By Todd McLeish

Dragonfly Predation on Eastern Newts

Common green darners are among the largest dragonflies in the Northeast, and they are voracious predators, capturing large flying insects – including other dragonflies – while in flight. During their long larval stage in freshwater ponds, they are equally predatory, feeding on aquatic insects, minnows, tadpoles, and even developing froglets.

But whether they also feed on the larvae of eastern newts was unknown. Although newt larvae are similar in size to other green darner prey, newts also contain a neurotoxin that may make them unpalatable. So Brian Gall, a biology professor at Hanover College in Indiana, conducted a series of laboratory experiments to determine whether darner larvae will eat newt larvae and whether the newts employ any behavioral strategies to avoid being eaten.

The palatability question is particularly complex, as it is unknown how much neurotoxin the newts contain in larval form. Adult newts have only low levels of the toxin, and Gall said they are known to deposit some of their toxin in their eggs, but is it enough to repel green darner larvae? Juvenile newts – called efts – contain high levels of the toxin, even though it is believed that they are unable to produce it themselves.

ELISE TILLINGHAST

Juvenile eft stage of the eastern newt.

In the first experiment, green darner larvae were provided newt larvae in all three developmental stages to determine which was preferred. "They ate them all," Gall said. "Young ones were eaten, old ones were eaten, and metamorphs were eaten. That was a surprise."

Next he assessed the survival rate of newt larva when exposed to dragonfly larva in environmental chambers. In two experiments, the dragonfly larvae ate 19 of 20 newt larvae. Because newt larvae rely on their sense of smell to detect predators, Gall then placed newt larvae in water previously containing green darner larvae, and it became clear that the newts could smell the dragonflies. They immediately slowed down their movements.

"Even though they don't have enough toxin to protect themselves, the newt larvae have behavioral mechanisms to help keep them safe," Gall explained. "When they smell a dragonfly, they reduce their activity and hide by sitting at the bottom of a pond until they don't smell that dragonfly anymore."

Given how voraciously common green darner larvae prey on newt larvae in controlled experiments, one might think that the newts may struggle to survive in the wild. But Gall isn't worried about them. "I'm sure the dragonflies are eating a lot of newt larvae, but every fall we find thousands of developing efts, so the dragonflies aren't getting close to eating all of them. The newts have evolved mechanisms to survive."

Still, he's curious how the relationship plays out in the wild. "Newts aren't confined in a little dish with nothing to hide them," he said. "I'd like to look at mortality rates in the field and understand how successful dragonfly larvae are in the wild when they have other things to eat. How likely are newt larvae to survive in those conditions?"

Deadwood: Salvage or Let it Lie?

When the next major outbreak of spruce budworm strikes the forests of the Northeast, millions of acres of trees will be at risk. Nearly 100 million metric tons of stored carbon will also be at risk of being released into the atmosphere when those trees die.

That realization got John Gunn thinking about the decisions landowners will soon be making about whether to salvage that timber after the outbreak hits or to leave the dead trees to decompose into the soil. Those decisions have significant implications for greenhouse-gas emissions, as well as for the ecology of the forest.

According to Gunn, a research assistant professor of forest management at the University of New Hampshire, if the trees are left in place to decompose, some of the carbon they had sequestered will eventually be absorbed into the soil, but much of it will be released to the atmosphere. If the trees are salvaged, some parts of the tree remain at the site to decompose, while most of it is hauled away. Depending on how the salvaged trees are used, some of the carbon may remain in the wood for many years. If it's made into paper, then the carbon is released much sooner.

Using data from the U.S. Forest Service and its Forest Vegetation Simulator, Gunn simulated the greenhouse-gas emissions likely to result from a number of scenarios after spruce budworm kills the majority of spruce and fir trees in the region.

"Our general finding is that the decision to salvage dead trees leads to more carbon in the atmosphere for the next 10 to 20 years," he said. "But after that time, you get to parity because of the new growth of trees and because there's still carbon stored in solid wood products."

From a total carbon emissions perspective, salvaging dead trees may be the better long-term decision even though leaving the trees to decompose is a better decision in the short-term. On the other hand, "climate scientists are telling us to do

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Spruce budworm defoliation as far as the eye can see along a branch of the Penobscot River near Chesuncook Lake, July 1974.

everything we can to reduce greenhouse-gas emissions over the next 20 years," Gunn said. So you have to weigh what's more important: the long-term potential emissions benefits or the short-term need to not send any more carbon to the atmosphere."

His recommendation is to look for the middle ground, in part because carbon emissions aren't the only consideration. Landowners must also factor in their need for a return on their investment, and ecological factors should also be assessed. "There are a lot of ecological reasons to leave that deadwood standing and leave that structure, because it's an important component for biodiversity," Gunn said.

He is now working with a team of computer scientists to evaluate this decision-making in a world where carbon has a value to society. "If we were to truly value carbon sequestered in the forest, it might nudge you toward decisions to let forests grow longer or leave the deadwood out there, assuming someone would pay you for it," he said.

Fungal Disease Plagues Porcupines

Porcupines are quite common across the northern tier of the United States, but scientists at the New Hampshire Veterinary Diagnostic Laboratory have discovered a crippling fungal disease that is often fatal, and it could have implications for the long-term health of porcupine populations in the region.

As part of a study of porcupine mortality in Maine, New Hampshire, and Massachusetts, pathologists at the lab examined 44 dead porcupines during a 7-year period and found 12 had died from a disease caused by a fungus known to cause ringworm in wild and domestic animals.

"The fungus usually causes localized, often minor skin infections in animals and people," said veterinary pathologist David Needle. "In porcupines, however, the skin lesion becomes severe and spreads to the whole body, resulting in debilitation and death if not treated. The pattern of disease caused by this fungus has never been reported in porcupines."

The porcupine's response to the fungus is to try to slough it off by growing a large quantity of keratin, which Needle describes as "a self-adhesive sheet of dried-out cells." But because the fungus thrives in keratin, and because no inflammation blocks the fungus, the fungus eventually grows over the animal's entire body, including its eyes and ears in some cases.

Because the disease has only been diagnosed in the three states – plus a new case in Connecticut – Needle believes that a regional subpopulation of porcupines may be susceptible to the pathogen. Additional cases have been identified by wildlife-rehabilitation clinics in the region, and a newly developed treatment protocol is having modest success at healing the animals.

NEW HAMPSHIRE VETERINARY DIAGNOSTIC LABORATORY

Porcupine exhibiting symptoms of fungal disease.

The fungus is zoonotic, which means it can be transmitted from animals to humans, although there are no reported cases of humans becoming infected by porcupines. But it is emerging at the same time that several other fungal diseases are affecting other wildlife populations around the world, from bats and frogs to snakes and salamanders.

How the disease found its way into porcupines is unknown, but Needle speculates that it probably emerged in the last decade and may be spreading. Because porcupines are not commonly rehabilitated and not studied extensively, it is unknown how common the disease is at this time.

"Porcupines are quite populous in some areas and are sometimes viewed as a pest, so concern for their population numbers isn't a high priority," Needle said. "There isn't a groundswell of financial backing to investigate the disease further. But in areas where fishers had been extirpated and have been recently reintroduced, there has been a plummet in porcupine populations. Added pressure from this fungus is not helping them. They are still common enough in New England that we are not aware of a significant population decline, but studies to assess this may be lacking."

To get a better idea of how widespread the disease is, Needle is now assimilating data from 400 dead porcupines studied at diagnostic labs across the country during the last 20 years. "We just started, but this new disease might be the most common diagnosis," he said.