One of the best fishing spots on the lake where we vacation was straight out from the cottage pier. A cabbage weedbed filled our end of the 300-acre lake, extending 50 yards off the nearshore rock and gravel shallows.

In early August, when we paid our yearly week-long visits, the bright green cabbage was thick enough to be unfishable, even with a weedless spoon. So I worked the deep edge, sitting in a boat at dusk, hopping a leech on an eighth-ounce jig.

The lake was never easy to fish, and it had no smallmouth bass, my favorite quarry. But on that weed edge, when conditions and fortune conspired, I would catch walleyes — once a seven-pounder — and the occasional largemouth or jumbo bluegill.

For 10 years, a trip to the cottage from our home in southeast Wisconsin was a favorite tradition. Then circumstances kept us away for two summers. When we returned, I motored out the first evening, looked for the cabbage weeds, and found them — gone. Not trimmed back, not thinned out — gone. Acres of weeds, every stalk and leaf.

I knew immediately what had happened. What I didn't envision were the changes, many distressing, others wondrous, that would unfold in the next several years.

The calm at the surface belies changes under water as rusty crayfish grab hold in Wisconsin lakes like the author's favorite vacation spot.

TED RULSEH

Rusty crayfish can change the lakes they invade for decades. Slowing their spread takes time and sustained commitment, but it's worth the work.

LIVING with the rusty red menace

Rusty crayfish, *Orconectes rusticus*, have a distinctive reddish patch near the back on both sides of their main shells (carapace) and have larger claws than most native crayfish. Rusties are aggressive and chase away other crayfish leaving the natives vulnerable prey for fish and mammals.

ERIC ENGBRETSON

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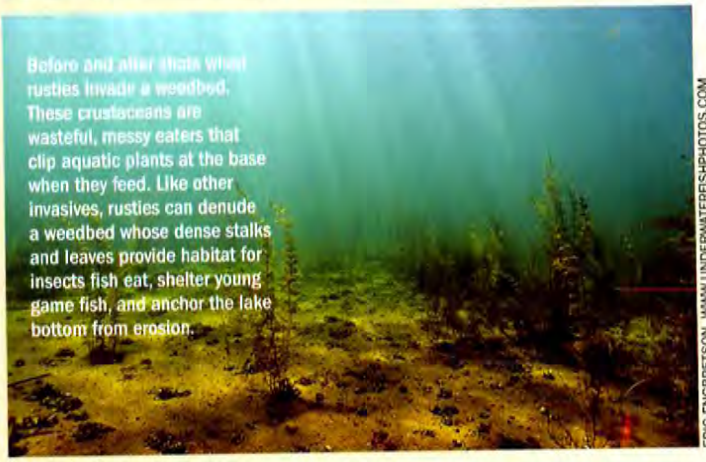


ERIC ENGBRETSON WWW.UNDERWATERFISHPHOTOS.COM

Before and after shots when rusties invade a weedbed. These crustaceans are wasteful, messy eaters that clip aquatic plants at the base when they feed. Like other invasives, rusties can denude a weedbed whose dense stalks and leaves provide habitat for insects fish eat, shelter young game fish, and anchor the lake bottom from erosion.

Sometime around 1960, a few anglers who fished a state to the south ended their trip to a northern Wisconsin lake by emptying their bait bucket – illegally — into the water. In succeeding years, other fishermen did likewise.

The bait, crayfish native to streams in the Ohio River valley, drifted to the bottom and dispersed. In this way, biologists believe, rusty crayfish (*Orconectes rusticus*) got a skittering foothold in the state's waters. As they became abundant, they probably spread farther as people harvested them, used them and sold them to bait shops.

Rusticus now live in lakes and streams throughout the state, including Lake Michigan and many of its tributaries. In some spots, they take over completely.

Rusties are extremely aggressive and have huge appetites. They do the most damage by eating water plants. "The way I describe what rusty crayfish do, they are underwater lawnmowers," says Jeff Maxted, an invasive species research specialist with the University of Wisconsin Center for Limnology in Madison.

"They are very messy eaters. They clip off a plant right where it meets the lakebed. They eat a little bit of it, but let most of it float away, and of course it dies. So the native plant beds disappear as a result."

The crayfish also eat bottom-dwelling insects like mayflies, stoneflies and midges, normally food for young game fish. They outcompete native crayfish for food which forces them out from under rocks, exposing the native crayfish to predator fish. Against rusties, the natives have no chance.

Rusties also reproduce rapidly — one female can lay nearly 600 eggs at a time. It's easy to see why they can take over, and when they do, it's not pretty.

I first saw *Orconectes rusticus* while vacationing in 1985 on Vilas County's Presque Isle Lake. They darted aside as I snorkeled among pencil reeds in a shallow bay. When my eye caught a slender, white shape on the bottom, I reached down to get it — a walleye skeleton, picked utterly clean, head to tail. One word captures the sensation: chilling.

I knew from the start that there were rusties in our favorite vacation lake in east central Oneida County. I would see them beside the pier at night, my flashlight beam revealing the large, rust-colored spot on each side of their bodies.

For several years after we started visiting in 1988, the rusty population didn't seem to change. Our son, Todd, would entertain himself by putting on a swim mask, chasing crayfish with a small net, and depositing them in a bucket on the pier. (I confess to, on occasion, coaxing a shriek from wife Noelle or daughter Sonya by tossing a crayfish into the water beside them as they swam.)

But suddenly, the rusties overcame whatever equilibrium had held them back. When we arrived in 2000, after our two-year absence, their population had exploded. To explore the shallows with a flashlight after dark was to risk a case of the willies: for each square foot of bottom in our swimming area, a crayfish, or two or three, prowled along, outsized pinchers held forward.

That wasn't the worst of it. Except for a couple of underwater humps along the lake's north shore, I had found very little fish-concentrating structure on the lake. The bottom profile is mostly like a shallow soup bowl, sloping gently down to a maximum of 25 feet. I depended on the cabbage weeds, more specifically the weed edges, to find fish.

Now the crayfish had cleared out the weeds — not just the big bed off our cottage but also a deeper-water patch out beyond the north shore humps, another good place for walleyes and for nice-sized perch. Here, along the edge at midday, Todd and I would catch perch on fathead minnows, offered on plain hook-and-split-shot rigs, fished straight down.

So reliable were the perch that one afternoon, toward the end of a vacation, when Noelle announced we had no meat in the icebox, Todd and I volunteered, fully confident, to catch dinner. And we did. Now the weeds and the perch were no more.

That first year back, I poked and probed around the lake like a man wearing a blindfold, the spots I knew now barren; my favorite tactics useless. A leech bounced on the bottom almost surely came back in the vicious pliers-grip of a crayfish.

My only recourse was to cast floating plugs at evening near pencil reeds on the east shore where, now and then, I hooked a largemouth bass. It was dismal — so much so that despite all the good times the lake had given us, all the memories, the pictures, the stories, the traditions, I wondered: should we keep coming back? Had *Orconectes rusticus* ruined the lake?

Rusticus don't take over every lake to which they are introduced, says Steve McComas, biologist and owner of Blue Waters Science, a fish and lake management business in St. Paul, Minn.

"It's a question of habitat," says McComas, who has worked on rusty crayfish problems with Wisconsin lake associations. "Rusties don't burrow. They need to hide under rocks to do well. In a lake with a mucky or peaty bottom, they might be present but never become dominant."

But on a rock, rubble and gravel bottom, as in our lake, they are trouble. "They can maintain a slow-growing, sustaining population for a while," McComas says. "But when the population hits a certain threshold, they'll go exponential, until they run out of food to eat or something starts eating them."

Our lake lies a few miles outside the tourist madness of Minocqua-Woodruff and Lake Tomahawk. Our weeks there are blessedly quiet, especially once the working world calls the weekend water skiers (and there aren't many of them) home on Sunday evening. Tall maples and birches shade our cottage deck, a perfect place to rest on a chair with a book and a cold drink.

As many as half a dozen loons fish the lake, and they come closer to our pier and to our boat than is typical. With binoculars we can spy on a bald eagle perched in a tall, white pine across the water, or watch him soar over the lake toward evening. Each afternoon, painted turtles sun themselves on logs in a back bay we visit by paddleboat or canoe. The kids always counted the days until our yearly trips, and Noelle and I did, too. The cottage owners had become our friends. It was hard to imagine a better place to spend a Northwoods week. So, in spite of *rusticus*, we kept returning.

Our second summer back, things looked worse than the year before. The nutrients in the water that once fed the cabbage weeds had to go somewhere, and that was into filamentous algae. It lay all over the bottom — fibrous clouds of it, several inches thick in some places.

Now it wasn't just difficult, it was impossible to fish a bait on the bottom. If I tried, the hook or jig came back covered with a musky-scented, greenish-black glob, sometimes with a crayfish besides. A crankbait or spinner would encounter, many times, a clump of algae suspended in neutral buoyancy, and return hopelessly fouled.

Since I wasn't about to give up fishing, there was nothing to do but try to adapt. Exploring carefully one evening, I found a fairly steep dropoff between a sunken gravel bar and pencil reeds along the lake's northeast shore. The contour of the hard bottom there formed what anglers call an inside turn, generally a good walleye spot.

Rusty crayfish lay in wait on the inside edge of a fish crib. They are efficient scavengers that can overcome an injured, dying fish and pick their bones clean. They also feed on aquatic insects, fish eggs and detritus as well as plants.

Trappers can reduce the density of crayfish but they are unlikely to eradicate the whole population once the exotic crayfish infest a water.

ERIC ENGBRETSON

Knowing I had to fish deep but stay off the bottom, I dug into my tackle box and tied on a floating jighead. With my needle-nose I squeezed a split shot to the line a foot and a half above the jig. Baiting the jig with a leech, I cast it out and, bit by bit, drew it back. When I lifted it from the water, algae covered the sinker, but the jig stayed clear. Pleased with myself, I pulled the clump away and cast again.

Several tries later, my graphite rod transmitted to my hand a subtle tap, tap. I snapped the tip back and soon reeled in a walleye, which reached just past the 15-inch mark on my tape measure — legal size. I caught one more keeper, and a few smaller ones, before dark descended. As the week went on, I picked up a few more walleyes, and my family enjoyed the filets, shaken in flour and cornmeal and pan-fried in butter. The lake still held fish. All was not lost, though I still couldn't find the perch.

Then one evening, while working my new favorite spot, I hooked a fish that didn't hold deep the way walleyes do, instead darting to the side, then rushing to the surface and leaping clear. When I brought it on board, no more than five or six inches long, the greenish-bronze sides and bright red eyes said it all: smallmouth bass.

A *rusticus* domination isn't usually permanent, McComas observes. "It's the typical invasive species pattern," he says. "You get an invader that's very well suited to the conditions. Because there is food, and because there isn't much of a predator base, the population explodes.

"That's how it is with rusty crayfish. But eventually the ecosystem can't sustain that high population density. And so it comes to an equilibrium. Eventually, natural forces catch up, and the population stabilizes at a lower density."

Once they've taken out all the weedbeds, the crayfish can become food-limited, McComas says. In addition, fish begin to prey on them — although that takes time. "Because rusty crayfish don't burrow," says McComas, "their behavior evolved so that when threatened, they take up a defensive posture. Native crayfish, when a fish comes by, will scurry away, but rusties will stand and fight.

"Because their pinchers are a little bigger than those of the native crayfish, that is a little bit scary to the fish, and

they leave them alone. So for a long time, fish are wary of the crayfish. They don't know how to eat them. Eventually, and it's hard to say how long it will take, the perch, bass and walleyes learn to eat the crayfish. It takes years for that to kick in, but when it does, there is some natural control."

Surprisingly, the best predators on rusties include yellow perch. "Perch feed on the smaller crayfish — up to about one inch long," McComas says. "Smallmouth bass are good predators, too, but yellow perch by far outnumber bass in most lakes, and they're pretty efficient predators."

The third summer after the *rusticus* explosion, there were signs the fish were beginning to take charge. At night on the pier, my flashlight caught far fewer crayfish than I had seen in recent times.

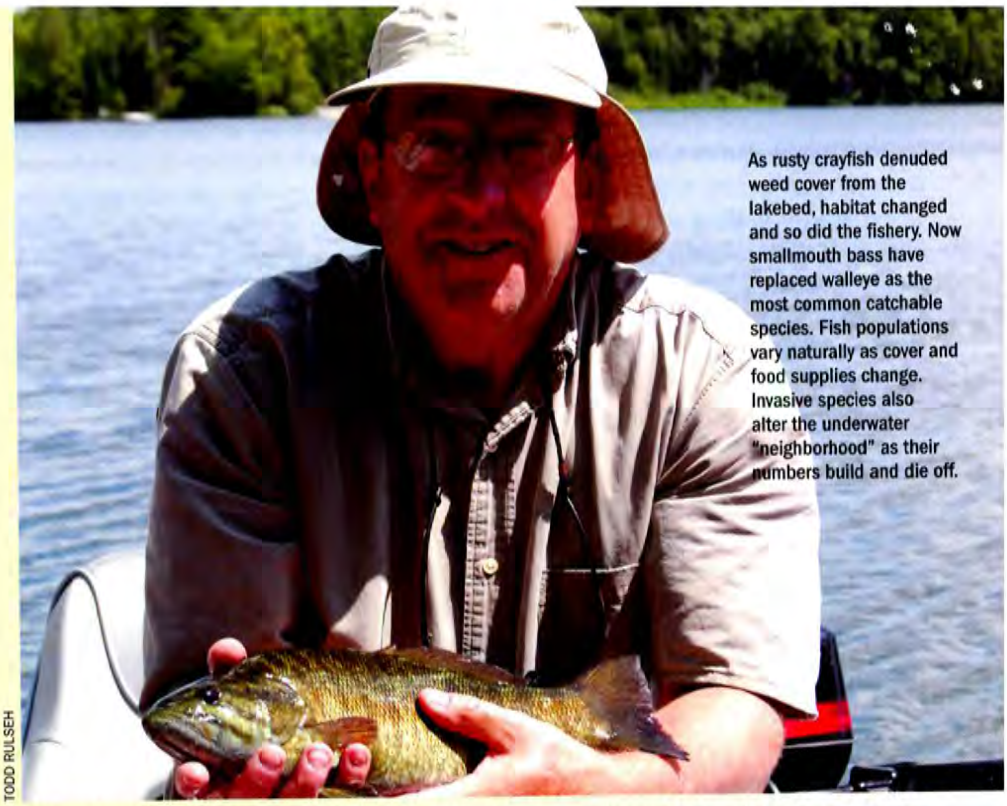
Unfortunately, algae still fouled the lake bottom, *rusticus* still intercepted my jigs, and the walleyes still were hard to find. When my inside turn in the northeast corner produced nothing, I turned to the sunken humps along the north shore. Floating jigheads, slip-bobbering, vertical jigging above the bottom — nothing worked.

Then, on the bright evening of our last day at the cottage, Todd and I tried the humps again, vertical jigging while drifting on a gentle breeze blowing toward shore. When Todd reported a hard strike, I tossed the anchor overboard. When it hit bottom in nine feet of water, I tied off the rope on a cleat.

Todd soon got another bite, and his rod bowed deeply. As I grabbed for the landing net, the fish jumped — a smallmouth, not a fingerling but fully mature, thick of body and brightly colored. A minute later, on the floor of the boat, it measured 15 inches. We released it and went back to work.

Moments later, Todd had another fish on, and then I hooked one — a double! Holding my bucking, bending rod in my left hand, I netted Todd's bass with my right. Todd then netted mine. In a flurry that lasted half an hour, without moving from the spot, we caught (and released) close to a dozen bass.

Besides providing sport, the bass surely were a reason for the crayfish decline, but there was another. Looking around the lake from our pier, I could spot white objects floating at intervals near shore — markers for crayfish traps.



TODD RULSEH

As rusty crayfish denuded weed cover from the lakebed, habitat changed and so did the fishery. Now smallmouth bass have replaced walleye as the most common catchable species. Fish populations vary naturally as cover and food supplies change. Invasive species also alter the underwater "neighborhood" as their numbers build and die off.

The latest research shows that the most effective control for rusty crayfish is a combination of fish predation and intensive trapping. The best evidence for this approach is the Sparkling Lake project in Vilas County.

There, a long-term study, funded by the National Science Foundation and being carried out by the University of Wisconsin Center for Limnology, has dramatically reduced the crayfish population through trapping and the manipulation of fishing regulations to favor smallmouth bass and rock bass. After eight years, Maxted estimates that the crayfish population in the lake has been reduced as much as 95 percent.

The problem is that trapping must be intensive and sustained, notes McComas. The 100-acre Sparkling Lake benefits from having a group of undergraduate students who take care of the traps each year. In a larger lake, relying on volunteers, such as lake association members, it can be hard to keep up the necessary trapping pressure.

"It just takes time," McComas observes. "You have to put in a major effort and sustain it over a number of years to start knocking that population down. When trapping, you're acting like a predator. If you don't keep on top of them, you won't be able to get control. It's a matter of setting the traps, putting in the time, keeping after it.

"In time, your volunteers can get burned out. You can hire someone to do it, but that gets fairly costly. Either way, it requires a significant level of effort. The trappers have to go out every day or every other day. You need a lot of traps to be effective. In a lake with a great deal of rusty crayfish habitat, you probably want 20 to 30 traps per acre. Then you have to re-bait and reset the traps. And you have to find some way to [sell or] dispose of the crayfish. Cumulatively, it's a big job."

Rusty crayfish are edible, and there is a commercial market for them. Some restaurants, for example, buy them for crayfish boils. Others sell them to pet food manufacturers. But the market is limited. "People who are trapping crayfish are not making much money on it," McComas says. "Right now, the commercial appeal is low."

During the next summer's visit, Todd and I investigated one of the wire-mesh traps placed by the lake association. Lifting the trap by its nylon rope, we found a couple dozen large crayfish inside, clinging to a lump of bait.

When fishing that week, I focused on smallmouths. Halfway through the week, I had caught none — I couldn't

find them where Todd and I had. Then on a cloudy but bright Thursday afternoon, I rigged with a leech on a plain hook and split shot, working it straight down, a foot or two above the bottom, moving gradually deeper, all the while letting a south breeze push me along a shoreline. Ten feet, 12, 14 — and then a twitch in the line. I set the hook, and my medium-weight rod soon bent to the point of creaking.

I call a smallmouth encounter satisfying when for a long spell we fight to a draw — he takes line, I get it back; he holds deep, I work him toward the surface hoping for a glimpse, and he dives again, making the drag sing.

This fight was satisfying, until on a powerful rush the hook pulled free. The next fish broke my six-pound line. Upgrading to eight-pound on a stouter rod, I tried again. On each of three drifts I boated one smallmouth, muscular and thick across the back — linebacker bass.

The next day I went back and did it all again, as always unhooking each fish and letting it swim off. Improbable as it may have seemed a few years back, our favorite lake had become an excellent smallmouth spot.

The pattern we've seen on our lake is fairly typical, Maxted says. Unfortunately, that pattern doesn't lead to the elimination of crayfish. "Once these things get into a lake and take hold, it is really, really hard to get them out," says Maxted. "That's why the focus really needs to be on prevention."

The question then becomes: How to focus on prevention? Money and people power are limited; there is no way to protect every body of water. "If we have 15,000 lakes in Wisconsin, and we want to implement prevention on some, how do we figure out which ones are most vulnerable and direct prevention there?" Maxted asks.

He and colleagues at the Center for Limnology first focused on learning the extent of crayfish distribution. Each summer, a crew of students set out traps in about 150 lakes and streams to see if rusties are present. "We find that they are pretty pervasive, perhaps in part because we're doing a better job of looking, but also because they are, in fact, spreading," Maxted says. "They are now found in every part of the state."

Which lakes are vulnerable? Those with hard rubble and gravel bottoms, for starters. Research also shows that rusty crayfish can live only in lakes with a certain combination of dissolved calcium concentration and pH. That means lakes on which to focus are those with crayfish-friendly chemistry where rusties do not yet live.

From knowing which lakes to protect, it's a long stretch to successful prevention. "We're getting pretty good at predicting where crayfish can live and where they can't," says Maxted. "But it's hard to move that information into the management realm, and it's hard to measure success. If a lake is not infested, is that because we protected it, or because it was never threatened?"

Preventive measures against rusty crayfish and against invasive species in general are widely known. Government agencies can monitor for invasive species, post signs at lake accesses, and perform education and outreach. Individuals can obey laws that forbid transport of crayfish, empty bait containers into the garbage rather than into the water, wash boats and drain live wells and bilges, and inspect boats and vehicles when leaving a lake to make sure there are no hitchhikers.

Even though *rusticus* is now widespread, prevention remains critical, McComas and Maxted agree. "Rusty crayfish can fundamentally change a lake ecosystem," Maxted observes. "You may end up with a nice smallmouth bass fishery after years of infestation, but in the process you've lost a number of native species — aquatic plants, a mix of fish, native crayfish, and possibly other small organisms, such as snails.

"The key point to remember is that there are many lakes and streams that could be home to rusty crayfish, but as yet are not. A common perception is that rusties are everywhere and there is nothing we can do about it. In fact, there are still plenty of lakes and streams we can protect."

Last year on our lake, I caught smallmouths again, and walleyes, too, in the humpy area off the north shore. On the last day of the week, I found, wonder of wonders, a patch of cabbage weeds near a gravel point. Having a couple dozen small leeches on board, I tried them down in the weeds and brought in enough perch for supper. The fishing is good, definitely better than it was 20 years ago.

Still, I can't escape the nagging reality that a sinister pest lives in the lake. Given my choice, if it meant the crayfish were gone, I would forego the smallmouth bass and go back to jigging for walleyes along the edges of the cabbage weed.

Since I don't have that option, the best I can do is observe the scientists' recommendations and do my part toward preventing the spread of invasive species, whether plant or animal. Nothing instills motivation like watching an invasion change the character of a place you love.

Ted Rulseh writes from Manitowoc.

You can slow the spread of invasives

Before leaving a lake or river:

- **Inspect your boat, trailer and equipment. Remove visible aquatic plants, animals and mud.**
- **Wash your boat with hot water or a pressure hose where the rinse water will not drain into a stream, lake or storm sewer. Let the boat dry thoroughly for five days before moving to another lake, if feasible.**
- **Drain water from boat, bilge, live wells and bait containers.**
- **Don't move live fish or fish eggs away from a waterbody.**
- **Only use leftover bait minnows on the same water.**
- **Discard leftover minnows if lake water, river water or other fish were added to your bait bucket.**

Wildfires, invasive pests and development all take their toll on wooded acres, but making it easier for forest families to plan their future may be more important in determining if the forest we see today will be here tomorrow.

Tending to tomorrow's woodland owners

Virginia Mayo Black

Many inheritors of woodland properties do not anticipate living on the property. Getting advice on promoting healthy forests and helping the family collectively manage the land is important to them.

ROBERT QUEEN

The big picture most people have of Wisconsin's 16 million wooded acres is that the forests consist mainly of large tracts of public lands and commercial timber. In fact, almost 60 percent of our forested acres are smaller parcels owned by individuals and families. And like the trees themselves, those owners are slowly aging. More than half of those private acres are owned by people 55 years and older. Their "kids" are often middle-aged with grown children of their own. These offspring are taking root far from their childhood homes and far from the forested acres their families own, often in another state altogether. As concerned as children may be about their parents' quality of life and end-of-life issues, the offspring may not want or have the skills to manage forested land they will be inheriting, even when they say they want to keep the land in family ownership.

A new challenge facing the state and the nation is understanding the needs of this next generation of forest stewards, says Forestry Division Administrator Paul DeLong. "Will these children of current landowners maintain the same commitment to the land and can we provide them with the tools to manage these forests? Both the attitudes and actions of this next generation of forest owners are vitally important to our state's economy, to the quality of life we enjoy and to a healthy environment," DeLong says.

The graying of America has focused attention on being financially solvent to cover health care costs, but there are other issues. One area that is less stud-