

By
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DRA GON FLY

paradise

**Slogging through bogs in
northwestern Minnesota,
researchers find rare species.**

ON A LATE JUNE AFTERNOON, Mitch Haag, Curt Oien, and six other scientists and volunteers wade through a tamarack and black spruce bog in the Red Lake Wildlife Management Area in northern Minnesota. The WMA's sprawling boreal bogs seem as prehistoric as the flying insects that live there. Water is everywhere—the 213,000 acres are 80 percent wetlands. It's a dragonfly's dream.

Haag and Oien are independent entomologists in their third summer of exploring the WMA and surrounding Beltrami Island State Forest. They report to the Department of Natural Resources what species of dragonflies they

Thanks to a decade of surveys in Minnesota, much has been learned about the distribution of Odonata species, such as this amber-winged spreadwing damselfly.





find. Deep in untracked peatlands, they attempt to collect, identify, and record rare specimens. They have slogged through swamps, canoed lakes and creeks, driven amphibious vehicles, and traveled by helicopter to survey the dragonfly population.

The Red Lake research is a spinoff from a statewide dragonfly survey. Little was known about the state's dragonfly species until 10 years ago when the Minnesota Odonata Survey Project was launched. Funding came from the DNR Nongame Wildlife Program, the critical habitat license plate fund, and a federal grant. Kurt Mead, author of *Dragonflies of the North Woods* and now a naturalist at Tettegouche State Park, led the project and organized experts and volunteers to look for dragonflies and damselflies around the state. (See Field Note, May–June 2012.) The effort added 24 Odonata species to the list of those known to live in Minnesota (currently 149 species) and yielded more than 2,000 new county records. It also began identifying the kinds of habitat different species need.

“There are quite a number in our state that we know live here,” Mead says, “but we don’t know why they’re so rare or why they are in one stream and not another.”

A few of the dragonfly species recorded during surveys at Red Lake include, from top to bottom, forcipate emerald, lake emerald, and ebony boghunter.



Swift, aerobic Odonata species such as the blue damselfly (above right) can outmaneuver a hungry bird. Armed with long-handled nets and practiced swings, Rachel MaKarral and Curt Oien search for specimens at Red Lake WMA.

After completing the statewide survey, the Odonata experts and volunteers transformed into the nonprofit Minnesota Dragonfly Society. They launched the Red Lake research in 2013. WMA manager Gretchen Mehmel sponsored the research using funds from timber sales on state-managed land. She enlisted Haag and Oien to conduct the survey to establish baseline knowledge of the WMA's dragonfly species. The survey would start to fill in the map of which dragonflies live where, and what they need to survive.

These aquatic insects are closely connected to the health of their habitat. "They're an integral part of the ecosystem," Mehmel says. "You keep monitoring them occasionally, and it's an early warning system if something changes or goes wrong."

What happens to the bog happens to the dragonflies. At the edge of any species' range, whether it's a moose or a subarctic damselfly, minor changes in air temperature or precipitation patterns can quickly affect a population. To detect these changes, one first needs to know what's out there, and where.

ODONATA REFUGE. With upland and lowland forests, open bogs, and wetlands, Red Lake WMA offers an intersection of landscapes well-suited to dragonflies. Patterned peatlands in particular provide optimal habitat, with trickles of open water separated by subtle rises of boggy land.

The Red Lake research has shown that the WMA and the state forest are important refuges for several special species. Among the 68 dragonfly species found so far, the researchers located a hard-to-find breeding site of the brush-tipped emerald (*Somatochlora walshii*). The rarest find has been a Quebec emerald (*S. brevicincta*). They also made discoveries that extended the known range of forcipate emerald (*S. forcipata*), lake emerald (*S. cingulata*), ebony boghunter (*Williamsonia fletcheri*), subarctic bluet (*Coenagrion interrogatum*), and amber-winged spreadwing (*Lestes eurinus*).

Every specimen they catch widens the known population of its species and improves understanding of critical habitat. For example, dragonflies that thrive in bogs



benefit from a lack of predators and competition. Because these waters have no fish, aquatic nymphs are safer and have more to eat. They are adapted to living in waters that are low in oxygen, acidic, and shallow enough to freeze all the way to the bottom. How the larvae live through deep winter frost is one of many dragonfly unknowns. “We have no idea,” Mead says.

Adult dragonflies are agile aviators, built to chase down and eat other flying insects. “Dragonflies are considered the world’s best fliers,” says Mead. “They are not the fastest, but nothing else can maneuver quite like a dragonfly.”

Unlike other insects, dragonflies have direct tendon connections from wing to muscle, giving them incredible power and maneuverability. Their eyes have up to 30,000 lenses; some act like polarized sunglasses to reduce glare. This lets dragonflies see their prey as bright specks of light, even in shimmering sunlight around water. Agility and vision are indispensable when pursuing airborne prey.

Adult dragonflies may not actually eat as many mosquitoes as people wish, because they are most active in midday and mosquitoes like dawn and dusk. But the carnivorous

From top to bottom: A dragonhunter preys on a fawn darner. The zigzag darner is a large, strong-flying boreal species. The four-spotted skimmer is found across much of the northern hemisphere.

dragonfly nymphs are ferocious hunters in their own right and will devour mosquito larvae. The massive dragonhunter (*Hagenius brevistylus*), found throughout Minnesota, eats other dragonflies and, Mead says, will even attack a hummingbird.

THE CHASE. The dragonfly surveyors are heading as directly as possible to longitude and latitude coordinates a half-mile from where the road peters out. A botanist has told them about a calcareous fen, a bog where cold water rises out of the ground rich in calcium, the necessary condition for certain rare plants and some uncommon species of dragonflies.

Today the surveyors might find another breeding site of brush-tipped emeralds. They might see zigzag darners (*Aeshna sitchensis*) or make another unexpected discovery of a species, such as a Quebec emerald. There is a good chance they could find species not previously found in the county or the state. Or maybe they will find nothing new.

On their way to the fen, the group trudges single-file through sphagnum moss and dark water, getting jabbed by branches and making jokes but no complaints. It takes an hour to go the half-mile. As they march, Oien reads measurements to their destination off the GPS. “1,300 feet.” That’s halfway. The group walks another 15 minutes. “Only 880 feet!”

Occasionally, they walk through dozens of lady’s-slipper orchids growing in dappled sunlight on soft, green peat. It feels like 300 million years ago when the world was covered in jungles and dragonflies first appeared.

Finally, they reach the fen and a cluster of forest clearings. From pools the size of hubcaps, groundwater rises with minerals

leached from limestone bedrock, painting the plants near the water chalky white. The minerals make the water alkaline rather than acidic—ideal conditions for the Hine’s emerald (*Somatochlora hineana*), the sole dragonfly species federally listed as endangered. Pushed toward extinction by drained wetlands, it has been found in Wisconsin, Michigan, Ohio, and Missouri, but not in Minnesota. Yet.

Haag and Oien assess and strategize. They look toward the treetops. They compare the fen to other places where they have found other dragonfly species.

The team eats lunch standing because there is nowhere to sit. Bedecked in hip boots, magnifying glasses, and bug nets, most of them look like 18th-century explorers. Haag’s 14-year-old son Jason wears sneakers, gym shorts, and a hooded sweatshirt. He’s the best bug-catcher in the crew.

Lunch is over when the buzzing of dragonflies is heard. Insect nets are unfurled. The standard way to determine if a species is present is to catch it, identify it, marvel for a moment, then let it go. If it’s hard to confirm the species or if the find is significant, the specimen is tucked in an envelope labeled with location and date. Most are later released; a few are killed and preserved by submersion in acetone.

Haag and Oien are looking down in the water for nymphs as well as up in the air for adults. “If you don’t survey the nymphs, you’re missing 50 percent of what’s out there,” Haag says.

Dragonflies live at least one or two years underwater as larvae and are adults on the wing for maybe only six weeks. Surveying nymphs can show additional species and confirm that a species is successfully mating

in a particular place. “You can’t really conserve a species without learning the breeding habitat,” Haag says. “Just because you see an adult there doesn’t mean they’re breeding.”

The nymphs are confounding to identify. Identification keys show how to determine the species of only about half the nymphs the researchers find. The nymphs molt multiple times as they grow, changing in appearance throughout their maturation. Identifying a species might involve measuring the ratio of certain tiny body parts to other parts.

“When it gets down to counting hairs on a larva butt, you’re getting into the nitty-gritty,” says team member Ron Lawrenz, a longtime dragonfly researcher.

THE FINDS. Each night in a cabin at Norris Camp, the historic Civilian Conservation Corps compound that serves as headquarters for Red Lake WMA, the researchers organize the day’s findings of adult dragonflies and nymphs. They examine many specimens under microscopes.

The Hine’s emerald was not found. Neither was the hoped-for breeding site of the brush-tipped emerald. But the nymph nets yielded one significant find: a forcipate emerald larva. It was the first of its species discovered in the area. Forcipate emeralds are specialized to live in calcareous fens. But Haag says even in these ideal habitats, they are difficult to find because they are never abundant.

Another hard-found species was the lake emerald. True to its name, it was flying above one of the few open bodies of water. The researchers got there by canoeing up a narrow stream twisting through the peatland. At each turn, they would lose their momentum and have to dig in to get going again. Beaver dams blocked their way. The creek “was

Volunteers receive hands-on training in identifying Odonata and handling specimens in the field. Learn how you can help at mndragonfly.org.

like a fairyland,” Oien says. “It was the clearest water you’ve ever seen. There were logs underneath that could have been there for thousands of years.”

When they first made it to that lake in 2014, they also saw lake emeralds flitting over the water. Paddling after them was like a steamboat chasing a fighter jet. “Males were patrolling territory, and it was insane how fast they would go across the lake,” Haag says. The researchers left without catching one. On their return trip in 2015, they again could not keep up in the canoes with the lake emeralds. But on the floating sedge mat at the edge of the lake, Jason Haag—with his youthful reflexes and eyesight—saved the day.

“He saw it coming, started the swing kind of early, did this over-the-head swing, and it ended up in the net,” his dad says, with a twinkle of pride in his eyes.

“He knows how to almost predict dragonfly flight,” Lawrenz says. “He’s one with the dragonfly.”

Despite good catches and valuable discoveries, much of Red Lake WMA remains a dragonfly mystery. Set within the WMA, the 87,000-acre Red Lake Peatland Scientific and Natural Area—the largest and most diversely patterned peatland habitat in America—has so far stymied Haag and Oien’s multiple attempts to access it. They have been beaten back by impassable terrain, thunderstorms, and mosquitoes. But they are returning to the WMA this summer for a new phase of research, and they hope to finally get into the bog that is so forbidding for those on foot and so welcoming to dragonflies. 

