic weeds on boat props and trailers should be removed at the launch.

priority and boater surveys show that it's paid off. Our efforts are proactive and highly collaborative, plus we have laws in Minnesota that prevent the spread of exotic species within the state that give us 'the teeth' to combat apathy about them," he notes.

Taking a lesson from what has worked in Minnesota, the Wisconsin Department of Natural Resources is actively seeking funding from federal and state sources. An expanded state program on exotic aquatic species would establish a watercraft inspection program and strengthen ongoing programs, such as public outreach, education and monitoring for exotic species. Policy changes and enforcement of transportation regulations is another option.

If funding became available, the Department of Natural Resources would establish a watercraft inspection system at key boat launches to increase awareness of problems caused by exotic species and to teach boaters how to properly inspect and clean their watercraft. Waters infested with problem species would be targeted for inspections to reduce the likelihood of spread. Inspections would also be conducted at fishing tournaments, sailing regattas and water ski tournaments that bring many watercraft users together at one location and increase the risk of transporting exotics.

With additional resources, the Department of Natural Resources would expand and improve Wisconsin's education program aimed at recreational boaters and anglers using displays at waysides, state parks and recreational areas. Other educational tools include billboards, species watch identification cards, publications and brochures, paid public service announcements, displays at symposiums, sport shows and conventions, and signs at boat landings.

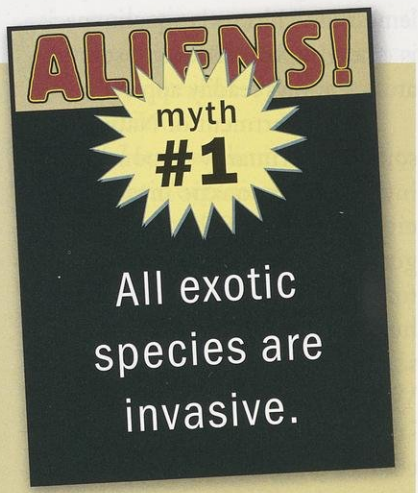
Funding also would broaden the statewide monitoring program for exotic species and results would be posted on the DNR's website. Additional monitoring studies would allow us to better understand impacts exotic species have on lakes, rivers and wetlands.

As a final component of this comprehensive plan, research would be directed at controlling the spread of certain invasive plant and animal species that are particularly problematic to Wisconsin's waters. This would be done through chemicals, biocontrols, barriers and other potentially viable, economical, and environmentally friendly methods.

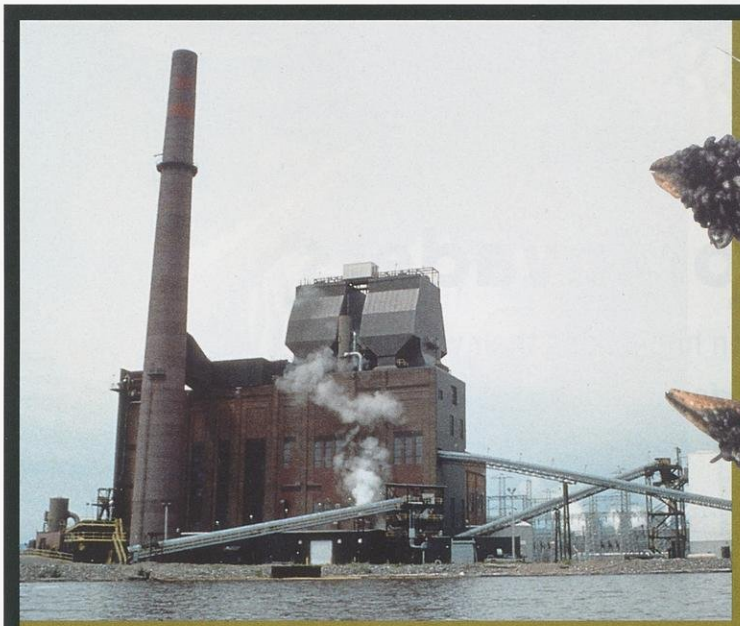
The DNR's aim is to find, prevent and control the spread of invasive exotic species and develop strong partnerships to foster enhanced protection of our aquatic resources.

"By working together, we've been able to focus on priorities, avoid duplication of effort and add consistency to programming and communications," Jensen says. "Aquatic nuisance species, after all, know no political boundaries." □

Ron Martin works with aquatic exotic species issues for the Department of Natural Resources.



Over 85 percent of all exotic plants and animals are not a problem for agricultural, ecological or human health. Many simply exist with the native species so they aren't considered invasive. Thousands of plants and animals have been introduced into North America without becoming a problem, however, there are certain characteristics that allow some species to spread out of control. If plants and animals were screened for potential impacts to native species, the problem of new weeds and pests would be greatly reduced.



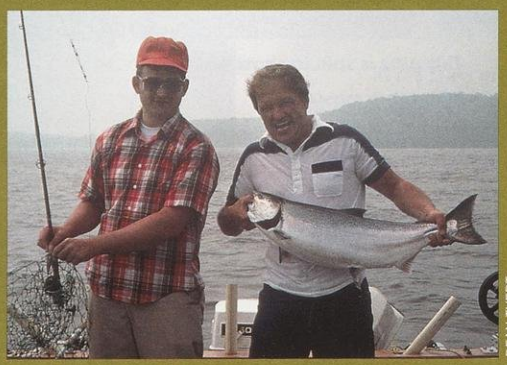
Zebra mussels clog water intakes costing water utilities millions of dollars annually.

Zebra mussels attach to crayfish creating a coat of shells.

(BOTH PHOTOS) DNR FILE PHOTO

Four reasons to care about aquatic exotics

1. **Economics** — The costs of controlling exotic species in the United States increase every year. A typical consumer absorbs these costs through higher water and electric bills. A Cornell University study reports that exotic species on land and water already cost the United States $138 billion annually. The Great Lakes sport and commercial fishing industry, valued at almost $4.5 billion annually, is at risk due to the growing numbers of exotics such as the zebra mussel, spiny water flea, sea lamprey, ruffe and round goby that prey on clams and mussels, invertebrates of all sizes, as well as fish eggs and small fish. Large water users in the Great Lakes, including municipalities and industries, spent about $120 million from 1989 to 1994 to combat the spread of zebra mussels.



DEAN TVEDT

Invading species like lamprey, ruffe and goby can harm native fish such as this walleye.

2. **Health** — Some exotic species may cause significant health problems. For example, a South American strain of human cholera bacteria was found in ballast water tanks of ships in the port of Mobile, Ala. in 1991. Cholera strains also were found in oyster and fin/fish samples in Mobile Bay, resulting in a public health advisory to avoid handling or eating raw oysters or seafood. Temporary bans on commercial harvest may be put into effect when health concerns exist.

3. **Ecological** — The rapid spread of zebra mussels in the Great Lakes shows how profoundly an exotic can alter the aquatic environment. These tiny mussels rapidly reproduce. Coupled with consumption of microscopic plants and animals, zebra mussels affect the aquatic food web, decimate native mussel/clam populations and place valuable ecological communities resources at risk.

4. **Recreational** — Invading species such as the sea lamprey, ruffe and round goby can harm native fish such as lake trout, walleye, yellow perch and catfish, which threaten a national sport and commercial fishing industry that supports 81,000 jobs in the Great Lakes. Aquatic invasive plant species such as purple loosestrife and Eurasian water milfoil quickly established themselves and in some cases replaced native plants. The proliferation of these exotic plants impairs boating, swimming and fishing, navigation and flood control, and degrades water quality as well as fish and wildlife habitat. — *list compiled from the Aquatic Nuisance Species Task Force and the Great Lakes Panel on Aquatic Nuisance Species*

A history of invaders

Exotic species have been hitchhiking their way into Wisconsin for decades.

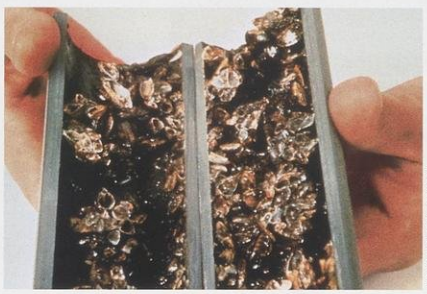
Al Miller

In 1988, residents of Monroe, Mich. turned on their faucets to find that they had no water.

The cause?

A small animal about the size of a thumbnail and weighing less than an ounce.

This hitchhiker from Eastern Europe moved into the Great Lakes on an ocean freighter and found the habitat to its liking. First discovered in Lake St. Claire in 1988 by a Canadian researcher, the zebra mussel became the scourge of the Great Lakes and the poster child of invading exotic plants and animals.



DON SCHLOESSER

This pipe is split to show that it is clogged with zebra mussels.

Like many invasive species, zebra mussels reproduce in huge numbers, so it's not the size of one mussel that's the problem, it's the millions of mussels matted together that can plug municipal water supply intakes like those in Monroe or the cooling water pipes leading into power utilities.

Zebra mussels were first discovered in

EXOTICS IN WISCONSIN THROUGH TIME

1829

Opening of the Welland Canal in 1829 connected Lake Ontario and the Atlantic Ocean with the upper Great Lakes and allowed boats and exotic organisms to bypass Niagara Falls.

1880

In 1880, about 75 common carp, native to Asia, were obtained by the Nevin Hatchery in Fitchburg from the U.S. Fish Commission. The Wisconsin Fisheries Commission placed as many as 35,000 carp in state waters from 1890 to about 1895 when the program was discontinued. Today, carp are present in at least 63 Wisconsin counties.

1920s

Sea lamprey invaded the Upper Great Lakes in the 1920s from the Atlantic Ocean through the Welland Canal.

1930s

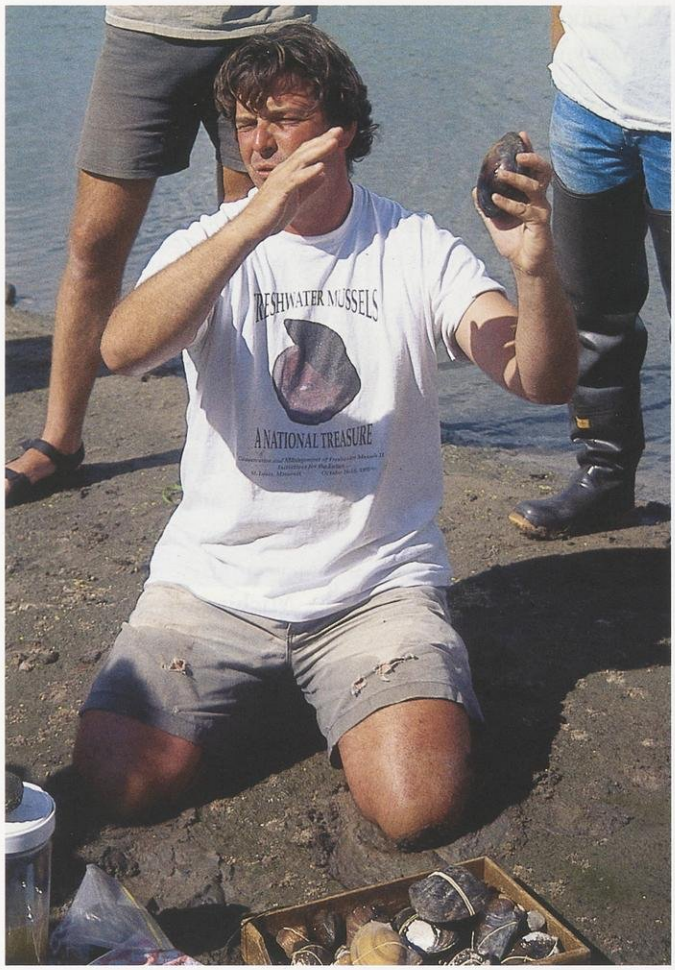
Alewives entered the Great Lakes through rivers and canals. They arrived in Lake Erie from Lake Ontario in 1931. In Lake Michigan, their populations exploded in the 1960s and 70s, resulting in huge die-offs. Today alewives are controlled by stocked salmon and trout. Alewife populations never became abundant in Lake Superior.

1959

The St. Lawrence Seaway was completed, allowing large amounts of ballast water to reach the Great Lakes.

1960s

Eurasian water milfoil came to North America from Europe in the 1940s. It spread westward into inland lakes by boats and waterbirds, reaching Midwestern states between 1950 and 1980. Infestations in Wisconsin were reported as early as the 1960s starting in south-



ROBERT QUEEN

Wisconsin in 1990 in Racine harbor. Between 1988–90, zebra mussels spread to parts of all five Great Lakes.

Persistent mussels in water intake lines cost Wisconsin municipal water utilities and power utilities about $10 million in 1994 for control systems. Annual maintenance costs run about $100,000 per plant. On the Mississippi River,

Zebra mussels have a voracious appetite and can out-compete native mussel populations for food.

ALIENS!

myth #2

If it is pretty or beneficial it can't be a problem.

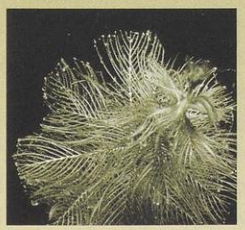
Not true. Purple loosestrife is beautiful in bloom, but replaces other wetland plants. Reed canary grass was once widely planted to turn "worthless wetlands" into forage production areas for cattle. Now, a large percentage of the once biologically rich marshes and meadows in the state are largely blanketed by this one grass species that provides little useful wildlife habitat or forage.

1970s

Purple loosestrife from Europe and Asia was introduced to the East Coast of North America in the 1800s. It first spread along roads, canals and drainage ditches, and later spread via the nursery trade as an ornamental. Purple loosestrife was detected in Wisconsin in the early 1930s and remained uncommon until the 1970s. It is now found in 70 of Wisconsin's 72 counties.

ern Wisconsin and now inhabit 54 counties and 338 Wisconsin waterbodies.

Rusty crayfish were likely brought to Wisconsin as bait. They may have spread via ballast water or by students after studying crayfish. Populations have expanded since 1960 throughout northern Wisconsin lakes and streams.



1980s

Northern lakes in Wisconsin were spared the Eurasian water milfoil menace until the mid-1980s when a second wave of infestation hit the state.

The Eurasian ruffe, a perch-like fish, was introduced to the Duluth-Superior harbor in the ballast water of ships in the mid-1980s. Ruffe have been found only in lakes Superior and Huron but are likely to spread to the other Great Lakes. Ruffe may harm valuable perch, whitefish and herring fisheries by competing for food and eating eggs.

zebra mussels threaten the state's clamming industry as they encrust native clams that are used as the seed for Asian cultured pearls. People walking Wisconsin beaches where zebra mussels are found also will find millions of tiny sharp shells cutting their feet and the putrid smell of decaying mussel tissue.

Zebra mussels are by no means the only invaders into Wisconsin. Early settlers brought plants and animals with them from Europe, some intentionally and some not.

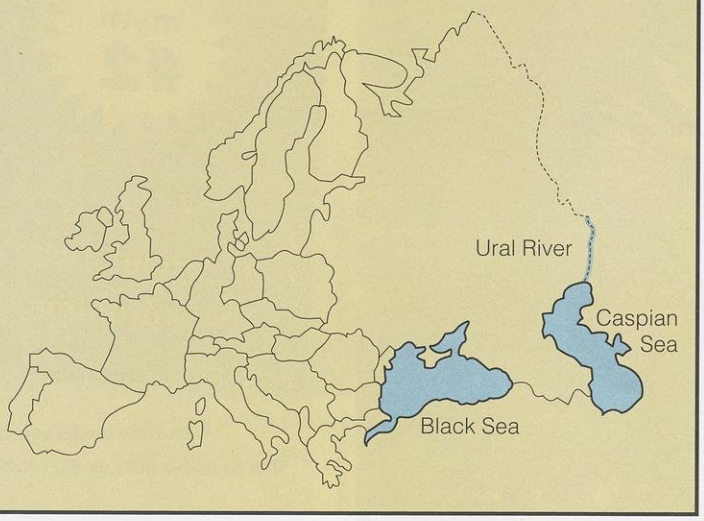
The U.S Fish Commission introduced the common carp in the 1870s as a food source. Pacific salmon also were introduced in the 1870s. Naturalists introduced fresh water snails later in the century to "increase diversity."

More recently, chinook salmon and coho salmon were released in the Great Lakes to consume the abundant and troublesome alewife. Other sport fish intentionally introduced into the Great Lakes are the rainbow and brown trout.

Many invaders have a history of moving along transportation routes.

As locks were opened on the St. Lawrence River in the early 1800s, they provided passage for vessels and fish, such as the sea lamprey and alewife. Passage from Lake Superior to the Atlantic was achieved in 1855, opening the door for the influx of exotics. When the St. Lawrence Seaway was completed in 1959, ocean-going ships could more easily transit the Great Lakes. Exotic hitchhikers caught rides inside these vessels in their ballast and on the hulls.

Where do they come from?



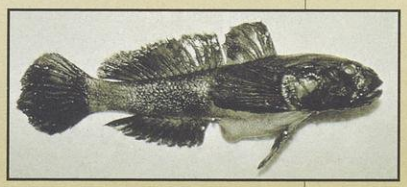
MAP BY MOONLIT INK

Wisconsin anglers may see many exotics in lakes Michigan and Superior or in inland lakes. More common are white perch, redear sunfish, three-spine stickleback, round goby and ruffe.

The more common aquatic exotic plant species include purple loosestrife, which invades wetlands and forces out native

1984

The spiny water flea was found in Lake Huron in 1984. It feeds on daphnia, an important food source for young fish and other organisms. Its spiny tail makes it undesirable prey for many predators. The fleas form large clouds in the lake and gum up fishing lines.



1990

The U.S. Nonindigenous Aquatic Nuisance Prevention and Control Act called for a standard for ballast water quality. About 21 billion gallons of ballast water are released into the nation's waters each year. Voluntary ballast exchange for ships entering the Great Lakes became mandatory in 1993.

The round goby has spread to many areas of the Great Lakes. This bottom-dwelling fish can displace native fish, eat their eggs and young, take over habitat, spawn multiple times in a season and survive in poor quality water.

1988

The University of Wisconsin Sea Grant established an exotic species program.

1990s

While first discovered in a Racine harbor in 1990, zebra mussels have expanded their range along the coast. They reproduce quickly, clogging intake pipes that serve industries and water treatment plants. They damage lakes and rivers, and native mussel species. They are spreading to inland waters.

1994

The Wisconsin Department of Natural Resources submitted a Eurasian water milfoil report and a zebra mussel report to the legislature.

ROBERT QUEEN

Chinook salmon started thriving again on the Great Lakes after a sea lamprey control program was initiated there.

plants, Eurasian water milfoil, curly-leaf pondweed and giant phragmites found in abundance in lower Green Bay.

Zebra mussels are found in 22 inland lakes, mainly in southeastern Wisconsin. Their encroachment was slowed by boaters who cleaned their boats of aquatic plants, drained their live wells, bait buckets and bilge water before leaving launch sites. If there is a good side to the zebra mussel invasion, it is the public visibility it brings to exotic species.

Because of the havoc caused by zebra mussels, Congress passed the Nonindigenous Aquatic Nuisance Prevention and Control Act in 1990, "to prevent unintentional introduction and dispersal of nonindigenous species into the waters of the United States through ballast water management..." This act also called for coordinating the activities of federal agencies, to develop control methods and to take steps to understand and minimize economic and ecological damage.

Two parts of the act are of particular interest. One provides $2.8 million a year for research and education. University of Wisconsin Sea Grant has taken full advantage of these funds since 1989. The second section authorizes $4 million a year (but only about $800,000 to $1 million has been appropriated each year) to implement state management plans to control exotic aquatic species. Wisconsin is in the process of developing a plan so the state can qualify for federal funding under the act. □

Al Miller is the advisory services director for the University of Wisconsin Sea Grant.

1998

The National Aquatic Nuisance Species Task Force approved a plan on the St. Croix National Scenic Riverway that provides funding to protect against the introduction of zebra mussels and other invasive species.

2000

The International Joint Commission (IJC) completed a study of exotic species in the Great Lakes. Recommendations called for biological standards for ballast water in ships.

1996

The National Invasive Species Act was passed.

1999

White perch were found in the Green Bay/Fox River system in 1988, in the Duluth harbor in 1986, and in the Milwaukee harbor in 1999. This relative of the white bass, yellow bass and striped bass, is an East Coast native.

President Bill Clinton directed federal agencies to fight invasive species "that are upsetting nature's balance, squeezing out our native species, causing severe economic damage and transforming our landscape."

2001

A policy is developed by the Great Lakes Panel on Aquatic Nuisance Species to guide ballast water management in the Great Lakes region.

Alien pathways

Hitchhikers and stowaways find success and spread.

Ron Martin and Bill Horns

GERARD FUEHRER

Exotic species may be transported by natural phenomena such as waterfowl and wind, though most new species are introduced to state waters through human activities.

From hitchhikers to stowaways, exotic species sometimes take the road less traveled and in many cases, it makes all the difference.

You might think that all exotics species are transported by natural phenomena such as wind or on animals. In fact, most new species reach Wisconsin waters through human activities. The rate of spread is far beyond any natural rate and often the environment is unable to cope with these invaders.

All of these new arrivals, regardless of the path that they take to get here, share one common characteristic. They have been introduced into an aquatic environment in which they did not evolve, and consequently have no natural enemies to limit their reproduction and spread. Given this competitive advantage, invasive species can cause serious problems for native organisms and disrupt natural communities.

Several species have been brought into the state and re-

JEAN MEYER

DNR FILE PHOTO

(left) **Commercial barge traffic is a potential pathway for exotic species.**
(right) **Accidental release of exotics sometimes happens through the bait business.**

leased intentionally for beneficial uses through aquaculture, the aquarium and pet trades, and horticultural practices, or to control other species. Some have harmed the aquatic environment while others have been beneficial. Still other exotic species have been introduced into this country unintentionally as a result of tourism, trade or commerce.

The major pathway for unintentional introduction of exotic species to the Great Lakes is through the ballast water of ships. Almost 800,000 tons of foreign ballast water is legally discharged into the Great Lakes each year. No state, federal or international agency has been able to effectively stop this.

Current regulations (in place since 1993) require that ships bound for the Great Lakes exchange their ballast water on the high seas (at a depth of 2,000 meters or 200 miles from shore). Also, technical solutions such as filtration, ozone, chemicals and ultraviolet treatment are being tested.

Recreational boaters, anglers, SCUBA divers, waterfowl hunters, bait industry, the aquaculture, nursery and aquarium trade, commercial barge traffic and canals are other potential pathways for exotic species.

About 161 species of exotic aquatic organisms have established a foothold in the Great Lakes.

As the Great Lakes has intensified as a transportation route, the rate of exotic species introductions has increased. More than one-third of the organisms have been introduced in the past 35 years, a surge that coincides with the opening of the St. Lawrence Seaway, which permitted more and larger vessels to pass between the Great Lakes and ports around the world.

The DNR's message to boaters, anglers, water-skiers, SCUBA divers, sailors and others who have the potential to spread exotic species is: Clean boats means clean waters. Cleaning boats can make a difference and the Department of Natural Resources and University of Wisconsin Sea Grant have strongly promoted this concept through public education and outreach efforts. □

Ron Martin and Bill Horns work with aquatic exotic species issues for the Department of Natural Resources.

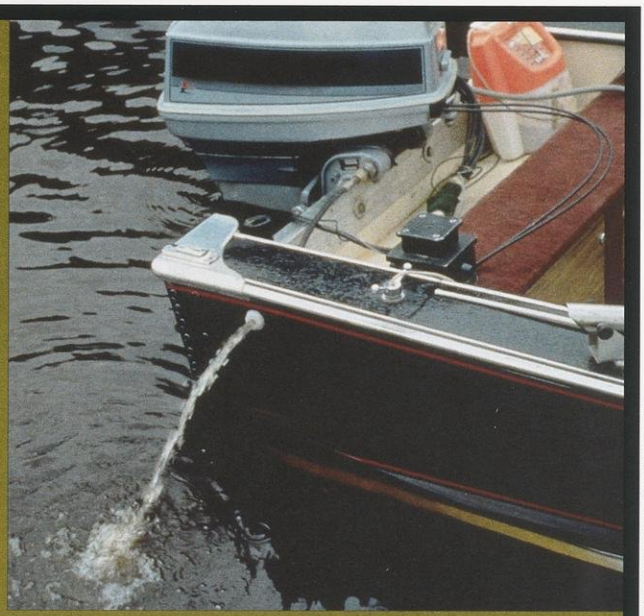
ALIENS!

myth #3

Biological controls are dangerous and the solution may become worse than the initial problem.

Not as true today. While it is true that early experiments with biological controls sometimes turned out to be serious mistakes — introducing the mongoose to the Caribbean Islands to control the rat population is a key example — in recent decades, federal regulations on biocontrols have become very strict. These regulations require extensive testing of any organism to be introduced to ensure that it doesn't impact our native plant communities, forests or crops. The key is that the organism used for biocontrol must be specific to the target species, otherwise it is not authorized for use.

All ships bound for the Great Lakes must exchange ballast water on the high seas.



Drain water from bilges and live wells before leaving a launch area.

(BOTH PHOTOS) DNR FILE PHOTO

A new policy on ballast water

In March, the Great Lakes Panel on Aquatic Nuisance Species established a final policy on managing ballast water in the Great Lakes region. The policy document culminated about eight months of intensive effort and was developed by consensus of approximately 40 regional authorities well versed on ballast water issues. These authorities included representation from the states, the province of Ontario, Native American tribes, federal agencies, the maritime industry, environmental and other non-governmental groups.

The policy objective is to eliminate introductions of aquatic nuisance species in the Great Lakes-St. Lawrence system. The policy also aims to reduce aquatic nuisance species dispersal between the lakes.

The policy recognizes that ballast water is a major pathway for introducing and spreading aquatic nuisance species, not only to the Great Lakes, but other coastal and fresh waters of North America. Ships take on ballast water to increase stability during ocean crossing and while moving between ports in the Great Lakes. Under the current regulatory system (in place since 1993), the U.S. Coast Guard requires all vessels bound for the Great Lakes to not only exchange their ballast water on the high seas, but to retain ballast onboard or use an environmentally sound alternative.

The policy statement developed a series of recommendations to address these concerns and advance a strong prevention and control effort. Key recommendations include:

- Establish criteria at the federal level for ballast water management practices/treatment technologies that are consistent throughout the Great Lakes region. To be effective the program must have the support of both the U.S. and Canadian governments.
- Address gaps and inconsistencies in ballast water management by adopting a binational, systemwide approach that coordinates regulations/guidelines among all jurisdictions.
- Apply regulations/guidelines at the federal, state and provincial levels to all vessels entering the Great Lakes-St. Lawrence system. Current U.S. Coast Guard regulations and Canadian guidelines apply only to vessels "in ballast" and excludes NOBOBs (vessels reporting no ballast on board), those vessels conducting coastal voyages and those vessels operating only on the Great Lakes.
- Ensure cooperation and coordination among all relevant U.S. and Canadian government agencies, the maritime industry and other stakeholders in developing and applying guidelines to manage ballast water.
- Evaluate alternatives to ballast water exchange on the high seas that are effective, environmentally acceptable, economically feasible, practical and enforceable.
- Secure long-term federal funding that provides sufficient support for research of alternative technologies.

The policy lays the foundation for a sound ballast water management program in the Great Lakes region notes Phil Moy, a fisheries and nonindigenious species specialist for the University of Wisconsin Sea Grant. Moy directed and coordinated this effort and further emphasizes that this policy document will be very important in addressing the changes that are needed in the National Invasive Species Act, which is up for reauthorization in 2002. — *Ron Martin*

Controlling exotics

Sometimes coping is the only option.

Phil Moy

They are stubborn.

Once an exotic species becomes established in a lake or stream, it is virtually impossible to eliminate it from the ecosystem — complete eradication of an aquatic species is rarely, if ever an option. The most we can hope for is to limit the population to a small area, and check that the control strategy doesn't seriously harm other organisms.

When the Asian longhorn beetle was found in Chicago, for example, affected trees were identified, quarantined and cut down.

Experience with the sea lamprey also has shown that even when a species-specific toxin is available, only long-term control rather than eradication is possible.

We cannot eliminate zebra mussels from a lake or river system once they become established without affecting other species. Their high reproductive rate and free-floating larval form requires that an entire population in a lake would need

This lamprey barrier was used to hinder the exotics' movement on the Brule River.

LARRY NIELSON

to be eliminated at the same time to remove them from the system. Some fish and ducks feed on zebra mussels, but they are not likely to eliminate zebra mussels from the environment.

Options for dealing with established exotic species are to manage the population or modify the ways we use aquatic resources. Industrial and municipal water suppliers use chemicals or hot water to prevent zebra mussels from clogging pipes and screens.

Eurasian water milfoil can clog boating lanes and affect the ability of fish to maneuver through the water. Even though Eurasian water milfoil can reproduce from floating fragments, mechanical harvest is the only option to keep waterways open.

Biological control using plant-eating insects is an option for exterminating exotics such as purple loosestrife and Eurasian water milfoil, but it takes time to see results. Until biological control can be expanded, hand pulling of pioneering populations and spot treatment using herbicides will continue to be important to curb its spread.

Since the invasion of the zebra mussel, significant effort has been devoted to public education, including boaters, as a key component in preventing its unintentional spread.

To raise awareness, the University of Minnesota Sea Grant Program produced a video that featured John Ratzenberger (a.k.a. Cliff Claven from "Cheers") to encourage boaters to stop the spread of exotics by cleaning their boats. The video is based on the national boater guidelines approved by the U.S. Coast Guard.

Zebra mussel, purple loosestrife, round goby and ruffe "watch identification cards" are distributed like baseball trading cards and provide a photo, a description of the exotic species, plus advice on what to do to report one. The Internet offers access to photos, articles and more.

Some states use roadside inspections to check boats and trailers for invasive species that may be "hitching a ride" to another lake. In many states it is unlawful to transport exotic species.

Boat launches offer an opportunity for education rather than enforcement. Educational efforts at the launches could include instructing boaters to clean weeds off motor, boat, trailer and water intake ports, and to drain live wells. Wisconsin boaters get information about exotic species when they apply for boat registration. Some states include such in-

ROBERT QUEEN

ROBERT QUEEN

Education efforts include signs at launch areas reminding boaters to be wary of transporting exotics when fishing or recreating.

ROBERT QUEEN

Attack Packs used by students contain books, video, samples, activities and overheads on exotic species.

ROBERT QUEEN

Exotics trunks contain teaching props such as samples of exotic species like zebra mussels and Eurasian water milfoil.

formation in fishing and hunting regulations and provide a list of infested waters.

Children also need to understand the effects of exotic species to help prevent their spread. Kits and workshops can provide teachers with information and materials on exotic species. Some lake associations have "floating classrooms" on pontoon boats to help young lake users learn about their lake and non-native species.

University of Wisconsin-Extension along with the Wisconsin Department of Natural Resources, University of Minnesota Sea Grant and the Wisconsin Association of Lake Districts have each developed their own exotics trunks, which contain key educational materials on invasive species.

"The trunks (the ones now being used by the Department of Natural Resources) contain teaching props focusing on four species — purple loosestrife, Eurasian water milfoil, rusty crayfish and zebra mussels," explains Laura Felda, the Wisconsin Lakes Partnership Adopt-a-Lake Coordinator. "This includes pressed specimens and brochures."

There are over 100 such trunks currently in circulation. For information on how you can receive an aquatic exotics trunk, call (715) 346-3366.

The aquatic nuisance species "Attack Pack" is another tool used by high schoolers to teach elementary school students about exotic species. The packs contain books, a video about aquatic exotics, activities, overheads and a PowerPoint presentation on exotic species in Wisconsin. In addition, a ruffe, round goby and zebra mussel are mounted in plastic paperweights. This allows the students to handle the specimen and easily examine all sides. Brochures and watch cards also are provided along with colorful maps to illustrate the distribution of exotics in Wisconsin and the United States. These materials are packaged in an easy-to-carry backpack.

For more information about the Attack Pack or to obtain one for use in your school, please contact Phil Moy at (920) 683-4697 or e-mail to pmoy@uwc.edu. □

Phil Moy is a fisheries and nonindigenous species specialist for the University of Wisconsin Sea Grant.

Follow these steps to make a difference

Controlling the spread of exotic species can include several approaches: eradication (trying to destroy a population when it is relatively small); containment (developing a strategy to limit or slow the spread of a population); or suppression (attempting to keep populations below thresholds that are harmful).

Education is a key component of all these approaches. However, for prevention programs to be effective, partnerships and cooperation between groups also is essential.

Take these simple steps every time you remove your boat from the water, regardless of whether you know the lake is infested or not:

- Drain water from live wells, bilges and other containers before leaving the launch area.
- Remove plant parts and animals from your boat, trailer and accessory equipment. Dispose of the removed materials in the garbage either at the launch area (if cans are available) or at home.
- Do not release live bait or aquarium pets into any waters.
- Wash your boat and trailer thoroughly with tap water when you get home. Flush water through your motor's cooling system, live wells and other areas that hold water or dry your boat and equipment for five days in a sunny location before transferring it to a new body of water.

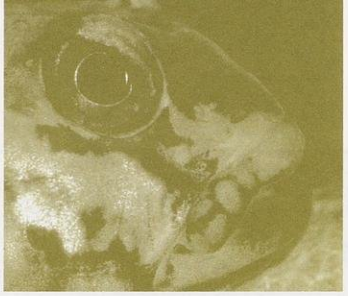
To help stop the spread of exotics, also watch for signs at boat ramps this summer.

The red "stop" sign, which may be posted at any water, reminds boaters to remove aquatic plants and other potential sources of exotic species from their boat and trailer. The yellow "caution" sign is posted at infested waters. The green "help" sign contains general information on preventing the spread of aquatic exotics.

ROBERT QUEEN

Follow the advice of signs posted at landings regardless of whether you know the lake is infested.

DNR FILE PHOTO



Chicago Sanitary Ship Canal

An electrifying experiment in stopping the spread of exotic species.

Phil Moy

DANE JUDE

The round goby is an aggressive bottom-dwelling fish that came from Europe near the Caspian Sea.

The Chicago Sanitary and Ship Canal serves as a vital transportation corridor for commercial and recreational vessels operating between the Great Lakes and the Mississippi River.

The Chicago Sanitary and Ship Canal, constructed in 1910, connects the South Branch of the Chicago River to the Des Plaines River. The confluence of the Des Plaines and Kankakee rivers forms the Illinois River. Originally, this waterway helped build the Midwest; today it provides a two-way conduit to expand the range of exotic species between the rivers and Great Lakes.

This conduit is how zebra mussels spread from the Great Lakes to the Gulf of Mexico. The grass carp, African water flea and round goby also are expanding their ranges using the canal.

The round goby is of great concern in Wisconsin and has been found in the Duluth-Superior and Milwaukee harbors, and at Sturgeon Bay. Like the zebra mussel it came from Europe near the Caspian Sea and is believed to have arrived in lakes Michigan and Superior from other Great Lakes in ballast water.

The round goby is an aggressive and bottom-dwelling fish that can displace native aquatic species. The goby prefers rocky, cobble habitat and preys on mussels, invertebrates, fish eggs or other small fish. It has the potential for rapid population growth since it spawns several times during the summer. It is illegal to possess and transport live gobies at any time, though people in Wisconsin may have one dead goby in possession with the purpose of sharing it with the Department of Natural Resources, University of Wisconsin Sea Grant or U.S. Fish and Wildlife Service staff for positive identification.

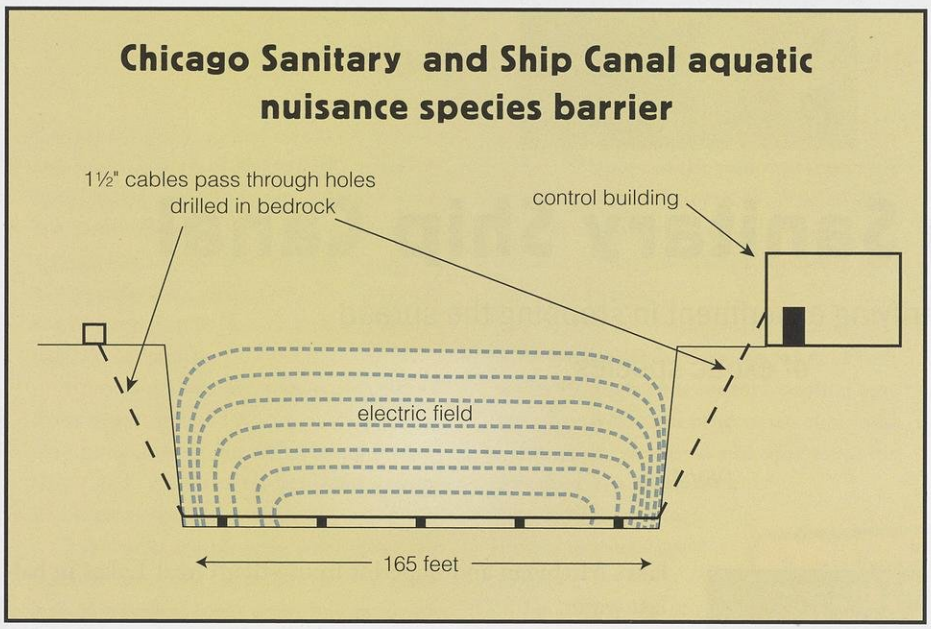
Other species that could spread into the Midwest or the Great Lakes through the canal include the black carp, bighead carp, striped bass and their hybrids, three-spine stickleback, fishhook water flea, quagga mussel (a mussel that can survive in deeper and colder waters than zebra mussels)

ALIENS!

myth #4

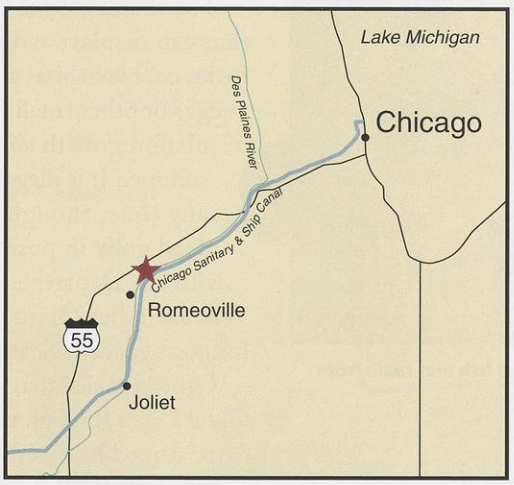
By the time you notice the spread of an exotic species, it is too late to control it.

True, in some cases. Some organisms, particularly those living in water, often are not detectable until their populations are quite high. But it is still possible to control the spread of an invading species if correctly done. Eradication may be possible only if an effective control effort is begun when a population is still small and the site is monitored for recolonization for many years.



MAPS BY MOONLIT INK FROM DNR AND UNIVERSITY OF WISCONSIN SEA GRANT DATA

An electric barrier will run through the water column to limit the spread of exotics through the Chicago Sanitary Ship Canal.



and the spiny water flea, which is a crustacean that is distantly related to shrimp, lobster and crayfish.

The spiny water flea is a European native that came to North America likely in ballast water and took up residence in each of the Great Lakes by 1987. It preys on smaller planktonic animals and may consume as many as 20 organisms in a day. The spiny water flea also targets a small water flea called daphnia that is food for many young fish and native crustaceans.

White perch spread is another concern. White perch already have been found in the Milwaukee harbor and are abundant in Green Bay. White perch, a relative of white bass, yellow bass and striped bass, is a native of the East Coast and entered the Great Lakes in the 1980s.

The fishhook water flea is an invasive crustacean that, like the spiny water flea, was first discovered in Lake Michigan in 1999 by a researcher working in Grand Traverse Bay and near Waukegan. It was introduced into the Great Lakes in the 1980s originating from the Caspian Sea in Eastern Europe and was likely transported to North America in ballast water. It has been found on fishing line near Chicago, although it has not yet been found in Wisconsin waters.

Considering its proximity to the Wisconsin-Illinois border, researchers predict that it is likely to appear in Wisconsin waters. Anglers have reported that fishhook water fleas foul fishing lines, which interfere with retrieving hooked fish. Some anglers have had to cut their lines because they are unable to reel them in. The masses of the water fleas look and feel like wet cotton batting. They also feed on zooplankton, which is an important food source for juvenile fish and invertebrates.

The National Invasive Species Act of 1996 authorized the U.S. Army Corps of Engineers to investigate whether these and other aquatic exotic species could be prevented from moving through the Chicago Sanitary and Ship Canal. The Corps and a multi-agency advisory panel indentified an electric barrier as an option that was commercially available, had the fewest permitting concerns, and would not interfere with day-to-day navigation on the canal.

The first step will be establishing a micro-pulsed DC electric field designed to deter passage up or downstream. Construction of the electric array, located at River Mile 297, near Romeoville, Ill. began this spring, and the barrier should be operational this summer. Monitoring by the Illinois Natural History Survey and the U.S. Fish and Wildlife Service will help determine the barrier's effectiveness.

The electric barrier will run through the water column with the strongest electrical current at the bottom to target bottom dwelling organisms such as the round goby.

"The barrier is one of the few experimental tools we have to limit the spread of exotics through the Chicago Sanitary and Ship Canal," notes Ron Martin, who works with exotics species issues for the Wisconsin Department of Natural Resources. "It probably won't be 100 percent effective on all species but it's the best tool that we have."

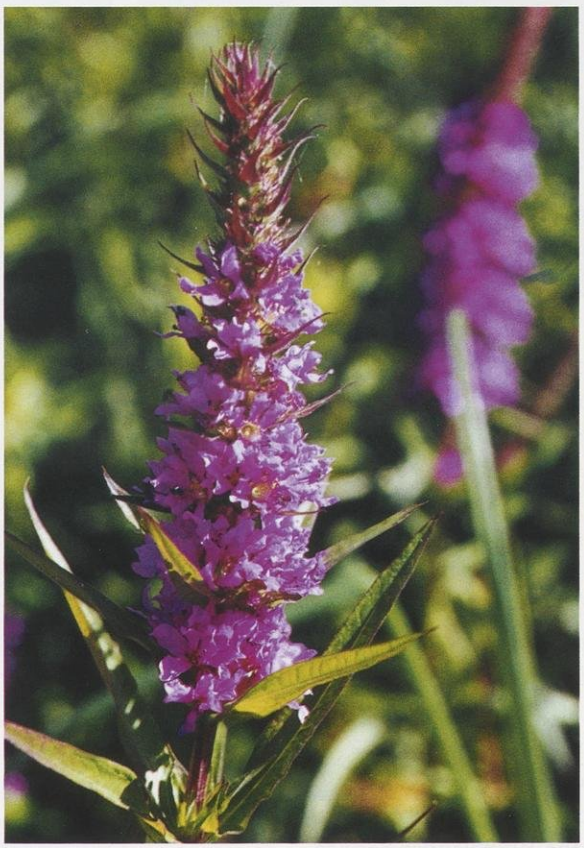
Future additions to the electric field may involve an acoustic array, bubble screens or some other technology. To learn more about the barrier project visit the University of Wisconsin Sea Grant's website at http://www.seagrant.wisc.edu/outreach.html. □

Phil Moy is a fisheries and nonindigenious species specialist in advisory services for the University of Wisconsin Sea Grant.

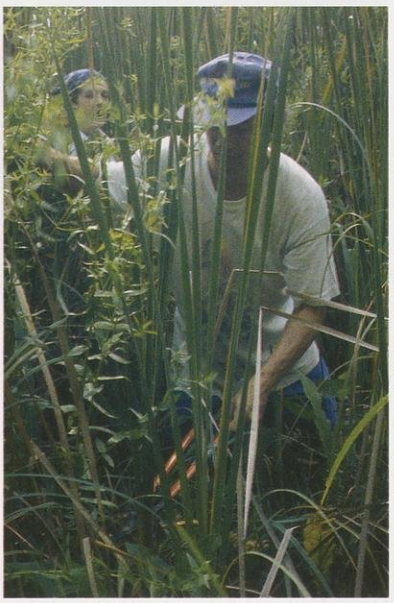
Purple invaders

How ghosts and beetles in the backyard help control the spread of purple loosestrife.

Brock Woods and Cathy Cleland



Beetles raised in nets *(lower left)* **are one natural option for controlling purple loosestrife populations that have gotten out of control in wetlands, waterways and roadsides in 70 of 72 Wisconsin counties.**



(LOWER LEFT) LORI REGNI *(ALL OTHER PHOTOS)* DNR FILE PHOTO

Last spring, you may have wondered about some strange ghost-like objects standing in a child's wading pool in someone's back yard. Wondered, but were afraid to ask?

Put your fears to rest. They weren't ghosts but net insect bags containing a purple loosestrife plant and hundreds or thousands of helpful beetles.

And not just any beetle, but a species that feeds specifically on purple loosestrife.

All too often, purple loosestrife is found growing along the fringes of wetlands, waterways and roadsides in 70 of Wisconsin's 72 counties. Despite its beauty, it aggressively displaces native plants and devastates shoreline and wetland habitats. This plant originated in Eurasia and arrived in North America in the 1800s by way of ship ballast and as a garden plant brought over by immigrants.

Eradicating this exotic has proven difficult.

Once established, purple loosestrife forms a dense tangle of roots and stems, crowding out native plant species and wildlife. Mature plants can produce from 100,000 to 3 million seeds per plant per year, which creates a huge seed bank viable for years. Traditional removal methods such as hand pulling, burning and chemicals are labor intensive and, though very useful for containing small

populations, have had limited success for larger infestations.

As a result, experts are increasingly turning to nature for a solution.

In Eurasia, the plants are kept in check by insects that feed on them. After years of rigorous testing to be sure they would only feed on purple loosestrife, several of these insect species were approved for release in the United States with the hope that they could help control the plant here. In 1994, DNR biologists began releasing some of these insects in Wisconsin. Monitoring release sites has shown the insects are an effective, natural and safe control for this exotic plant.

Two species of Galerucella beetles show particular promise in both reducing the plant's spread and rendering it less competitive with native plants. Beetles decrease flowering and seed sets by feeding on the developing stem. Leaf feeding also weakens purple loosestrife, helping native plants choke it out.

The Department of Natural Resources, through the Purple Loosestrife Biocontrol Project, has enlisted help from students, scouts, lake associations and individuals in raising the beetles for release since 1997. Over a million and a half of these beetles have been released in more than 200 sites statewide by these cooperators. Monitoring these sites has shown the beetles to be an effective, natural control for this exotic plant.

Notable assistance has come from two other parts of the state. Since 1998, Barron County seasonal worker Dave Blumer has not only released beetles in many sites in and around the county, but also has recruited teachers in most of the county's secondary schools to do the same. In 1999, DNR staff at the Rhinelander Service Center began working as a northern hub of this activity. They began raising beetles while working with cooperators like John Bie from Woodruff and providing plants for raising beetles to the Lucky Hills 4-H group in Taylor County. Since then, the center staff has released many beetles, in addition to helping other cooperators get started.

Many other special biocontrol efforts were integrated with traditional methods. For example, in 1999 Lori Regni, from the Post Lakes Protection and Rehabilitation District, spearheaded a campaign to eradicate loosestrife from Langlade County. Informational literature was distributed, residents were asked to remove purple loosestrife from their shorelines, a group was organized to remove flowering tops and dig purple loosestrife from the shores of the Post Lakes in 1999, filling three rowboats. In 2000, the project continued as Regni arranged to have more than 20,000 beetles raised and released in the Post Lakes area.

Other examples include Camp Manito-wish YMCA, where campers and staff have released beetles as well as pulled purple loosestrife along the shores of Boulder Lake for

Members of the Post Lakes Protection and Rehabilitation District are active in eradicating purple loosestrife from Langlade County.

LORI REGNI

LORI REGNI

the last two years. At Horicon Marsh, cooperation between Department of Natural Resources and federal workers has resulted in rearing and releasing beetles that reduced purple loosestrife all over the marsh.

SUPPLIED BY CORNELL UNIVERSITY

(left) **Adult Galerucella beetles are released at sites targeted for purple loosestrife control.** *(below)* **The beetles feed on the leaves and stems to weaken the plant.**

DNR FILE PHOTO

Charlie Shong, superintendent of the Lake Pewaukee Sanitary District where beetles have been raised since 1999, says a small investment of time, space and a few materials are all that is required to become involved with biocontrol. Permission is granted to volunteers to grow purple loosestrife as a food source for the beetles, since the cultivation of the plant is banned in Wisconsin. The plants are gathered from local wetlands. Beetles needed to start rearing are either collected from former release sites or acquired from the Department of Natural Resources in Monona or Rhinelander.

The Pewaukee Sanitary District also is partnering with the Lake Country Rotary in Hartland and the Pewaukee Rotary Club to raise and release beetles in the district. To build a future for exotics management, the sanitary district hosts a spring high school summit on exotic species. The high school kids teach others at their schools and even middle schoolers about management options for controlling exotics.

While these beetles will not eradicate loosestrife, they may reduce the population enough that cohabitation with native species becomes a possibility, Shong notes.

Volunteers dig their plants in March and April, put the plants in pots or buckets and cover each with a net insect bag. They are placed in children's wading pools because they require a lot of water to grow. The pools are placed in areas of full sunlight.

Beetles may be acquired from the Department of Natural Resources or collected in May as they emerge from the leaf litter and soil where they've hidden throughout the winter. Ten beetles are placed on each bagged plant where they feed and lay eggs completing their life cycle. The eggs hatch, larvae emerge, feed, pupate, and about 1,000–2,000 new adults emerge from each pot in 7–10 weeks. The pots are taken to a purple loosestrife site where the beetles are released. Project materials are then stowed away until the next spring's rearing. It costs about $200 to $300 to produce 10,000 or more beetles.

The DNR's beetle program will continue as long as there is funding and interest for it. Contact the DNR aquatic plant manager in your region or the Biocontrol Program Office in Monona at (608) 221-6349 or woodsb@dnr.state.wi.us for more information. □

Cathy Cleland works on aquatic exotics issues for the Department of Natural Resources and is stationed in the Rhinelander office. Brock Woods works on the Purple Loosestrife Biocontrol Project out of the DNR's Research Center in Monona.

ALIENS!

myth #5

All aquatic plants are weeds.

Not true. In fact, there are hundreds of species of native aquatic plants that are critically important parts of a lake or river ecosystem. Currently, Wisconsin has only a few invasive aquatic plants — these are the ones that cause problems for boaters and anglers, as well as for fish and other plants. They receive the most attention because they are problematic.

DNR FILE PHOTOS

SCUBA divers may be called in to find and destroy Eurasian water milfoil. Early detection and identification is critical for controlling this exotic.

Weed warriors watch for milfoil

Self-Help Lake Monitoring volunteers have been the backbone of water quality testing in Wisconsin since 1986. In fact, today about 650 Wisconsin volunteers invest their time and energy to help with everything from taking secchi readings that monitor water clarity to collecting water chemistry samples, taking dissolved oxygen readings and monitoring aquatic plants.

Now, many of these volunteers also have answered the call to be weed warriors in a battle against Eurasian water milfoil. Many, but not all, of the weed watchers are Self-Help volunteers.

Weed watchers are trained by the Department of Natural Resources or University of Wisconsin-Extension to distinguish native aquatic vegetation from the exotics and in particular to differentiate the Eurasian variety from the seven species of native milfoil. Early identification makes eradication or control much easier and can help prevent its spread. The most recent information available from Oct. 2000 shows that Eurasian water milfoil is found in 54 of 72 Wisconsin counties.

Volunteers receive a packet containing fact sheets, reporting forms and a laminated sample of Eurasian water milfoil. The weed watchers motor around their chosen lake once or twice a summer on clear, calm days checking plant beds and raking up suspect plants.

Since Eurasian water milfoil can grow in water up to 20-feet deep, volunteers check both the near shore areas and deeper water. In particular, areas near boat landings are carefully inspected since boats are the primary carrier of Eurasian water milfoil to other waters.

If the exotic water milfoil is present, fragments may wash up on beaches, so volunteers also thoroughly check these areas. When volunteers find a plant they think is Eurasian water milfoil, they share their findings with a plant expert, usually their local Self-Help coordinator. The plant is verified and the results entered into a DNR database.

Dissolved oxygen levels are lower where milfoil carpets a lake.

DAVE MARSHALL

One observant volunteer weed warrior, for example, found a fragment of Eurasian water milfoil near the boat landing on Lake Minocqua in Oneida County last September. This was the first report of the exotic on this lake. The plant was verified and the lake association hired a diver to remove the Eurasian water milfoil plants near the boat landing and dispose of them. With luck, the diver found and destroyed the aquatic exotic intruder in this bay. Plant surveys will be done in the future so a control strategy can be worked out if Eurasian water milfoil is found again. Early identification is essential in this battle.

Contact your local DNR Self-Help Coordinator if you are interested in becoming a weed warrior. — *Sandy Wickman*

Tales from the exotics battlefront

The exotic that would feed the world got away

Izaak Walton extolled the virtues of carp in 1653 as "The Queen of Rivers."

In 1882, Dr. Increase Lapham wrote: "The day will come when the people of the state (Wisconsin) will thank the men who have introduced and planted this extra fine species of fish (carp)."

But in Wisconsin, the carp's reign as queen of the rivers has been questioned, and the thanks that Lapham predicted has yet to be heard.

In fact, if Walton and Lapham could see us now, and witness the havoc carp have caused in some Wisconsin waters, they might be eating their words.

The common carp is native to Asia but was introduced in Wisconsin 121 years ago as a food source. Since then, carp have become a nuisance especially in southern Wisconsin. Carp is the main fish species in some waters, outcompeting native game fish for food, spawning area and habitat.

"Early efforts to help carp thrive in the state were aimed at ending starvation in Wisconsin," explains Steve Gilbert, the DNR fisheries biologist for Vilas County and a fisheries historian.

DEAN TVEDT

DNR FILE PHOTO

The common carp was introduced in Wisconsin 121 years ago as a food source.

As many as 35,000 carp were placed into Wisconsin waters in 1890 and distribution continued until 1895, when the program was discontinued.

Problems associated with carp were recognized as early as 1901. Fisherman considered them a nuisance. Excessive carp populations uproot native underwater plants, attack plant species such as cattails and resuspend sediments making the water cloudy.

Laura Stremick-Thompson, a DNR fisheries biologist, notes that carp especially are abundant in large, shallow lakes and streams in southern and central Wisconsin such as the Horicon Marsh.

The Horicon Marsh in Dodge County includes the 20,976-acre Horicon National Wildlife Refuge and the 10,967-acre state Horicon Marsh Wildlife Area.

"In this geographic area," Stremick-Thompson notes, "that habitat has been so modified from its original form by agriculture, dams and other human interactions that we created the ideal carp habitat. This is a shallow, wide-water marsh."

Carp survive very well in the state's warm waters with little concern for low oxygen content, pollution or sudden temperature changes. The carp's ability to tolerate low oxygen levels often leaves it as one of the last survivors in oxygen depleted waters. Competition exists between young largemouth bass and carp of all ages for food and habitat.

"Carp have contributed greatly to the marsh's lack of native vegetation and desirable fish species," Stremick-Thompson notes.

Part of the marsh's long-term wildlife and fishery habitation project includes carp control, which is overseen by a coalition of the Department of Natural Resources, U.S. Fish and Wildlife Service and a citizen advisory Horicon Marsh Management Committee.

The fish toxicant, rotenone, was used at Horicon Marsh last year to kill thousands of carp. Stremick-Thompson notes that before the treatment, the marsh's fish population consisted of 48.7 percent bullhead, 48.5 percent carp and just 2.5 percent desirable species such as northern pike, walleye and panfish.

By killing the carp, it was hoped that submerged plants would grow and provide food for waterfowl, plus shelter and spawning areas for invertebrates and fish.

Historical carp controls have included seining, erecting barriers to prevent carp from entering new waters, using electrical current and chemical treatment.

"The fishery has improved since the rotenone treatment, but not as much as we had anticipated," Stremick-Thompson notes. "But it is a slow process and the goal is to keep carp at an acceptable level."

Following the chemical treatment, work began to restock the marsh with predatory fish that could act as a bio-control for carp. Forage species are being stocked to establish a food source for other fish species such as northern pike and smallmouth bass. Follow-up chemical treatments will be used in certain areas of the marsh when carp spawn to further target the adult population.

"I think of carp as a symptom of a larger problem," Stremick-Thompson notes. "A symptom of a really degraded ecosystem. And many people don't know that carp are an exotic, they just know that they are a nuisance."

LARRY NIELSON

LARRY NIELSON

The fish toxicant, rotenone, can be applied at the source or sprayed by helicopter to kill carp.

ALIENS!

myth #6

It is natural for plants and animals to move around. And since it is nature, it'll all even out in the end.

Not true. Often, they don't balance out. Ecosystems have evolved over hundreds of thousands of years with plants and animals moving around slowly, allowing the rest of the community to adapt to them. As humans move plants and animals around the globe, they purposefully leave behind the organisms that keep them in control in their homeland. Some of these introduced species find an ideal environment to spread without anything to keep them in check. Meanwhile, native species are being lost and ecosystem functions are altered.

How tiny smelt wage war on walleye

While other exotic introductions to Wisconsin have received much press and public attention, an exotic called rainbow smelt is turning up in inland lakes in the shadows of the media spotlight.

Vilas County is one example where rainbow smelt has reduced native fish such as walleye over the past 10 years.

Smelt, also called "frost fish" or "ice fish" for their silvery color, can be a tasty treat when rolled in corn meal and fried until golden brown. But on the loose in many Wisconsin waters, it is anything but appetizing.

"Because of rainbow smelt, six lakes in Vilas County have lost a naturally reproducing walleye population," notes Steve Gilbert, the DNR fisheries biologist for Vilas County.

Many people are surprised to learn that rainbow smelt is exotic to Wisconsin. Smelt is a marine fish native to the north Atlantic coast of North America. There also are a few freshwater smelt that are native to several inland lakes in Maine.

MIKE MILLER

DEAN TVEDT

Rainbow smelt has reduced native fish such as walleye in Vilas County.
(top) **Rainbow smelt (smallest) and alewife (middle) are exotic while bloater chub (largest) are native.**

In the early 1900s, smelt from a freshwater source in Maine were stocked in Crystal Lake, Mich. The fish made their way into nearby Lake Michigan and soon were showing up in all the Great Lakes. The first finding of rainbow smelt in Wisconsin was in Little Sturgeon Bay (Door County) in 1928. Through accidental or intentional efforts, they have been spreading inland ever since. In fact, the spread of rainbow smelt to inland lakes may be due in part to anglers who put live smelt in bait buckets where eggs and milt mixed, fertilized and then were "stocked" when the angler dumped the contents into the wild. Such dumpings are illegal and since smelt are classified as "rough" fish, they cannot be transported live within the state without a permit from the Department of Natural Resources.

"We are just now realizing all the adverse impacts that this species is having on our native fish communities," Gilbert notes.

The reasons walleye are susceptible to smelt are two-fold. First, walleye hatch about the same time as smelt do.

"The young walleye then move to the middle of the lake to eat zooplankton," Gilbert notes. "Circumstantial evidence indicates that adult smelt feed on little walleye."

In addition, young walleye compete with young smelt for the same zooplankton food source.

"There isn't much left at the dinner table when smelt are done," Gilbert notes.

Sparkling Lake in Vilas County shows how drastically smelt change fish diversity in a lake. The lake had a history as a good natural walleye fishery. Smelt were discovered there in low numbers in 1981 and as their numbers increased, walleye populations started to fail. Stocking walleye, which had not been necessary since the late 1950s, was resumed in 1997 to offset the effects of the smelt. But Gilbert notes that the stocking has only had limited success.

Currently, there is no easy way to remove smelt from a lake without harming the rest of the fishery, Gilbert says. Thus, public education is the best tool to prevent rainbow smelt from spreading in Wisconsin. In addition to walleye, populations of native fishes such as cisco (lake herring), whitefish, lake trout and yellow perch have declined because of smelt.

"We encourage people to follow the same steps for rainbow smelt that they use to help stop the spread of other new exotics such as ruffe and gobies," Gilbert says. "People need to be careful not to transport them to uninfested waters."

DNR FILE PHOTO

Rusty crayfish have rusty spots on each side of their carapace (outer covering). Their claws are smoother than most other crayfish.

Doug Jensen, the Exotic Species Information Center coordinator for the University of Minnesota Sea Grant, knows it can be tough to identify a rusty crayfish. That's why Minnesota has special regulations to prevent their spread. Live crayfish taken from a waterbody can only be used as live bait in that same waterbody in Minnesota. Selling live crayfish for bait or aquarium use is illegal.

The concern is that the "rusty" upsets the ecological balance in infested waterbodies in Minnesota and Wisconsin.

Rusty crayfish are native to streams in Ohio, Kentucky and Tennessee, but populations have rapidly expanded since the 1960s in the lakes and streams throughout northern Wisconsin.

Jensen notes that 42 waterbodies in Minnesota are infested with the rustys and over 110 lakes and rivers in Wisconsin.

"It's interesting because when we talk about exotics such as the round goby and spiny water flea, they came from another continent," Jensen notes. "But rustys are native to other parts of the Great Lakes, and have become an invader in other parts of the country."

Rusty crayfish reduce aquatic vegetation and deprive native fish of cover and food. They eat just about anything and use their claws to uproot vegetation making waters murky and decreasing plant growth, which also leads to potential shoreland erosion.

"Rustys mature when they are small (about 1⅜ inches) and eat more than native crayfish species," Jensen explains. "In fact, they can eat twice as much because they have high metabolisms."

Other potential problems with rustys are that they eat fish eggs, raid fish nets, and displace native crayfish.

Some cabin owners on heavily infested Wisconsin and Minnesota lakes have stopped swimming because they fear stepping on them and being pinched.

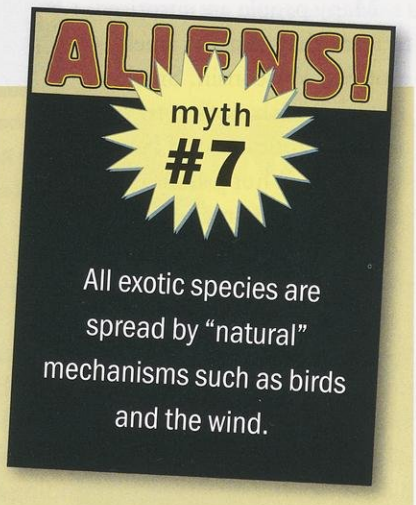
"They look ominous and have been known to target people's toes," Jensen notes.

Rusty crayfish have robust claws and dark, rusty spots on each side of their carapace (outer covering). Their claws tend to be grayish-green to reddish-brown and smoother than most other crayfish.

As proof that the railroad tracks go both ways when it comes to exotics and their overseas travels, rustys also have found their way from North America to Europe and are causing havoc for Scandinavian crayfish populations.

Unfortunately, there is little that can be done to eradicate rustys once they are established. They are edible, but so small that even crayfish lovers consider them a lot of work for a forkful.

"There's no silver bullet technology or management strategy to eradicate them right now," Jensen notes. "That's why it's so important to prevent their spread."



Not true in a majority of the cases. In fact, people are a major contributor to the spread of exotic species from purposely introducing carp to North America to unintentionally introducing zebra mussels via ballast water and transporting Eurasian water milfoil by recreational boaters and anglers.

MIKE MILLER

Native whitefish populations on Lake Michigan are increasing in the wake of sea lamprey control efforts there.

Sea lamprey and alewife packed a powerful punch

The fish community in Lake Michigan — and to a lesser extent Lake Superior — has changed dramatically over the last 100 years largely due to the introduction of exotic species.

One of the greatest impacts on the Great Lakes has been the eel-like sea lamprey, which is native to the Atlantic Ocean. It made its way past Niagara Falls via the Welland Canal by the 1920s, and colonized Lake Michigan in the 1930s and Lake Superior in the 1940s.

ROBERT QUEEN

These eel-like sea lampreys are parasites that feed on bodily fluids of other fish by attaching to the fish with a sucker-like mouth.

The effect of the sea lamprey on lake trout, whitefish and other large bodied species was devastating, explains Bill Horns, a DNR Great Lakes fisheries biologist.

For example, before the lamprey invasion of Lake Superior, the lake trout harvest averaged about 4.5 million pounds; by 1960, it was less than 500,000 pounds. The lamprey is a parasitic species that feeds on bodily fluids of other fish by attaching itself to a fish with its sucker-like mouth and rasping a hole in the body. Fish that survive

those attacks often have scars to prove it. But, only one in seven fish survives a lamprey attack. Each adult lamprey can consume 40 pounds of fish a year. Along with harvest by commercial fishing and habitat degradation, lamprey contributed to the extermination of lake trout in all the Great Lakes, except Superior.

In response to the lamprey invasion, the Great Lakes Fishery Commission was created in 1954 and given authority to implement a binational sea lamprey control program.

MIKE MILLER

This chinook salmon was attacked by a lamprey that rasped a hole in the salmon's body and left a wound.

The commission developed a program that uses barriers to block the migration of adult sea lamprey upstream to spawn, uses a selective lampricide (known as TFM) to kill larval sea lamprey, sterilizes males, and is studying the use of pheromones to lure adult lamprey into traps.

By the 1960s, the sea lamprey control program had reduced sea lamprey abundance by 90 percent to the point where large fish such as lake trout, salmon, burbot and whitefish once again thrived in the Great Lakes. This opened the door to fish stocking and resurgence of sport and commercial fisheries. Yet, this parasite still takes about half as much of the lean lake trout from Lake Superior as do sport and commercial fishing, emphasizing the need to continue sea lamprey control. Sea lamprey control costs taxpayers $15 million annually.

Like the lamprey, alewives gained access to Lake Michigan through the Welland Canal. The first documented report in Lake Michigan was in 1949.

Because lamprey had collapsed the lake trout populations in Lake Michigan in the 1950s, there were no predators to control alewives. In Lake Michigan, the alewife population became too large to support in the 1960s and 70s, resulting in huge die-offs. Some will recall beaches littered with piles of silvery dead alewives in places such as Milwaukee. The abundant alewives may have hurt some native species including yellow perch.

In 1966 fish biologists turned to coho salmon and stocked them in Lake Michigan as alewife predators and followed by stocking chinook salmon, brown trout and rainbow trout.

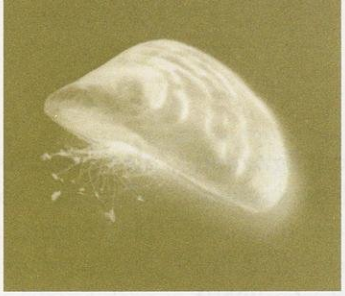
"It's an example of controlling an exotic with another exotic," Horns notes. "Alewives are held in check primarily by the chinook salmon, which also is not native to Lake Michigan." □

The alewife is a silvery fish and member of the herring family.

DAVE MARSHALL

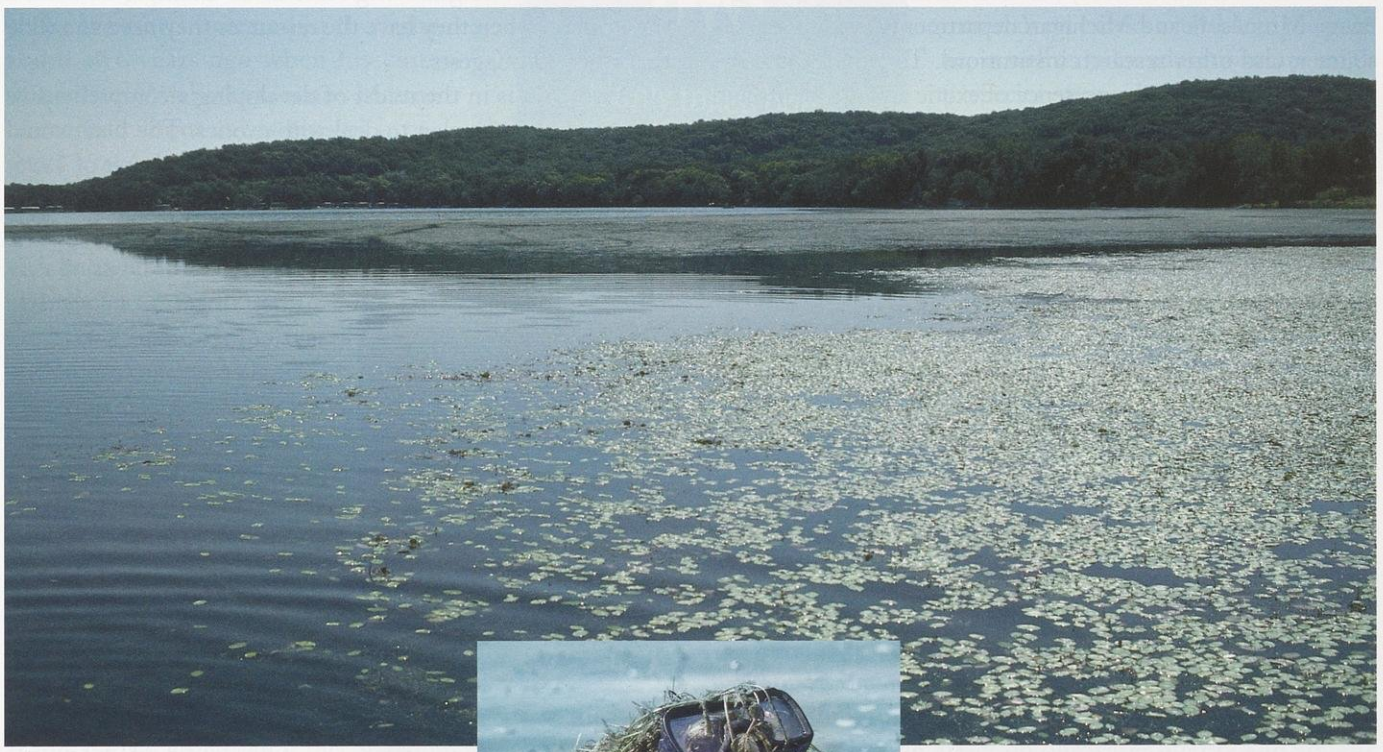
The alewife population in Lake Michigan became too large to support in the 1960s and 70, leading to massive die-offs.

DNR FILE PHOTO



Managing aquatic exotics

Working across the state on many fronts to tackle some tough invaders.



ROBERT QUEEN

ROBERT QUEEN

The spaghetti-like invader, Eurasian water milfoil, clogs fish habitat and crowds out native plants.

It has all the makings of a dramatic Saturday morning cartoon.

A superweed has invaded Wisconsin.

It is capable of stopping a speeding boat and has a chokehold on Wisconsin lakes.

It is colonizing new sites and clinging to bait buckets, motor props and trailers. As it gets chopped up into pieces, each fragment grows anew, clogging up fish habitat and crowding out native plants.

Enough is enough.

After decades of this abuse, the Wisconsin DNR and its partners agree that it is time for action and have stepped up the fight on this submersed and spaghetti-like invader known as Eurasian water milfoil.

In fact, DNR staff and their partners are working across the state on many fronts to try to control a variety of nuisance aquatic exotic species.

While the Wisconsin Department of Natural Resources does not have a specific hit squad to wack invasive species, the agency is working to strengthen its efforts to research, monitor and control exotics in Wisconsin's waterways.

But the agency also is realistic that fighting exotics and managing their spread can be overwhelming — over 160

species of fish, plants, animals, invertebrates, algae and pathogens have been introduced to the Great Lakes system since the early 1800s.

"We have a lot of shoreline in Wisconsin and not a lot of staff to work on the exotics issue," notes Chuck Ledin, DNR Great Lakes and Watershed Planning section chief. "We've been trying to target the spread of exotics on a small scale and marshal our forces, but we need a core of people dedicated to this issue."

That's why the agency works with many partners on curbing the spread of exotics. Partners include such groups as the University of Wisconsin and University of Minnesota Sea Grant institutes, University of Wisconsin-Extension, U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Minnesota and Michigan departments of Natural Resources, and other research institutions. Together, these organizations monitor the presence of exotic aquatic plants and animals through underwater diving, aerial photography and reports of "alien" sightings from concerned citizens. Public reporting of new exotic species occurrences is critical.

In its attack against Eurasian water milfoil, researchers from the Department of Natural Resources along with local lake organizations and the University of Wisconsin-Stevens Point are finding that the pest may have met its match in a native beetle, the milfoil weevil. While no funding source currently exists to systematically stock lakes with beetles, lake organizations can organize and finance their own control efforts with the Department of Natural Resources providing some technical advice.

Bill Swenson, a biology professor in Superior and a fisheries specialist for the University of Wisconsin-Extension, has educated people about the threats of exotic species on aquatic ecosystems in the state for 20 years. He says Wisconsin needs the kind of comprehensive public education program that Minnesota has.

"We have a neighboring state as an example of what a state can do when they have the resources they need to tackle the issue," he suggests.

Wisconsin is in the midst of developing a comprehensive state management plan to deal with exotics. The plan would meet the goals of the National Invasive Species Act of 1996, and provide the framework to address the problems caused by aquatic exotic species.

DNR Water Division Administrator Susan Sylvester says controlling aquatic exotics is one of her top priorities.

"I'm excited that Governor McCallum included $300,000 (annual appropriation) in his budget as a first step to implement this program," Sylvester says. "We will keep moving toward improving our control of these exotic organisms."

The scope of activities outlined in the plan are broad and aimed at preventing new introductions, controlling the spread of exotic populations and reducing exotics while safeguarding public health and the environment.

"We are trying to find a balance between control and prevention, but if we're going to be effective we have to act now before these species become a problem," Ledin says. "Once an exotic is established it is nearly impossible to eradicate."

DAVE MARSHALL

(right) **Zebra mussels increase water clarity.**
(below) **But zebra mussel shells litter beaches and can cut bare feet. On some Wisconsin beaches, people need to wear shoes to get to the water.**

DNR FILE PHOTO

Finally, the Department of Natural Resources has developed a draft policy to react when unintended exotics are discovered. It will provide a blueprint for all state agencies that collectively work together to control an invasive exotic species.

"We need a state policy that makes it illegal to import exotics, raises public awareness by listing 'bad' exotics and forms a statewide management plan to control particularly bad species," Ledin suggests. "Laws prohibiting in-state transport also are critical."

State Representative Dan Vrakas (R-Hartland) agrees that exotic species is becoming a hot issue statewide.

He became interested in the issue about two years ago when his constituents in Waukesha County, became concerned about zebra mussel invasions. Vrakas has a biology degree from UW-Stevens Point and is on the Assembly's environmental committee. He says he is familiar with the threat exotics such as zebra mussels can have on the environment.

Two years ago, he and Lieutenant Governor Margaret Farrow called for a summit on exotic species in the state. The group has met several times, formed a task force on exotics and secured $50,000 (in the previous state budget) for education on exotic species. The Department of Natural Resources uses that money to fund educational materials and post signs at boat landings.

"I'm encouraged that $300,000 was set aside in the Governor's budget each year of this biennium for invasive species to more aggressively measure, control and possibly even eradicate some aquatic invasive species," Vrakas notes. "We need to develop a plan in Wisconsin and work with the Department of Natural Resources and other state agencies so that we can qualify for some federal funding as well."

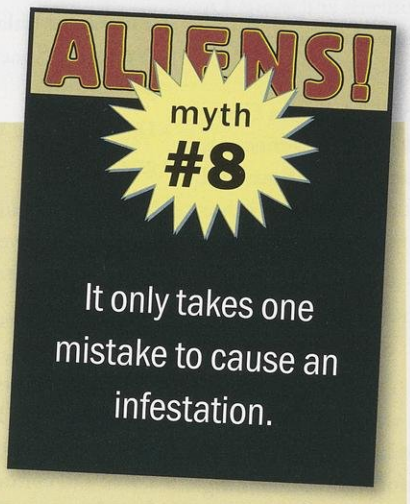
"The threat is real, and our efforts to combat these invasive species must be quick, focused and effective," Vrakas says. Farrow and Vrakas supported additional funding to educate the public about exotics.

"Zebra mussels are what called my attention to the issue," Farrow recalls. She had left a line in the water off her pier on Lake Michigan during a 10-day trip and when she returned she found that a large collection of zebra mussels had formed on the line.

"I paid attention to that," Farrow notes.

She then did research on the species and found that it is a native of the Caspian Sea and while it can help increase water clarity by eating plankton, zebra mussels have such a voracious appetite that they reduce the amount of food available to fish species. Zebra mussels also taint and contaminate potable water supplies and encrust boat hulls.

"There are even layers of zebra mussel shells in the sand of beaches on Elkhart Lake. They can cut feet and kids have to wear shoes to get to the water," Farrow notes.



Actually, most introductions of exotics fail, but the more times an exotic is introduced, the greater the chance it will eventually take to the system. That's why natural resources managers agree that it is important to try to reduce the frequency of introductions.

Farrow, a former teacher, stresses that education is our best tool to stop the spread of exotics.

She believes the DNR's job should be to work statewide to make educational materials on exotics available to the public, as well as tailor educational materials to species of concern in each region. But she also believes there should be local effort to educate boaters and other water uses about what they can do to help control the spread.

Among her suggestions is that lake-area taverns and restaurants offer car wash coupons to boaters so that they can more efficiently clean their boats and trailers of zebra mussels and aquatic exotic plants. She also says the sanitary districts and lake associations can play an educational role.

Farrow calls Charlie Shong, superintendent of the Lake Pewaukee Sanitary District, a hero for his efforts to educate children about exotic species and discuss how these species will impact the next generation.

"Hopefully, the educational efforts we're making now will have a long lasting effect on our water quality and aquatic community," Farrow notes.

Farrow agrees that coupling a state management plan and exotics policy with additional funding and education is the best strategy we have to reduce the risk of new introductions of invasive aquatic species while minimizing biological and economic consequences to natural ecosystems.

"We can't always stop exotics from getting into our waters," Farrow notes. "But we have to try to stem their growth. We need to be vigilant in how we take care of our boats and our waterfront property. We need to look at the toll that exotics can take on our waters and we have to try to manage them." □

For more information

The following websites provide more information on exotic aquatic species in Wisconsin and the Great Lakes region.

- The **Wisconsin DNR** website at www.dnr.state.wi.us/org/water/wm/glwsp/exotics/ provides information on the state policy on invasive species, a list of species of concern and more. Or call the DNR at (608) 266-9270 for questions about aquatic exotic species.
- The **Great Lakes Sea Grant Network** established the Sea Grant Non-Indigenous Species (SGNIS) website at www.sgnis.org. The site is a searchable collection of research publications and education materials produced by Sea Grant programs and other research institutions across the country on zebra mussels and other aquatic nuisance species.
- The **University of Wisconsin Sea Grant** posts information on aquatic exotic species at www.seagrant.wisc.edu/outreach.html. For more information call (608) 262-0905.
- The **University of Minnesota Sea Grant** website at www.seagrant.umn.edu/exotics/index.html has over 22 pages of Aquatic Nuisance Species research and outreach information including images. They support research and public education programs related to Lake Superior and Minnesota's water resources. Call (218) 726-8712.
- The **U.S. Geological Survey Nonindigenous Aquatic Species** website is located at nas.er.usgs.gov. The site features scientific and general information.
- The **National Aquatic Nuisance Species Task Force** website is located at www.anstaskforce.gov.
- The **Great Lakes Fisheries Commission** website is located at www.glfc.org.
- The **Great Lakes Commission/Great Lakes Panel** on Aquatic Nuisance Species website is located at www.glc.org/ans/anspanel.html.
- **U.S. Fish and Wildlife Service** website is located at www.fws.gov.
- The **Great Lakes Indian Fish and Wildlife Commission** Exotic Pest Plant website may be accessed online at www.glifwc.org/weeds/index.htm.
- The **U.S. Coast Guard** published "Voluntary Guidelines for Recreational Activities to Control the Spread of Zebra Mussels and Other Aquatic Nuisance Species" in the Dec. 28, 2000 issue of the Federal Register. These guidelines were compiled by a multi-agency committee of the Aquatic Nuisance Species Task Force and contain recommendations for boaters, anglers, waterfowl hunters, SCUBA divers, etc. The guidelines can be accessed online at 152.119.239.10/docimages/p56/119638.pdf. For more information on the USCG's ANS program, visit their website site at www.uscg.mil/hq/g-mmso/mso4.
- The **Army Corps of Engineers** has a website located at www.wes.army.mil/el/homepage.html.

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continued from page 16

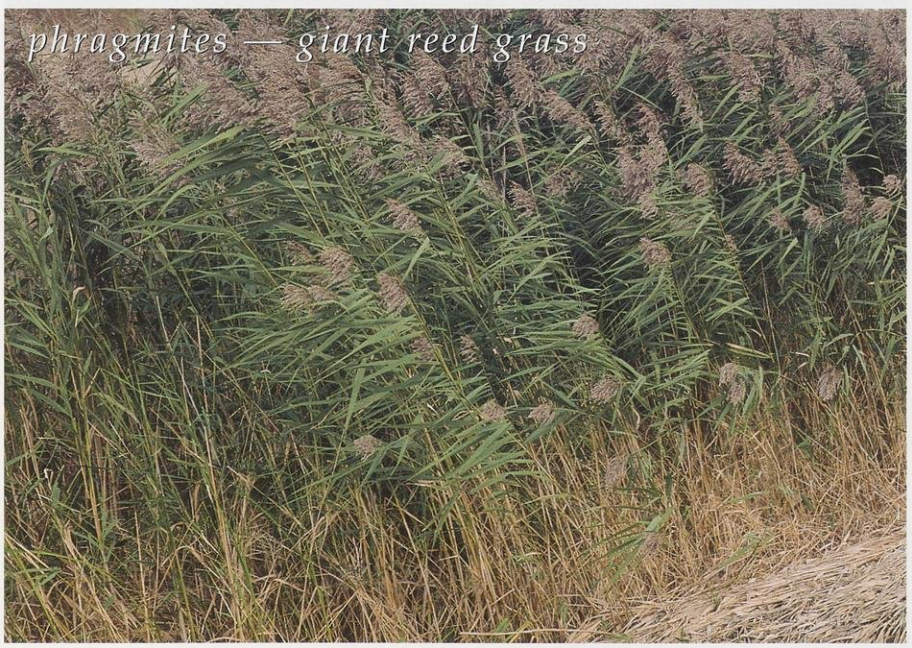
Twenty-four to watch for

These two dozen plants most commonly invade natural areas in Wisconsin.

Plant name	Forests	Grasslands	Wetlands	Lakes and Streams
Invasive Trees, Shrubs and Vines				
Black locust *(Robinia pseudoacacia)*	X	X		
Common buckthorn *(Rhamnus cathartica)*	X	X	X	
Glossy buckthorn *(Rhamnus frangula)*	X		X	
Bush honeysuckles *(Lonicera species)*	X	X		
Japanese barberry *(Berberis thunbergii)*	X			
Multiflora rose *(Rosa multiflora)*	X	X		
Autumn olive *(Elaeagnus umbellata)*	X	X		
Oriental bittersweet *(Celastrus orbiculatus)*	X	X		
Invasive Herbaceous Plants				
Garlic mustard *(Alliaria petiolata)*	X			
Dame's rocket *(Hesperis matronalis)*	X	X		
Canada thistle *(Cirsium arvense)*		X		
Japanese knotweed *(Fallopia japonica)*	X	X	X	
Spotted knapweed *(Centaurea bierbersteinii)*		X		
Leafy spurge *(Euphorbia esula)*		X		
Wild parsnip *(Pastinaca sativa)*		X		
Nodding thistle *(Carduus nutans)*		X		
Plumeless thistle *(Carduus acanthoides)*		X		
Crown vetch *(Coronilla varia)*		X		
Bird's foot trefoil *(Lotus corniculatus)*		X		
Purple loosestrife *(Lythrum salicaria)*			X	X
Reed canary grass *(Phalaris arundinacea)*		X	X	
Phragmites *(Phragmites australis)*			X	
Eurasian water milfoil *(Myriophyllum spicatum)*				X
Curly-leaf pondweed *(Potamogeton crispus)*				X

spotted knapweed

DICK BAUER



phragmites — giant reed grass

S. KELLY KEARNS

invaders have already excluded the otherwise abundant wildflowers. I remind the kids that since garlic mustard is an edible plant, they could safely eat the leaves and flowers, but when they pull most invasive plants they should be wearing gloves. Before we leave the area we mark the site with a bright orange ribbon and take note of the location so our friend can return for the next several years to pull the plants that will emerge from seeds already waiting in the soil.

BETTY CZARAPATA

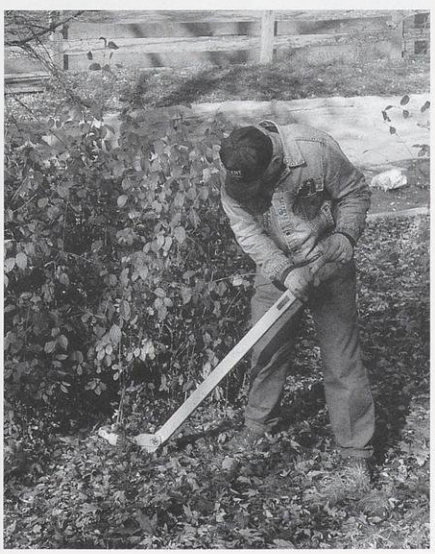
Students from four high schools participate in Weed-Out!, a program to pull invasive plants from Milwaukee County parks.

Garlic mustard is one of our relatively recent weeds, spreading rapidly in woodlands throughout much of southern and eastern Wisconsin in the last 15–20 years. Other weeds, such as buckthorn and honeysuckle shrubs, have been around for several decades, spreading their seeds with the aid of birds from one woodland to the next. Wind and water help disperse many weed seeds, while mowing equipment, tires and boots are often unintentional vectors that expand the range of many invasive plants. As these plants spread, they often shade out and displace native wildflowers, ferns and tree seedlings, altering wildlife habitat and leaving only bare soil or a single species carpet of weeds on the forest floor.

Some of these plants, such as multiflora rose and autumn olive, were intentionally planted — grown by agencies such as the Department of Natural Resources and Soil Conservation Service. Landowners were encouraged to plant them as windbreaks and for wildlife habitat. Although Wisconsin DNR discontinued the sale of all invasive non-native trees and shrubs 20 years ago, the plants still remain on the landscape, spreading their progeny further each year. It is only in retrospect that we realize the folly in suggesting that rapidly growing plants from another part of the world would be better for our native wildlife than the native plants they evolved with.

The good news is that many forests, particularly those in the Northwoods, have not yet been impaired or overrun by garlic mustard and other aggressive plants. Due to our cold, long winters and our location near the center of the continent, many species that infest regions to our south, east and west have not yet spread to Wisconsin. However, we know that many of these species are expanding their range. Of particular concern are species that might take advantage of the warmer winters and longer growing seasons that we have experienced in recent years. Japanese honeysuckle and kudzu — two vines that blanket millions of acres in the southern U.S. — have moved as far north as central and northern Illinois.

BETTY CZARAPATA



S. KELLY KEARNS

(left) **Students of all ages can learn to appreciate plants, recognize invasive species and help remove them. This grade-schooler pulls garlic mustard.** *(below)* **Exotic species of buckthorn can be pried out with a weed wrench.**

We still have some time to teach landowners and others about plants they need to vigilantly watch for and remove before allowing an infestation to expand. In recent years awareness of the issue has blossomed. Landowners and public land managers are clamoring for information on ways to identify and control plants that are invading their woodlands, grasslands, wetlands and lakes.

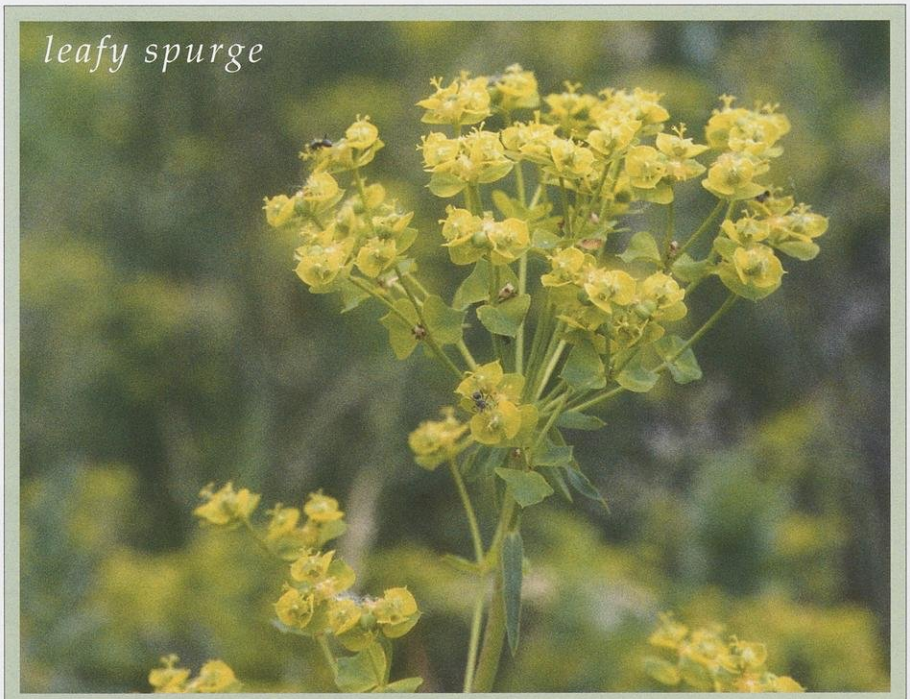
In response to this interest, many individuals and organizations have taken on the task of educating the public and local administrators about ways to control invasive plants locally. A few examples:

- The Milwaukee County Park People have galvanized thousands of volunteers to pull garlic mustard and cut buckthorn from Milwaukee County parks.
- A group in Sauk County is working with highway maintenance crews to encourage them to mow and spray in ways that better contain roadside weeds and slow their spread into adjacent farm fields, grasslands and forests.
- Land managers on public lands and private conservation areas are regularly experimenting with control methods to see what practices work best in their regions. They are sharing their results with others.
- The Great Lakes Indian Fish and Wildlife Commission has developed an online pilot project to show the range of purple loosestrife and keep records of new occurrences.
- Hundreds of cooperators are rearing beetles to feed on loosestrife populations in their communities.
- A technical advisory committee has worked for the last two years developing a proposal to help the state legislature revise state weed laws to be more effective while not making unreasonable demands of landowners.

Although concern about the spread of invasive species is growing, there is still much to be done. We need to find ways to screen new species before they are introduced to North America and selectively prevent the importation of plants with the potential to be invasive. Efforts are underway to develop a national strategy for invasive species with consistent guidelines for preventing their spread. More research is needed on the economic and ecological impacts of certain species as well as research on effective control methods.

A recent "Plants Out of Place" conference in Eau Claire drew over 600 people to share their knowledge and concerns about plants that invade our lands and waters. Many of the participants also spent a day organizing a new statewide "Invasive Plants Association of Wisconsin (IPAW)." This membership-based organization will host a website, develop educational materials, draw up a comprehensive list of plants that are invasive in Wisconsin's wildlands and take on other tasks to deal with the many invasive plant issues. They also plan to work with industry groups such as nurseries and seed companies to find ways to contain invasive plants without blaming or unduly burdening any sectors of the economy. IPAW also will act as an umbrella organization to the many regional and county-based efforts to control invasive plants in the state. Persons interested in getting involved in IPAW or a local group can find more information on the group's temporary website at www.plantsoutofplace.org or by writing to IPAW at P.O. Box 5274, Madison, WI 53705-0274.

S. Kelly Kearns manages the Plant Conservation Program for DNR's Endangered Resources program.



leafy spurge

S. KELLY KEARNS

Sources for further information:

The Wisconsin DNR site about invasive plants — www.dnr.state.wi.us/org/land/er/invasive_species.htm

Detailed information on many invasive plants from The Nature Conservancy — http://tncweeds.ucdavis.edu/

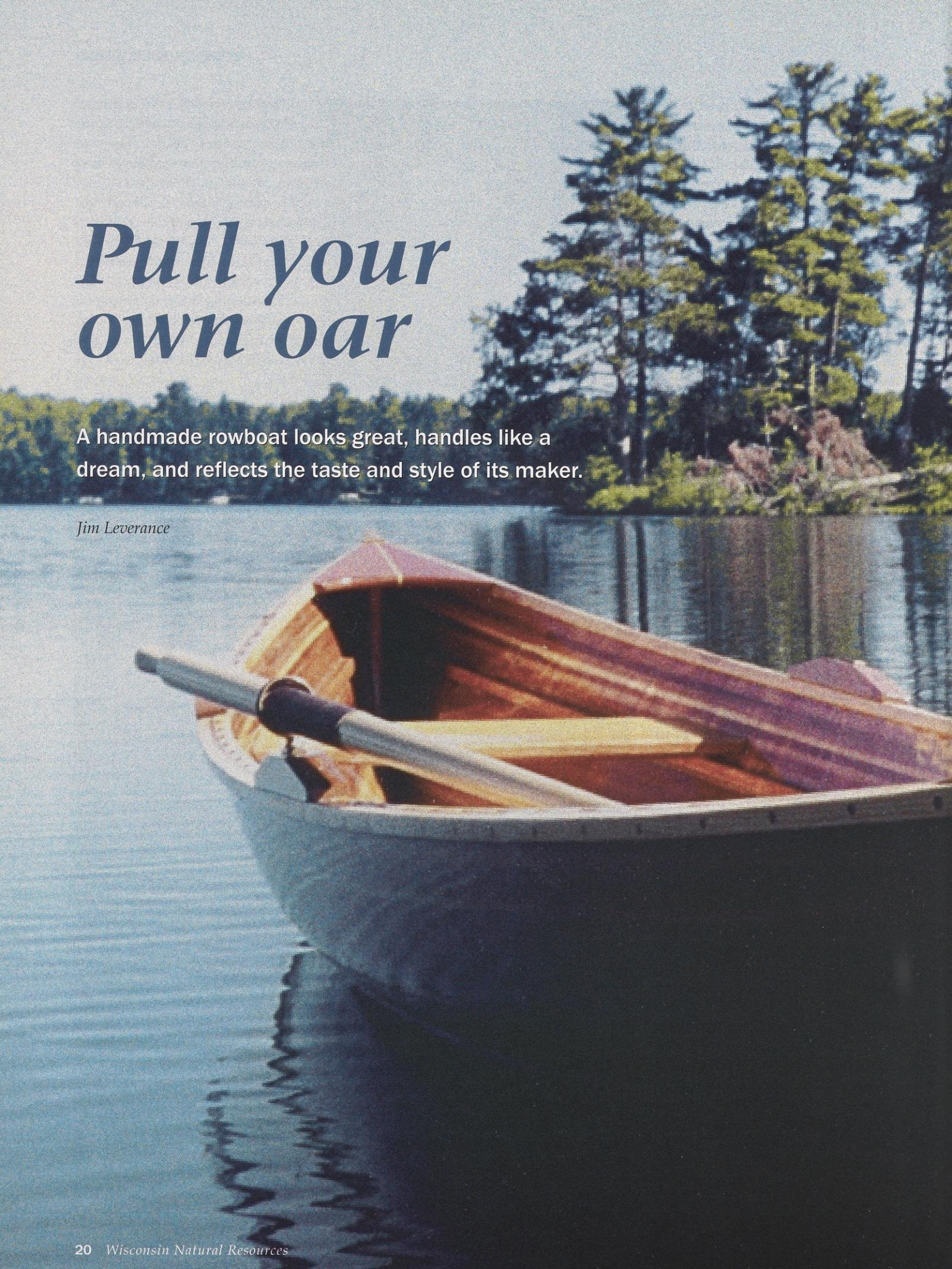
Wis. Manual of Control Recommendations for Ecologically Invasive Plants, May 1997. Bureau of Endangered Resources, WDNR, Box 7921, Madison, WI 53707-7921 (This manual is also available on the DNR website listed above).

Color brochures on garlic mustard and buckthorn are available at all University of Wisconsin County Extension offices.

Pull your own oar

A handmade rowboat looks great, handles like a dream, and reflects the taste and style of its maker.

Jim Leverance



I always liked smaller wooden boats and I think row trolling is a great way to fish. It is relaxing, therapeutic, and good for both body and soul. But in years of searching, I never found the rowboat I was looking for — something functional, good looking and affordable. Most motored fishing boats are wide, heavy and are not easy to row. After a few years, it dawned on me that the only way I was going to get the boat I wanted was to make it myself.

Several years ago, this magazine carried an article ("Strippers," October 1991) about building cedar strip canoes. I knew the authors and fueled by that article, I enlisted their help as mentors, borrowed forms from a neighbor who had crafted a canoe, and built a 17-foot cedar strip canoe.

That experience whetted my appetite for making a rowboat. I looked at a lot of boating magazines, attended boat shows, visited stores and finally found a style that seemed right for me. I selected a 17-foot-long Rangeley design, a rowing boat with an hourglass shaped transom and keel.

Read, look and practice

If you're tempted to take on a similar project yourself, start by reading a few good books with step-by-step instructions and photos. I particularly liked *Illustrated Guide to Wood Strip Canoe Building* by Susan Van Leuven, published by Schiffer Books. Reading is a cheap way to evaluate your own skills and decide whether or not you want to proceed.

Look at several designs and, if possible, test each kind of boat in the water before you buy plans, a kit or lumber. Building a boat to suit your size and needs will keep you much happier.

Learn from experience, if you can. Offer to help someone build a boat to anticipate the decisions you'll have to make and get comfortable with the tools you'll need to use. Boat building courses are also available in various parts of the country. Search for them in specialty magazines and on the Internet. The Wooden Canoe Heritage Association, www.wcha.org, is an excellent source of builders and suppliers.

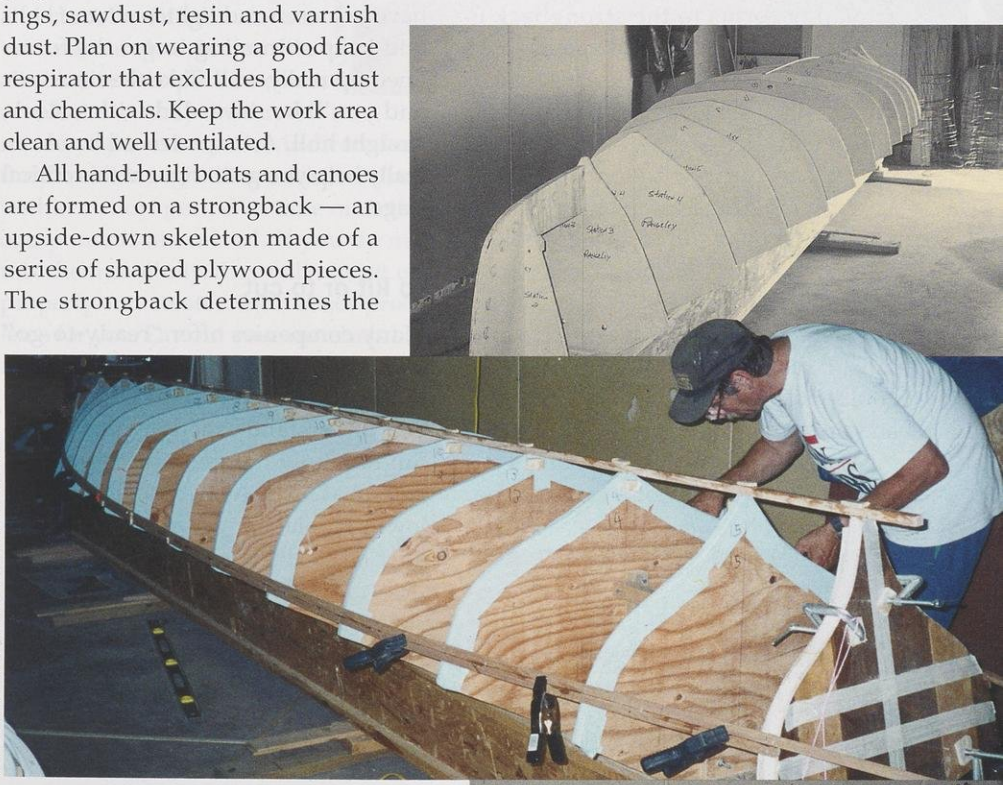
Clear the decks in the workshop

Make sure you have plenty of workspace and you can get your finished product out the door when you are done. If you can't get it out, don't build it there! I'm using part of my garage. Be prepared for a flurry of wood shavings, sawdust, resin and varnish dust. Plan on wearing a good face respirator that excludes both dust and chemicals. Keep the work area clean and well ventilated.

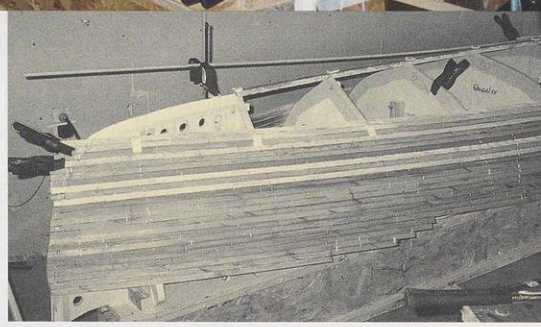
All hand-built boats and canoes are formed on a strongback — an upside-down skeleton made of a series of shaped plywood pieces. The strongback determines the shape and dimensions of the boat. You can vary the spacing of forms to build a boat that is longer, narrower, wider, flat-bottomed or keeled. Wood strips are joined and glued to each other on these forms, then fiber glass, seats, gunwales and hardware are added to finish the boat.

The critical step in building a boat is taking the time to construct a solid strongback. It must be absolutely flat and level. Don't scrimp or cut corners here! The "how-to" books offer lots of building options. I used wooden construction I-beams, just like the ones used for floor joists in some homes. I screwed 2"x 6" boards into the inside top and bottom of the I-beams to create an open-ended box. Then I screwed scrap three-quarter inch plywood to the top to create a flat surface for the forms. The strongback was heavy and cumbersome, but also strong, functional and flat. Disassembly will be easier because I built it with screws rather than nails.

In my design, each form is shaped from three-quarter inch plywood. I like keeping the forms wide, strong and rigid so I have plenty of support when I staple on the wood strips.



(ALL PHOTOS THIS PAGE) JIM AND JANE LEVERANCE



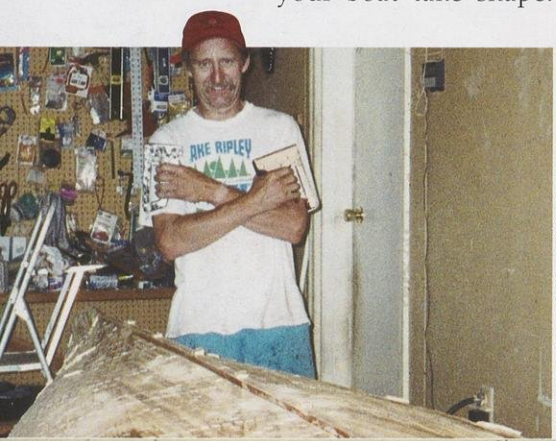
(top to bottom) **Take your time preparing to build a handmade boat. The strongback needs to be sturdy, absolutely level and set at a comfortable work height. The forms and strongback form are an upside-down skeleton on which the boat takes shape one strip at a time. Each piece of the form must be perpendicular to the strongback, properly spaced, anchored and adjustable so it's plumb square. Author Jim Leverance measures and checks each piece. The hull slowly takes shape as strips are glued and stapled.**

The strongback should be set up at a comfortable work height. You don't want the back strain of stooping over or reaching too high. Even though I placed

the beams on the garage floor, I soon discovered poured concrete floors are not completely level. Use scrap pieces of wood to shim. I measured and re-measured pieces several times, and used a construction level to check that the forms were square.

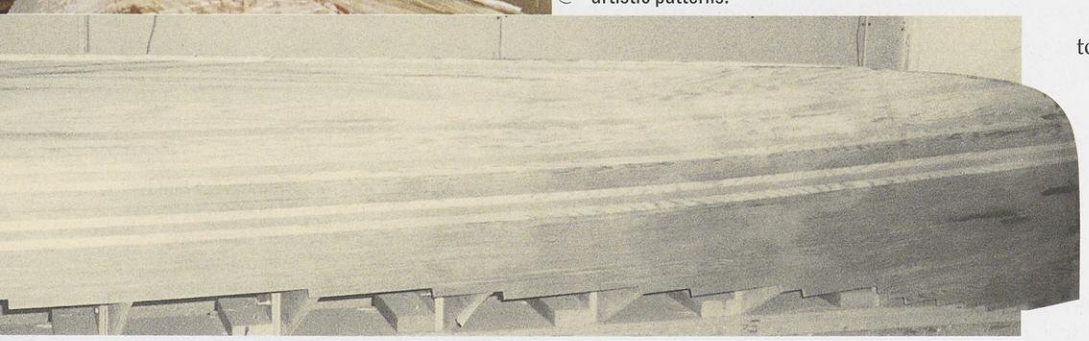
Most "how-to" books tell you that attaching forms to the strongback is pretty simple. You should spend some time and do it right, because it's easy to knock the forms out of alignment, which will change your boat's shape. I braced each form with four-inch-high scrap wood glued to pieces of 2" x 4". These L-shaped supports were bolted down to the strongback with lag bolts and horizontally into the forms using quarter-inch bolts with washers and nuts. I overdrilled the forms a tad so I could make adjustments by loosening and tightening the bolts.

As you attach the forms you will see your boat take shape.



(BOTH PHOTOS) JIM AND JANE LEVERANCE

Staples hold the wood strips tight to the forms and each other while the glue dries. Darker strips of wood can be added to form stripes and other artistic patterns.



Mark the centerline on each side of the form and on the top. Keep the forms perpendicular to the base of the strongback, and use old playing cards to shim under the supports to square out the forms. Then align the centerlines you marked on the side and top using a piece of string held like a plumb line slightly above each form and right down the center of the keel line. The bow and stern of the boat establish the two end points of your string and determine the location of all forms in between.

It will be a complete miracle if all the forms align right away. Usually you have to loosen and tighten a lot of bolts and keep shimming to get the forms lined up really well. Take the time now and you'll be rewarded with a sleek, straight hull. An experienced hand can really help you get it right at this critical stage.

To kit or to cut

Many companies offer "ready-to-go" boat-building kits. Should you decide to buy a kit, talk with the company so you understand exactly what you are buying, how finished the pieces are, and what procedures the company follows to replace faulty materials or provide replacements if you damage any pieces.

If you choose your own wood and watch your costs, you can probably save about 50 percent over the kit price, but the pieces won't come pre-cut and ready to use. I bought three-quarter-inch thick western red cedar boards that I subsequently cut down to make wooden strips. I had to search a bit, but found two local lumber stores that could provide clear boards with long, straight grains in lengths over 12 or 14 feet long. I was fortunate enough to purchase some boards 20 feet in length!

Many of the "how-to" books describe how to join shorter boards. You'll want to buy some shorter boards, anyway; not every part of the boat needs long strips.

Since I like to match the grain in the wood and do patterns rather than just run the wood strips randomly, I spent a lot of time selecting the right boards. Some builders like to alternate stripes of darker and lighter wood strips. Boards cut from heartwood near the center of a log are generally quite dark. Sapwood, from the outer part of the tree, is lighter. A mix of these allows you to put stripes and other designs into your boat. Be aware that the darker wood is somewhat harder and may sand differently than lighter wood.

I used a table saw to cut the three-quarter inch lumber into quarter-inch strips. Some lumberyards will do this for you — for a fee. It took my wife and me about three hours to cut our strips. I bought a high quality saw blade with a narrow kerf (thickness) for about $70. Considering that the blade had an eighth-inch kerf and I was cutting quarter-inch strips, we lost a strip every two cuts. Ouch! That's very expensive sawdust. Practice your cuts and your technique on a cheap piece of cedar first. Be careful and use appropriate safety gear and push sticks. Also plan on creating a makeshift deck on both sides of the saw to provide support for the long boards as you feed them through the blade.

Make sure you hold the board tight to the fence as you feed in the stock so that you keep the width at exactly a quarter-inch. You don't want to end up with thicker strips because they are harder to bend to meet the contours of your forms. Thick strips also make your project more expensive as you will get fewer strips from each board.

Once the strips are cut and sorted, it's time to start assembly. The strips are stapled to the forms to hold the shape and pattern using a staple gun loaded with 7/16-inch staples. The edges of adjoining strips are glued together (I use a brown carpenter's glue) and stapled with quarter-inch staples to hold them tight while the glue hardens. Even though you will have to pull all these

staples out before you sand, don't be tempted to skimp. Eventually I expect to have more than 2,000 staples to remove from my boat. A sharpened beer can opener works great to remove the staples.

High-stress areas, such as at the ends or where the strips are bent at severe angles, need to be nailed to hold the strips to the form (and each other). Use small diameter 1–1½" nails with blocks behind the nails. Place masking tape over small blocks of scrap wood to keep them from splitting or being permanently glued to your boat surface. You may need lots of these blocks.

You will use a lot of glue (likely at least a half gallon). Wipe off excess glue with a dampened rag after you staple and before the glue sets. Hardened glue on the surface of the strips would otherwise need to be sanded or scraped off. Wiping is a lot easier. Also make sure you rinse or change wiping rags frequently to keep the work surface clean.

The top edges of your boat (gunwales) need to be capped with a harder wood to prevent damage. Strong, bendable white ash is an excellent material, but finding pieces longer than 14 feet may be difficult. You may have to connect them with scarf joints or laminate pieces together. Sitka spruce is a good, strong alternate to ash and, although expensive, may be available in up to 20-foot lengths.

Glassing the boat

Once the boat is formed, the staples are removed, and the boat is sanded. (Believe me, that's quicker to say than to do!) The surfaces will first be covered with epoxy resin, then covered with fiber glass cloth treated with epoxy resin for strength, weather-resistance, added waterproofing and durability. Canoes generally have one layer of fiber glass on the interior surface and another on the exterior. My rowboat calls for two layers on the exterior.

"Glassing" is a slightly tricky procedure. You'll be encumbered by face protection, a respirator and gloves. As the cloth/resin mix dries, you'll work out bubbles, look for creases and ensure good contact for both strength and protection. "How-to" books will show you how to fix bubbles if they persist. To minimize bubbles and creases, fiber glass cloth should be laid on the bias at an angle to the predominant weave direction.

Epoxy resins are expensive and come in different forms. While somewhat similar, they all share two important characteristics — they need to be mixed at the exact ratios indicated on the directions and they must be used within a short period of time once the components are mixed. If you do not mix them carefully, they will not set up properly and create major, major problems for you. Lay out your materials before you mix the resin, follow directions carefully and use disposable gloves, eye protection and a respirator when handling resin and hardeners.

JIM LEVERANCE

THE NEWFOUND WOODWORKS, INC.

THE NEWFOUND WOODWORKS, INC., WWW.NEWFOUND.COM

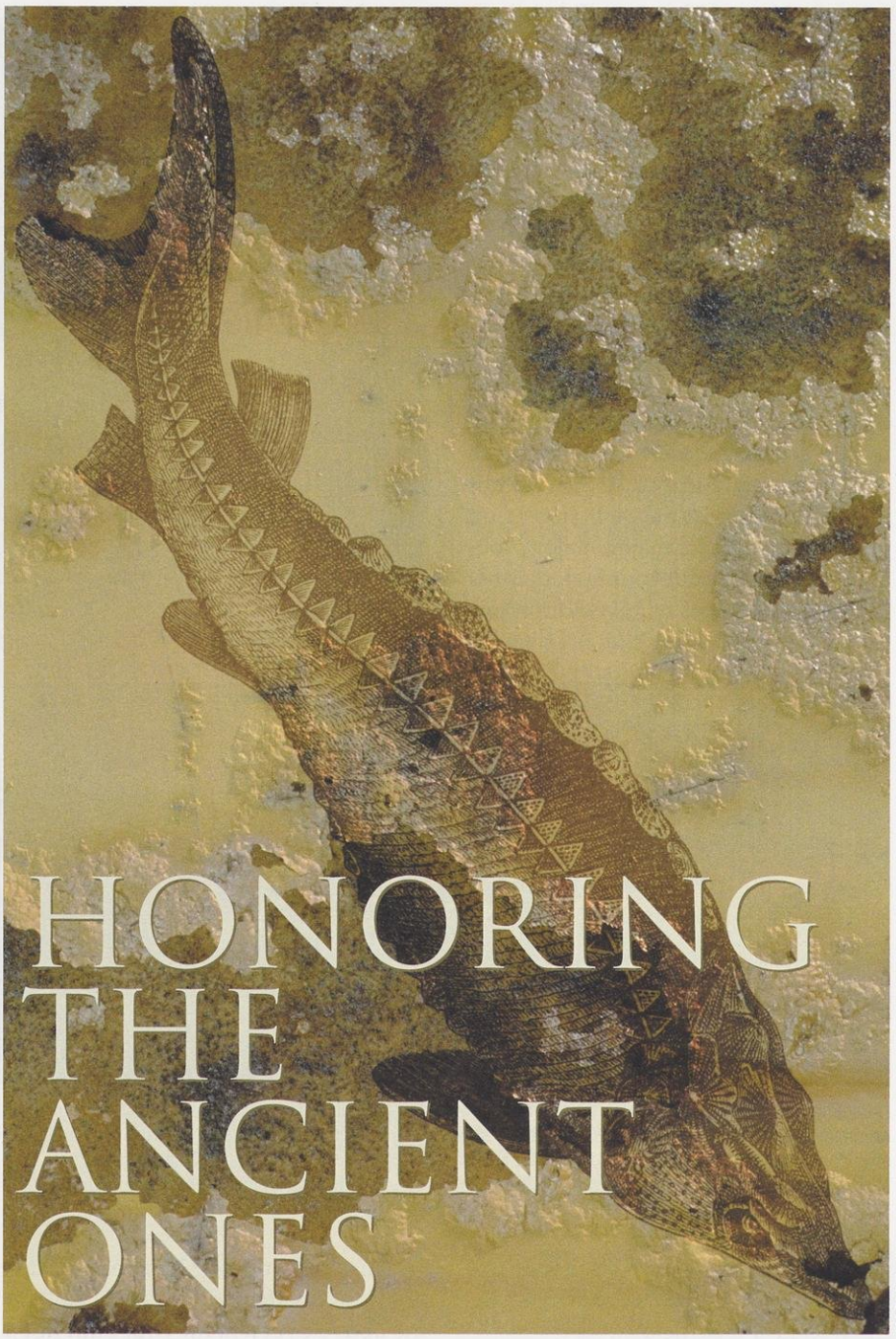
(top to bottom) **After the glue dries, staples are removed and the hull is sanded several times. Epoxy resins are painted on the outside and sheets of fiber glass are laid on. Then the boat is removed from the strongback and the inside is sanded, coated with resins and layered with fiber glass. Gunwales, seats, oarlocks and decking are added afterwards. The finished boat is light, sturdy, maneuverable and elegant.**

Resin manufacturers also offer calibrated pumps for mixing resin and hardener. The pumps work well, but sometimes you only need to mix a smaller amount. I bought two graduated cylinders, like those we used to use in chemistry classes, and I keep one filled with resin and the other with hardener so I can mix the exact amount I need for smaller jobs like laminating the gunwales.

Seat supports, seats and oarlocks are added after the fiber glass layers are finished.

This boat-building business sounds like a lot of effort, doesn't it? Don't let the above overwhelm you. I am not a hardcore woodworker and have only a few tools. If I can build a boat, so can you. Homemade boats require work and upkeep, but the benefits far outweigh the drawbacks. Your reward is a lightweight, strong craft that I think is prettier than fiber glass or aluminum and will be a real joy to use for a long, long time.

Jim Leverance, team leader for DNR water programs in the Lower Rock River, works in Janesville.



HONORING THE ANCIENT ONES

MOONLIT INK

Biologists and the public alike want to restore lake sturgeon to their ancestral waters.

Lisa Gaumnitz and Jack Zimmerman

A female lake sturgeon heavy with eggs presses her nose into a rocky reef in the cold, dark waters below a dam of the Wisconsin River in late April. Smaller males swim around her, watching closely for a sign she is ready to spawn. Anglers in a nearby boat jig fish for walleyes while 50 yards away, turbines hum in a powerhouse that churns river current into electricity.

Decades earlier this slow-growing, long-lived sturgeon might have roamed against the current upstream toward the headwaters of this great river. Now 26 dams tame the Wisconsin and block her upstream passage. So, she has chosen this pile of rocks as the birthplace for a new generation of an ancient fish.

"Fossil records show lake sturgeon have been around for 100 million years," says Ron Bruch, a DNR sturgeon biologist. "Whatever killed the dinosaurs didn't kill the sturgeon."

Human forces proved more insurmountable than glaciers, drought and 100-year floods.

Dams, pollution, habitat degradation and overharvest have dramatically reduced lake sturgeon populations in many Wisconsin boundary waters over the past 100 years, and eliminated them from other stretches of water.

Late last year a coalition of sturgeon experts and enthusiasts wrapped up a plan that charts a course for managing Wisconsin lake sturgeon well into the 22nd century. That plan seeks to preserve the lake sturgeon inhabiting the Lake Winnebago system — the world's largest and healthiest population — to restore lake sturgeon to its former home, and to sustain it in other waters where it's common.

"Our ultimate goal is to re-establish lake sturgeon through their entire original range in Wisconsin," Bruch says.

A slow recovery from decades of overharvesting

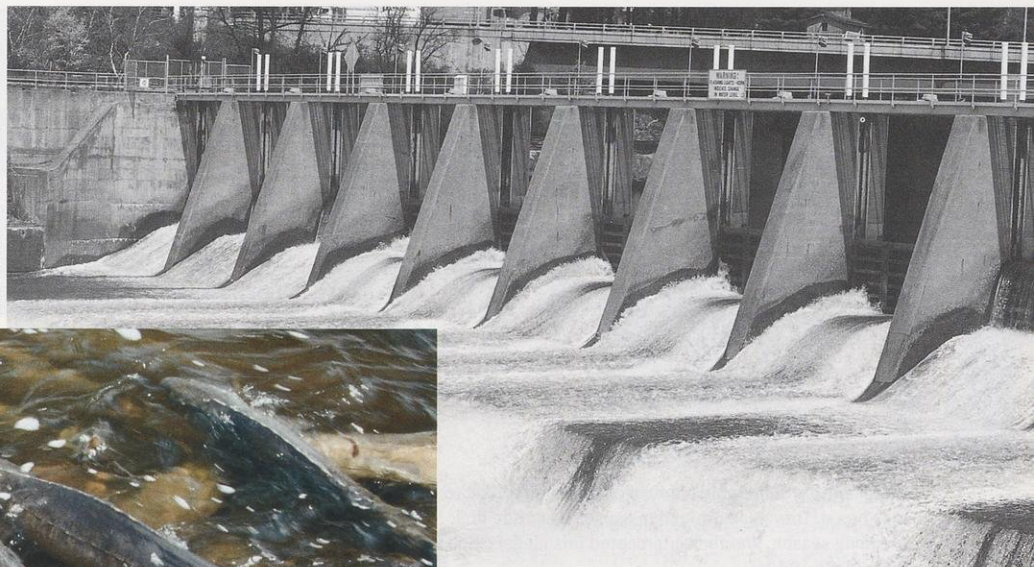
Lake sturgeon are living fossils, relics from the Upper Cretaceous period of the Mesozoic era. They retain many of the same primitive characteristics from their earliest days: bony plates along the body instead of scales; a flexible rod called a notochord in place of a backbone; a long snout and a tubular mouth with no teeth. They cruise lake and riverbeds, using barbels that hang in front of their mouth as feelers to sense snails, insects, leeches, crayfish and small clams. Their mouths protrude to suck up such food.

Lake sturgeon rank as Wisconsin's largest and oldest fish: a record 195-pounder was speared in Pokegama Lake in Vilas County in 1979, a 170-pounder was caught with hook and line from Yellow Lake in 1979, and an 82-year-old was taken from Lake Winnebago in 1953.

Historically, they were found throughout the Great Lakes and Mississippi River basin. They flourished in Wisconsin's boundary waters including the Mississippi, Wisconsin and Menomonee rivers, Lake Superior, Lake Michigan and Green Bay.

The Menominee, Winnebago, Ojibwa, Potawatomi, Oneida and Sauk tribes all revered the giant fish. But European settlers who moved into the territory in the 1800s initially considered them a nuisance because there were so many other preferable species available.

"They viewed lake sturgeon as a fish that caused problems for them — it got into their gear and tore up their nets," says Fred Binkowski, Senior Scientist with the University of Wisconsin-Milwaukee Great Lakes WATER Institute who has spent the last 20 years raising and researching lake sturgeon in his laboratory and in field studies.



ANN WHIPP

RONALD M. BRUCH

Impediments like the Dells Dam stopped natural upriver migration on the Wisconsin River and reduced the lake sturgeon's range.
(left) Sturgeon travel upriver to spawn over shallow rocks each spring.

It wasn't until after 1865 that settlers started to realize the economic value of lake sturgeon and started intensively fishing them. Sturgeon eggs, as the settlers learned, can be made into the famous delicacy — caviar — and their flesh is excellent eating fresh or smoked. Settlers also could use a gelatin extracted from the sturgeon's swim bladder to make jams and jellies and to clarify alcoholic beverages. The fish were also used for oil and glue, and their smooth skins were tanned for leather.

Sturgeon can grow big and old. This 180-pound, 82-year-old fish harvested by Elroy Schroeder of Appleton in 1953 was a record-breaker from Lake Winnebago.

COURTESY OF RONALD M. BRUCH

Dams built to float logs and harness river power for industry and electricity in the developing state blocked the sturgeons' spawning migrations and isolated their populations in many waters. Pollution and overharvesting also took their toll. By the 1900s, Wisconsin's lake sturgeon population had dropped to about 10 percent of what it was before European settlement, Binkowski says.

The state established a minimum size limit of eight pounds in 1903. That modest regulation, followed in 1915 by the closure of the harvest season, planted the seeds of the world's first sturgeon management program.

Legal harvests began again in 1931 on the Lake Winnebago System with the first regulated spearing season. The first professional biologists were hired in the 1940s. Since that time, state fisheries biologists, conservation wardens and sturgeon enthusiasts have tweaked season structures and rules to better protect lake sturgeon populations, particularly adult spawning females, Bruch says.

Female lake sturgeon do not sexually mature and start producing eggs until they are 20 to 25 years old, and then they spawn only once every four to six years. Males mature when they're about 12–15 years old and 45 inches long. Most of them spawn every other year.

A population can take generations to recover under such a timetable. So DNR limits the harvest to five percent or less of the estimated population, and in 1999, working with a citizen advisory group, established a cap system on Lake Winnebago to further control the harvest.

Harvest totals had been increasing as the number of spearers grew and better water clarity led to better spearing conditions. Now the spearing season shuts down at the end of the next day after spearers hit 80 percent of one of three caps: 400 adult females; 400 juvenile females; or 1,350 adult males.

With the help of Sturgeon For To-

COURTESY OF RONALD M. BRUCH

Sturgeons are vulnerable to poaching and they are quite old before they breed. They need protection especially during their spring breeding season. Wardens intercepted this illegal catch from the Wolf River in the 1940s.

morrow, a conservation group that Bill Casper and other sturgeon spearers founded in 1977, wardens have significantly reduced poaching on the Lake Winnebago-Wolf River System. The group, now 2,500 members strong, helps organize, pay for, and serve on round-the-clock patrols to guard spawning sturgeon along the Wolf River.

Its four chapters also fund projects to install rock riprap to improve spawning sites along the Wolf River, Casper says. Where there once were about 12 natural spawning sites, there are now 50 to 60.

"We have the best self-sustaining population of lake sturgeon in the world right here in this system," Casper says. "We want to keep an eye on it so we can go fishing and our kids and grandkids can go fishing."

Such vigilance among all parties has helped boost the number of spawning adults on the Winnebago System from about 11,500 total spawning adults in the 1970s to an estimated 9,000 adult females and 27,000 adult males in 2000. Lake sturgeon also are common in the Menominee River, Lake Wisconsin, the St. Croix River to the Gordon Dam, Namekagon River below the Trego Dam, and the Chippewa and Flambeau rivers.

"Through good sound regulations and good sound biological management, Wisconsin has succeeded in preserving this valuable treasure," Binkowski says. "Its program is a model for the world."

Sturgeon experts converge on Wisconsin

That model will be on display July 8–13 when 250 sturgeon scientists, specialists and commercial interests from more than 20 countries gather in Oshkosh for the 4th International Sturgeon Symposium. Participants will spend a week discussing the latest sturgeon research and management activities, including cooperative research Wisconsin DNR is conducting with its neighbors on the Menominee River. Here, experiments with fish passages and varying water flows may help lake sturgeon overcome the barriers of dams.

Participants also will get a window into lake sturgeon management and culture in Wisconsin. They'll tour Binkowski's laboratory, where he's unraveled the secrets to successfully propagate lake sturgeon and has since moved on to learning more about the fish's early life cycle, feeding habits, and reproduction.

Symposium participants will visit DNR's Wild Rose State Hatchery, where Steve Fajfer and his crews now annually raise 40,000 fingerlings. The intensive process includes daily cleaning of the sturgeons' tanks, and a diet of brine shrimp and other live food instead of commercial feed pellets.

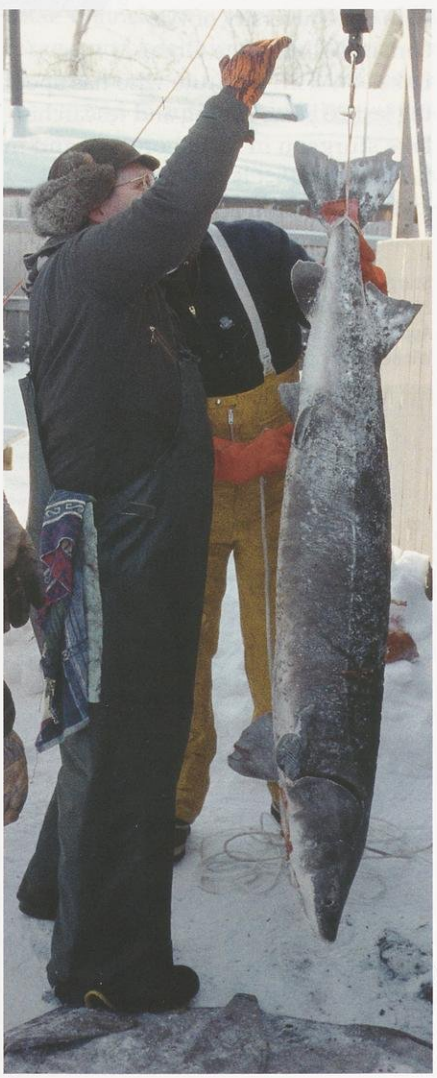
The participants will visit spawning sites created by putting down riprap, and they'll be honored guests at a traditional feast and sturgeon dance on the Menominee Reservation.

The conference also will focus on the growing threat posed by international black markets for caviar. With sturgeon populations in Russia dwindling and poaching rampant there, Wisconsin sturgeon biologists worry that unscrupulous caviar dealers may start targeting Lake Winnebago's stocks to meet the demand for premium caviar. They fear the threat could be compounded by the Wisconsin aquaculture industry's desire to raise lake sturgeon for commercial sale and to repeal an 85-year-old ban on selling Wisconsin lake sturgeon eggs and flesh.

Having a legal market for sturgeon would provide poachers an easy way to get rid of illegally harvested wild lake sturgeon. Allowing live sturgeon to be sold into the aquarium industry also could introduce new parasites, diseases and genetic dilution into the species, researchers say.

"We're looking to what may happen to our stock 10, 20 or 30 years down the road," Bruch says. "Any move to commercialize the species is not a good thing for lake sturgeon or Wisconsin citizens."

Monitoring the fish harvest remains an important management tool. DNR staff weigh, measure, age and determine the sex of each harvested lake sturgeon.



DNR FILE PHOTO




(LEFT TO RIGHT) ANN WHIPP, RONALD M. BRUCH, FRED BINKOWSKI, STEVE FAUFER

(left to right) To restore lake sturgeon to dammed portions of the upper Wisconsin River, adult fish are captured below the Dells Dam just before spawning time. Ripe spawn is stroked from gravid females and mixed with milt, then the adults are released. Fertilized eggs are raised at the Wild Rose State Hatchery using techniques and information from University of Wisconsin Sea Grant research. Healthy sturgeon fingerlings are stocked in their ancestral water on the Wisconsin River. Some are also returned to the river below the Dells Dam.

A collective plan to sustain sturgeon

Some of these issues helped spur a broad group of lake sturgeon experts to come together as a team to evaluate and update Wisconsin's goals for managing lake sturgeon populations, and to forecast the obstacles they'd need to overcome, according to Karl Scheidegger, a DNR fisheries biologist who coordinated the effort.

Representatives from DNR, Sturgeon for Tomorrow, the Wisconsin Wildlife Federation, the U.S. Fish & Wildlife Service, the Great Lakes Indian Fish and Wildlife Commission, the Menominee Tribe, the University of Wisconsin System, the aquaculture industry, several private sporting organizations, the sport fishing industry, and the angling public participated. Sturgeon Management Assessment Team members recommended the following actions:

- Develop standard techniques to assess populations, catches and harvests.
- Identify critical season habitats and habitat improvement opportunities.
- Review stocking and reintroduction proposals to ensure genetic integrity is maintained.
- Create a separate license fee for hook-and-line sturgeon fisheries.
- Restrict all sturgeon species propagation to the State of Wisconsin and federal, tribal and commercial aquaculture under a cooperative agreement for research and rehabilitation.
- Implement the statewide lake sturgeon management plan.

The statewide plan builds on or complements a handful of existing restoration efforts and recognizes the unique circumstances that may require different approaches on different waters.

One project the Department of Natural Resources is working on with the Menominee Indian Tribe, the federal Bureau of Indian Affairs and the U.S. Fish & Wildlife Service aims to restore a self-sustaining population to the Upper Wolf River. Last October, these partners transferred sturgeon from the Lower Wolf in accordance with the Menominee Reservation Lake Sturgeon Management Plan. The partners have transferred 80 sturgeon in the past five years and are on the verge of establishing actively breeding stock in a section of the Wolf River that has not seen spawning sturgeon in many decades.

Recovering a member of the tribe

Tribal history indicates the last sturgeon disappeared from tribal waters in the 1950s, 30 years after the second of two dams was erected on the Wolf River that cut the Menominee off from a fish that played a central role in their cultural and spiritual lives, according to Doug Cox, environmental specialist, tribal member and a member of the statewide assessment team.

Lake sturgeon are part of the Menominee creation story. Every spring, as sturgeon gathered by Keshena Falls, tribal members also would gather to celebrate the sturgeons' return with a ceremony of dance, drumming and a feast. Neighbors would be invited to come and participate, and would be given a fish to take home in their wagon. The celebration continues to this day, with fish the Department of Natural Resources provides the tribe for that purpose by agreement.

The tribe hopes they soon will be able to get their own fish from their own reservation's waters. In accordance with the plan, they have set a goal of establishing and maintaining a self-sustaining population of 500 fish within the Wolf River segment that flows through the reservation.

"The tribe looks at lake sturgeon as a component of itself," Cox says. "When one of those components is missing, there's something that just isn't right — and that's what's important to the tribe, not that the fish are there for the taking, but that they exist and are sustained."

Bringing sturgeon back to ancestral waters

Sturgeon are also being restored to the Wisconsin River from Stevens Point to Lake Du Bay in a different way. Fishery biologists wanted to bring back sturgeon to this stretch of the river without introducing new strains of the fish. In the fall of 1991 and 1992, fisheries crews set large-mesh entanglement nets in Lake Wisconsin, captured and transferred 182 sturgeon ranging in size from 20 to 40 inches. Those first were transferred to the Stevens Point Flowage near their upper range, as documented in historical records. That stretch of the river had excellent habitat for the newly transplanted fish to reproduce and grow.

Biologists knew that as their popula-

tion increased, sturgeon would eventually pass downstream over the dams and repopulate the remaining portions of the river. Regulations were changed to close the river to sturgeon fishing in an attempt to keep the new arrivals from being removed by anglers. The biologists stopped the transfer project after two years, concerned about poor reproduction and possible overharvest of female sturgeon by anglers in Lake Wisconsin.

They came up with a new approach in 1997 to capture adult fish below the dam in the Wisconsin Dells, remove their eggs, and send them to the Wild Rose State Fish Hatchery for rearing.

Every year for the past four years, workers at the Kilbourn Power Generation Station at the Dells Dam have measured daily spring water temperatures and called DNR fisheries crews when sturgeon begin to show up below the dam to spawn, cued by rising water levels and temperatures.

Because spawning lasts for only a few days and it's nearly impossible for workers to be there at the exact spawning time, DNR crews capture some fish and hold them in tanks at the generating station until the fish are ready to spawn. When the fish are ripe, fish technicians massage out a few quarts of eggs from the females, place them in spawning jars, and add milt, or sperm, from male sturgeon. The few quarts of eggs stripped from one or two females do not hamper the natural reproduction that takes place in Lake Wisconsin. All the adult sturgeon are returned to the river.

Wild Rose State Fish Hatchery raises the fry in tanks where they are intensively cared for over the next three or four months before being stocked. A portion of the sturgeon fry raised at the hatchery is released below the Dells Dam to compensate for the eggs removed at spawning time.

The restoration plan, now in its fourth year, is working just fine. Thousands of sturgeon fingerlings are being raised and stocked in central Wisconsin. In time they will mature and spawn, and the homecoming for this ancient fish will be complete. Eventually when lake sturgeon populations have been restored, the river will once again draw those who want to catch or just watch the age-old spawning ritual of this remarkable, ancient fish.

Lisa Gaumnitz is an environmental writer covering water and fisheries issues for DNR's Bureau of Communication and Education. Jack Zimmerman is DNR's fisheries biologist at Wisconsin Rapids and leads the sub-team.

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Blanding's turtles *(Emydoidea blandingii)* spend a good six to seven months of their year hibernating in pond bottom mud. They are fairly tolerant of cold temperatures and may emerge from winter's inactivity as early as April. Mating occurs in the water in spring. Females begin nesting in June, leaving the safety of their pond to travel overland as far as a half-mile to find a sunny nesting site in moist, well-drained soil. The turtles are vulnerable during this overland trek as they often cross highways. After choosing the perfect site, the females dig holes and deposit from 6 to 17 elliptical white eggs, each averaging 1.4 inches in length. After covering the nest, females leave.

If the sun-warmed nests are not destroyed by hungry skunks and raccoons, turtles hatch in 50 to 75 days from August into October. The temperature during incubation determines the sex of the 1.3-inch-long hatchlings. Eggs incubated at 25° C (77° F) or lower become males, while those exposed to higher temperatures become females.

GREGORY K. SCOTT

Blanding's turtles are long-lived and start reproducing at age 14–20. There's little research tracking these turtles from birth through their early development.

The young turtles make their own perilous journey back to water, then they seemingly disappear. Very little is known about their young lives until they attain a length of about six inches. Once they are large enough to be safe from predators, we see them basking in the sun.

Blanding's turtles are long-lived and 14 to 20 years pass before they reach sexual maturity. Even then, only about half of the females nest each year. Old turtles may be 50 to 75 years old and still capable of reproducing.

Blanding's turtles feed on snails, crayfish, small fish, tadpoles, frogs, insects, earthworms, slugs and anything else that slow-moving reptiles can catch. On land, they may consume plants, berries and grasses.

Wisconsin is nearly in the center of their Great Lakes distribution. Here, and throughout much of their range, they are listed as a threatened species. Though recent surveys suggest the Blanding's turtles are becoming more numerous, human activities causing wetland loss, habitat fragmentation and road development take their toll.

In my own slow meanderings, I have crossed paths with several Blanding's turtles. Each encounter has been memorable and I always give the turtles the right of way and watch them. I'm entranced by their beguiling, infectious "smile," and I can't help but return it.

Don't let her kid you. The sure-footed, quick-paced Anita Carpenter walks and watches wildlife near her Oshkosh home.

LAKES AND AN EYE IN THE SKY

At a recent convention of the Wisconsin Association of Lakes, workshops [described ways to] combine satellite information with information collected by local volunteers who test those waters at the same time. Could you do one of your great articles about fish or an enviromental question that such data might help answer? At the convention we wondered if silt raised by powerful motorboat traffic lessens fish spawning or if turbidity changes summer feeding habits in fish. Can lower dissolved oxygen levels from die-backs of Eurasian water milfoil push muskies out of their usual bays and lakes? As global warming (regardless of its cause) warms our lakes, will fish movements change?

James Imse
Hayward

Remote sensing is an especially powerful tool when we can verify satellite images with on-ground observations. DNR has tremendous opportunity to work with lake volunteers to do such collective research. The volunteers gather information every two weeks spring through fall about the biological conditions, water chemistry, water temperature and clarity of waters across the state.

FISHING IS DIFFERENT FROM FISH HUNTING

About your February story "Rod squad," I really feel sorry for those people who hunt rather than fish on ice for our finned friends. The article reminded me of a bunch of people driving deer. What you describe is fish "hunting," not fishing. The real art to ice fishing is to watch the regulars and learn how to locate and outwit fish, not surround them and run down the quarry.

These folks with their fish finders and 20-hole patterns are just like the musky hunters who, at 15-minute intervals, roar up to the shore by our cabin, flail the waters for five minutes with elaborate rods from expensive boats, then speed to the next spot. There was a time when musky fishers row-trolled the lake in non-wake boats and enjoyed the sport. Now we have people who get all hyped up during the winter watching "professional" fishing videos, investing upwards of $30,000 in boats and 150-horsepower motors to re-enact the thing they so firmly believe is fishing.

Ben Thompson
Eau Claire

TRACKING WOLVES

I really enjoyed the February article on wolf tracking, "The herd that tracks the packs," and would like to keep learning as much as possible about wolves. How can I contact the Timber Wolf Alliance and other wolf organizations of its kind?

Jennifer Mehring
Kenosha

The Timber Wolf Alliance — Write Pam Troxell, TWA coordinator Sigurd Olson Institute, Northland College, Ashland, WI 54806 or logon to www.northland.edu/soei/twa/index.html.

Timber Wolf Information Network — E110 Emmons Creek Road, Waupaca, WI 54981 or logon to www.timberwolfinformation.org/.

Wolf tracking training requires a 2–3 day study of wolf ecology, and a 1–2 day study of animal tracking. Wolf ecology courses are available through the following:

- *Treehaven UW Field Station near Tomahawk. 3–4 courses on wolf ecology each winter. Phone (715) 453-4106.*
- *DNR's Sandhill Outdoor Skills Center, west of Wisconsin Rapids. Courses on wolf ecology usually during the winter. Phone (715) 884-2437 or 889-6333.*
- *Timber Wolf Alliance, Wolf workshop at Pigeon Lake on August 17–19, 2001. Phone (715) 682-1490.*

PACK SIZE

I don't understand the wolf pack numbers published in your February 2001 piece. If 250 wolves are spread among 66 packs, then most packs would have four or fewer wolves; many fewer than the 6–10 or more wolves per pack that you describe.

(name withheld by request)

Wolf Biologist Adrian Wydeven replies: Good question. The average wolf pack size in Wisconsin is less than four animals per pack. We consider any pair or a greater number of wolves showing breeding to be a pack. The pack size ranged from 2 to 11 wolves last winter, but most years we have few packs with more than eight animals. Since packs are spreading, most years we have a lot of new packs that would consist of only two wolves. Our count last year also included 13 loners, but we believe this count of lone wolves is probably low most years.

SPIED A WOLVERINE?

The wolf tracking piece was very interesting. While hunting deer near Bone Lake between Luck and Cumberland off Highway 48, I had a unique experience. I had shot a deer the day before, and about 9 a.m. the next morning, I noticed an animal eating the remains. The animal made four or five trips back and forth taking food to storage or at least taking it away. I was in my tree stand and it passed directly under me, so I had a real good look. It was a wolverine, no mistake. I watched it for two mornings and feel very fortunate to have seen such a rare animal.

Roy W. Jones
Falcon Heights, Minn.

MUIR'S MILES

This expatriate Wisconsinite spent a major part of this winter reading *John Muir, The Eight Wilderness Discovery Books.* Justin Isherwood's excellent essay ("Conversations with a stick," February 2001) dismisses Muir's travels as that of "a Wisconsin boy who walked a thousand miles." I haven't taken the time to figure it out, but I would guess that Isherwood underestimated the length of Muir's journeys by factors of ten, probably closer to 100.

Dr. James A. Tibbitts
Jonestown, Penn.

FINDING NATURAL AREAS

On the back cover of each issue, you feature a state natural area. Is there a publication that lists and gives directions to all of these?

Victor Paape
Wauwatosa

Lists of the state natural areas by county and by alphabetical order are available from the Bureau of Endangered Resources, Wisconsin DNR, P.O. Box 7921, Madison, WI 53707. Fact sheets about many of the natural areas list the location, attributes, access points and management activities at each property. Many of these fact sheets also include maps. In fact, you can download information about many of these sites from the DNR website, www.dnr.state.wi.us, or by linking to this particular part of the site: www.dnr.state.wi.us/org/land/er/snas.htm.

STICK TO IT

We love your publication and find many things to compare between Wisconsin and Florida. We really enjoyed your older piece about fish printing (Gyotaku) and think that's a great way to prove we actually caught a fish of that size.

Then I got to reading about "the stick" in its various forms. I was reminded of when I lived in Pennsylvania and hiked around the woods. There were some good sticks and some that just didn't hold up to good stick standards. When I found a good one, I would keep it for several months.

COMMENT ON A STORY?

Send your letters to Readers Write, WNR magazine, P.O. Box 7921, Madison, WI 53707 or e-mail letters to sperld@dnr.state.wi.us.

The personal touch in your articles is one of the most endearing qualities. Keep up the great writing!

Fran Kirby
Jacksonville, Fla.

FOUL FISH?

My son-in-law, John, and I were shore fishing for walleyes on Lake Petenwell in early November when a small walleye John was retrieving was grabbed by a musky about 10 feet from shore. After a 15-minute struggle on 8-pound test line, we brought the musky in close to shore and noticed it was foul hooked in the dorsal fin. I went into the water and flipped the fish onto the beach (Not on the first try!).

We noticed a very strange look to the fish as he got close to shore. Both eyes were "bugged out" and looked very weird. There were apparently tumors growing behind the eyes bulging them out and a portion of one tumor extruded out above the left eye. There was also a large tumor about six inches by two inches on the left side of the floor of its mouth. Its left cheek in front of the gill cover had a large inflamed mark that was purple and red in color. The fish was 44" long and looked to be well filled out. I took a few pictures with John holding the musky, then we released the fish.

I have fished the Petenwell for 30 years and never caught a diseased or malformed fish. We wondered how common our experience was and hope your staff or readers can help explain this.

James H. Lenz
Waupun

Fisheries Health Specialist Susan Marcquenski responds: It's hard to diagnose from a photo, but musky and northern in Wisconsin can be infected with a virus called lymphosarcoma that causes bloody tumors that usually appear on the surface and skin. (Don't confuse this with another virus, lymphocystis, that infects walleye and panfish.)

I don't recall examining other musky from the Petenwell with this condition, so I would say the occurrence is rare. Nevertheless, I will let the local fish biologist know about this report and staff can keep an eye open for this during subsequent surveys. We encourage anglers to share such reports. In fact, if they catch exotic fish like the round goby, we encourage them to keep the specimens (cold, please!) and take them to a DNR station for identification.

BLUEBILLS DOWN?

Not once in your February story about bluebills ("Flight of the bluebills") did you say why bluebill numbers are so low. In Wisconsin we/I hunted greater and lesser scaups for more than 30 years, but for the last 12 years or so the population has been so low in northern Wisconsin that I wouldn't want to shoot one if I saw one at all.

JAMES H. LENZ

I think the DNR's open-water hunting regulations ended the great bluebill hunting in northern Wisconsin for good. Scaup are helpless to open-water hunting and I, for one, would like to see open-water hunting either cut back or done away with all together. There is no need to hunt the bluebills down to the last duck.

James Mattson
Ashland

Waterfowl Biologist Jon Bergquist responds: The major decline in scaup populations is occurring in the boreal forest population and we really don't know if something is occurring in the boreal forest north of Wisconsin that affects these ducks, if conditions have changed elsewhere in their habitat, or if other factors explain the population drop. We recover few bands for scaup that might help provide an answer. I suspect that the bulk of the scaup that come through Wisconsin come from this boreal forest region and population.

AG VIEW OF BAITING AND TB

Much of Wisconsin's deer herd lives on private property of hard-working farmers and their families. Deer can take $20, $50 or $100 every day out of farm family wallets on every acre planted in crops. This is a loss that will never be reaped.

I think every bushel of bait put in the woods that draws deer, helps some farmer pay taxes and fights crop damage at the same time. There is no less ethics in putting out corn than in many other practices used in hunting. We keep pointing fingers at baiting, yet look the other way when our pickups and boats full of every conceivable artificial device are used. We say that's all right because some big manufacturer or "sportsman" sells it!

I also hear a lot about bovine tuberculosis. Instead of pointing the finger at corn piles, we should be looking at sales barns where these infected cattle and other animals are taken, sold and dispersed throughout the countryside.

I think a lot fewer farm gates would be closed to hunters if we started calling a spade a spade.

Edward Fleisner
Menomonee Falls

The bait debate continues. As for bovine tuberculosis, our October issue will discuss three of the emerging diseases wildlife health officials are tracking closely in Wisconsin, including this one.

COVER LOVER

What an outstanding front cover on the February issue of Elizabeth Snyder. That photo should win first prize in any photo contest. In fact, the whole issue was great. Keep up the good work.

Harry Silc
Shorewood, Ill.

FUN AND INFORMATIVE

It's always a joy to read Anita Carpenter's essays on wild things. Her keen observations and elegant prose are a rare combination today when too many writers let computer spell checkers choose their words. Obviously, Carpenter does not. She carefully chooses the proper noun, verb or adjective.

I learned a new word, *irrupt*, in her recent piece about evening grosbeaks. It was the precise word for great flocks of these fascinating birds showing up unpredictably. Irrupt means to increase abruptly in size of population. That word stands alone and is not a synonym for the more familiar *erupt*, which means to break out or burst forth.

Lovers of language can rejoice.

Rosemary Thielke
Milwaukee

OOPS!

A salmon shown on p. 5 of our aquatic exotics insert in this issue is misidentified as a walleye in some copies. Salmon are also introduced species.

Thrills and skills

So what will your summer vacation be like this year? More of the same old, same old: Sitting around the cabin in a haze of cigar smoke and DEET with Uncle Percy and a platoon of his euchre buddies, trying to turn two bluegills and some leftover minnows into bouillabaisse for 12? Or will it be a time to challenge your physical limits, expand your mental capacities, develop a flickering desire into a fully-fledged passion, experience — dare we say it — *adventure?*

DONNA AND TOM KRISCHAN

The choice is yours, and Nicolet College in Rhinelander is going to make it easy for you. This year the college's **Outdoor Adventure Series** offers more than 60 inexpensive summer courses, trips and outings for you to enjoy. You'll savor the surprises and thrills only an up-close encounter with nature can provide, and learn outdoor skills to enhance all your future ventures into the wild.

To help you choose which courses suit your physical condition, the classes are ranked on a scale of 1–5, with 1 being the least strenuous (a talk on tying fishing knots, for instance) and 5 the most physically demanding (like a 5-day sea kayaking trip.) Course instructors are experienced in their chosen fields and enthusiastic about sharing their knowledge and love of nature with others.

TRAVELER will give you just a brief taste below of what Nicolet has to offer. For the full meal of courses in the Outdoor Adventure Series, call (800) 585-9304 or (715) 356-6753.

ROBERT QUEEN

Nicolet College offers outdoor adventures spring through fall for hikers, sailors, canoeists, anglers and gatherers.

Fly fishing: Under the auspices of Nicolet, fly-fishing world-record holder Bill Sherer will host a number of evening classes on selecting proper equipment and honing technique at the We Tie It Shop in Boulder Junction. Offerings include "Fly Casting: Beginner and Intermediate" on June 16, July 12 and August 16; "Knots & Leaders" on July 19; "Fly Fishing for Trout" on June 28; "Fly Fishing for Bass" on July 26; and "Fly Fishing for Musky" on August 9.

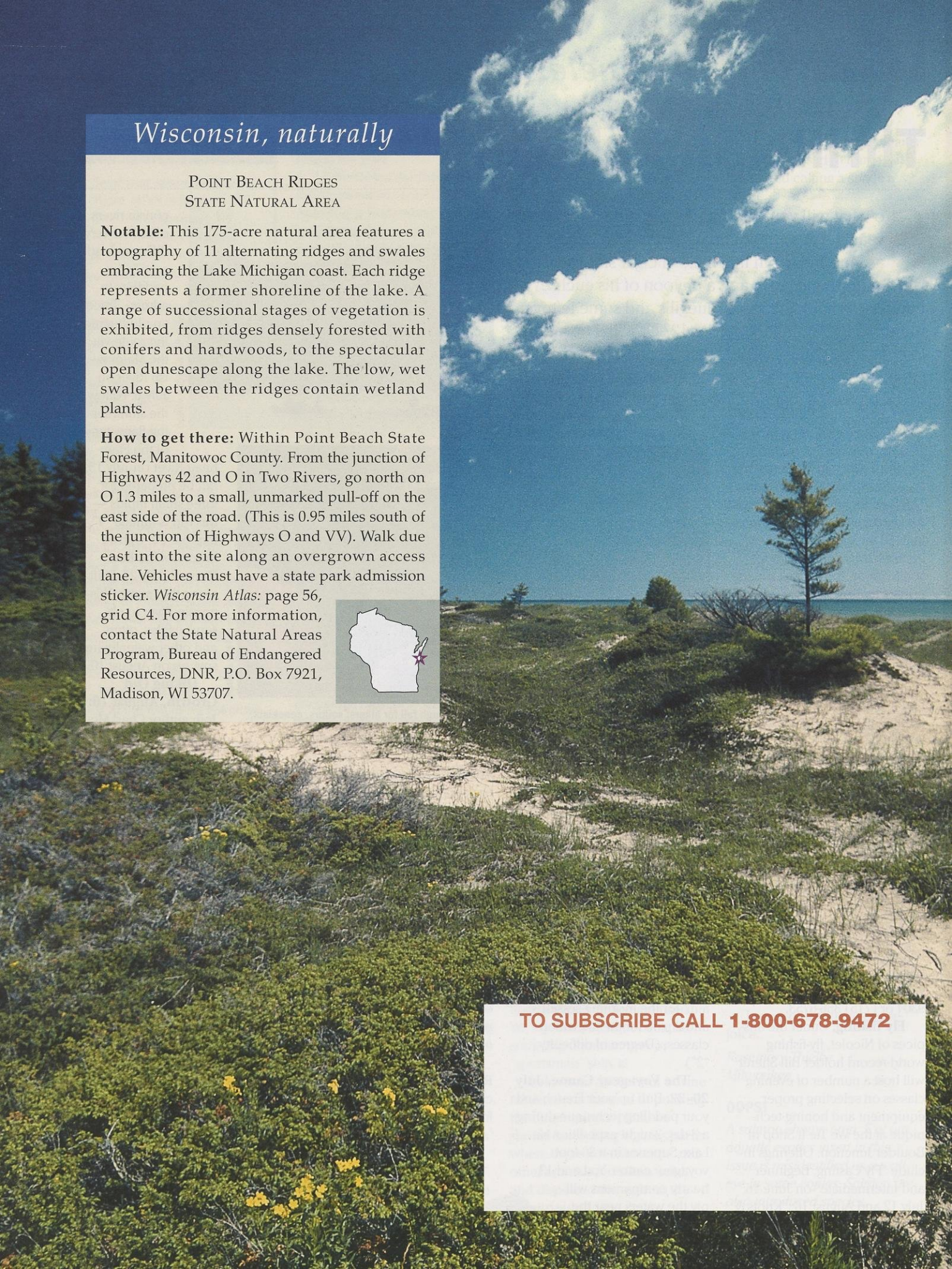
Sail the Apostles, June 17–18: All hands on the deck of the *Sandpiper,* a 35-foot classic wooden ketch, will have a turn at the wheel and the chance to trim the sails, jibe and tie a clove hitch during half-day sailing lessons. The *Sandpiper* will shove off from Bayfield at 9:30 a.m. for the morning sessions and 2 p.m. for the afternoon classes. (Degree of difficulty: "2")

The Voyageur Canoe, July 20–22: Buff up your French and your paddling technique during a 3-day, 2-night expedition on Lake Superior in a 36-foot voyageur canoe. You and 13 hearty companions will ply the waters near the Apostle Islands in the big birch-bark craft capable of carrying four tons of *fromage, vin* and beaver pelts. Guide Ron Hobart, clad in the authentic garb of a 17th-century voyageur, will regale his canoemates with saucy tales of life in the woods and on the waterways of the New World. The trip (ranked "3" on the challenge scale) will begin with safety training to familiarize all crew members with the operation and handling of *le grand bateau. Bonne chance et bon voyage!*

Great Northern Rivers: Day-long canoe trips down four northern Wisconsin rivers offer four very different landscapes for paddlers to admire. Trace an old fur-trading route via the Manitowish River on July 6. Follow the shimmering flatwater of the Flambeau River on July 13, but be prepared for three small rapids — this trip is ranked "4". Explore the Ojibwa history of the Bear River on July 27. Drift along the mighty Wisconsin River to observe eagles, otters and other water-loving species on August 10.

Hiking Old Growth, August 10: Join author Chad McGrath and naturalist John Bates for an all-day hike through three stands of northern old growth forest, each representing a specific type of forest community. It's a wonderful opportunity to experience living history and walk among giants.

Fall Mushrooms, August 21–22: Learn about edible wild mushrooms — and the species to avoid — during an overnight workshop and forage walk culminating in a grand gourmet mushroom feed at the Kemp Field Station on Lake Tomahawk.



Wisconsin, naturally

Point Beach Ridges State Natural Area

Notable: This 175-acre natural area features a topography of 11 alternating ridges and swales embracing the Lake Michigan coast. Each ridge represents a former shoreline of the lake. A range of successional stages of vegetation is exhibited, from ridges densely forested with conifers and hardwoods, to the spectacular open dunescape along the lake. The low, wet swales between the ridges contain wetland plants.

How to get there: Within Point Beach State Forest, Manitowoc County. From the junction of Highways 42 and O in Two Rivers, go north on O 1.3 miles to a small, unmarked pull-off on the east side of the road. (This is 0.95 miles south of the junction of Highways O and VV). Walk due east into the site along an overgrown access lane. Vehicles must have a state park admission sticker. *Wisconsin Atlas:* page 56, grid C4. For more information, contact the State Natural Areas Program, Bureau of Endangered Resources, DNR, P.O. Box 7921, Madison, WI 53707.