



Dragonflies are lovely to look at.  
Unless you're a mosquito or  
other prey.

BY DAVE SHEPARD

**BEAUTIFUL BEAST** Taking a break from hunting, a saffron-winged meadowhawk dragonfly rests on a leaf. Sunlight shining through its wings refracts into a prism of colors.

PHOTO BY JOHN ASHLEY

**T**he most efficient predator in the animal kingdom doesn't have huge claws, fearsome fangs, or sharp talons. Its body isn't covered by fur or feathers, and it most certainly does not appear to be well camouflaged.

This fearsome predator weighs less than an ounce, has six legs and four wings, and can often be a brilliant iridescent color. It's the dragonfly.

Dragonflies have the highest success rate of any predator. Wolves are successful less than 20 percent of the time when they try to catch prey. In South Africa's Kruger National Park, six of seven leopard hunts end in failure. Studies of Bengal tigers in India's Kanha National Park estimate that just one in 20 hunts results in a kill. Yet Harvard University researchers have found that dragonflies capture prey such as mosquitoes in 90 to 97 percent of attempts. "The brain uses a highly optimized hunting strategy that allows the dragonfly to predict

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where the prey is going and the appropriate muscle commands to intercept it," neuroscientist Anthony Leonardo of the Howard Hughes Medical Institute in Maryland told the BBC in 2015.

Dragonflies are one of the most ancient flying insects. They first appeared almost 300 million years ago, predating dinosaurs. That has given them a long time to perfect their flying and hunting skills.

More than 5,000 species of dragonflies and the closely related damselflies occur worldwide. The smallest wingspans are just three-quarters of an inch, while the largest span more than six inches. Scientists have identified 34 damselfly species and 59 dragonfly species in Montana, the largest with a wingspan of about four inches.

Dragonflies and damselflies belong to the order Odonata, from the Greek *odontos*, meaning "toothed one." Though they don't have teeth like most carnivores, dragonflies possess powerful serrated mandibles, or jawbones, used to hold and crush prey. Even better than teeth, you might say, considering the dragonfly's predatory proficiency.

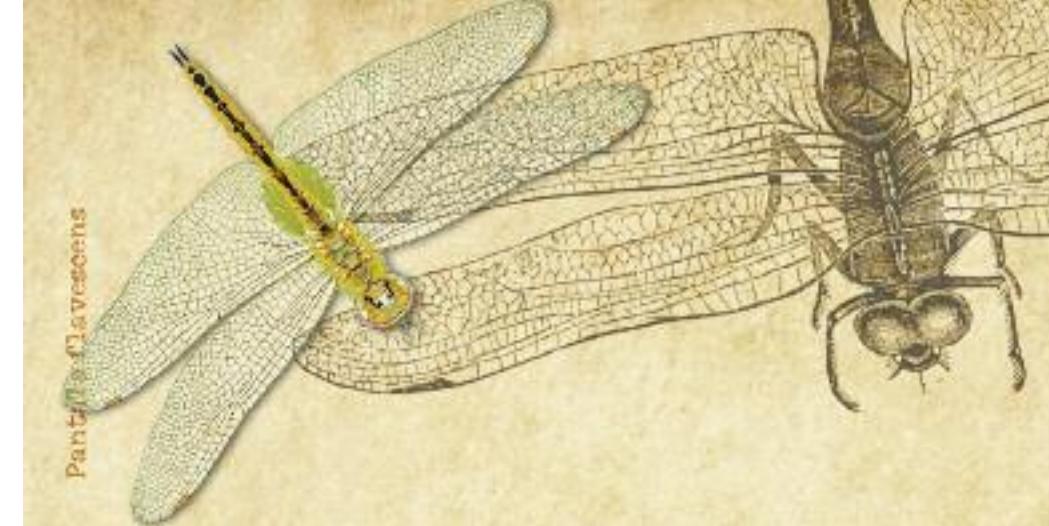
#### UNDERWATER TERRORS

A dragonfly begins life as an egg, laid inside plant tissue or directly in water. Eggs hatch into aquatic nymphs, the form in which a dragonfly spends most of its life. The larval stage lasts only a few months for smaller species, but it extends to over five years for larger ones. The nymphs are as accomplished at hunting underwater as their adult forms are in the air. When chasing prey, nymphs expel water through gills in the rectum, creating a type of jet propulsion. A hinged, toothed mouth part called a labium shoots forward and rapidly retracts, capturing and pulling prey to their mouth. These voracious feeders eat almost anything they can capture, including mosquito and other insect larvae, blood-worms, tadpoles, and even small fish.

Dragonflies undergo what's known as an incomplete metamorphosis. They do not have a pupal stage; the adult emerges directly from the nymph. When ready to become an adult, the nymph makes its way to the water surface, generally at night, and begins to breathe air. It crawls out of the water onto a reed or other plant, molts its



Dragonfly nymph



outer skin, and emerges as an adult dragonfly. Depending on the species, it will live from only a few weeks to almost two years.

#### AERIAL ACES

Dragonflies may be the most accomplished fliers in the insect world. This is in large part due to the unique muscles that operate their wings. Most insects' wings are indirectly operated by muscles attached to the thorax. When the muscles contract, the entire thorax flexes, causing the wings to move. This is like trying to flex your shoulder blades by taking a deep breath. It's an efficient use of energy, but limits maneuverability.

The dragonfly's wing muscles are attached directly to a hinged base on each wing. While the fore and hind wings of most four-winged insects are coupled and move together, each of the dragonfly's four wings has its own set of muscles and can be operated independently. This allows dragonflies to change direction and speed far faster than most insects.

In addition to the independent wing movement, a dragonfly's wing structure is remarkably stable and strong.

These attributes allow some large dragonflies to fly at speeds of more than 30 miles per hour. Dragonflies can also fly in six directions—left, right, up, down, forward, and backward—and hover in place for as long as a minute. You'd think all this flying ability would require an insanely rapid wingbeat. Yet a dragonfly beats its wings a relatively modest 30 times per second. Compare that with bees, which beat their wings more than 200 times per second, or a mosquito, whose wings beat up to 800 times per second.

One disadvantage of the dragonfly's zippy, multidirectional flight is that it requires vast amounts of energy. To fuel this demand, a dragonfly must eat 20 percent or more of its body weight daily. For a paddle-tailed darner, that means consuming about 80 mosquitoes.

Dragonflies use their six specialized legs to form a basket and catch their prey while



Flame skimmer dragonfly

STACY THORNBURGH  
NYMPH PHOTO: SHUTTERSTOCK; PHOTO ILLUSTRATION BY LUKE DURAN/MONTANA OUTDOORS

## The continual search for Montana odonates

People began to study Montana's odonates (dragonflies and damselflies) in the 1870s, when H. Hagen conducted natural history surveys of what would soon be Yellowstone National Park. Over the next century, several other authors contributed to that base of knowledge. In 1975, George Roemhild produced a comprehensive paper covering the damselfly species in Montana. In the mid-1990s, Kelly Miller and Daniel Gustafson presented a concise list of all known odonate species in Montana, along with notes on the history, known distribution, and potential species that likely lived here but hadn't yet been seen. At that time, 80 odonate species were known to occur in Montana. Recent aquatic insect surveys conducted by Dave Stagliano while working for the Montana Natural Heritage Program boosted the understanding of odonates here.

I began adding to the knowledge base of this fascinating group of insects starting in 2008. Fueled by personal interest, I began researching the known distribution, habitat requirements, and occurrence potential of Montana's odonates. Using new technologies such as Google Earth satellite imaging, I identified potential habitats of dragonfly and damselfly species not yet known to occur in those areas. The sites often contained populations of species I'd hoped to find.

Over the past decade, fellow odonate enthusiast Bob Martinka (a retired FWP senior manager) and I sampled sites and habitat types in every Montana county. We have added 13 new species to Montana's odonate list and expanded the known range of many other species, some of which had previously been documented from only a single location. To date, 59 species of dragonflies and 34 species of damselflies have been documented within Montana. All of this recently gathered data has been presented to the Montana Natural Heritage Program and deposited within Odonata Central, a national database that houses the most comprehensive range maps of North American odonates. ■

—Nate Kohler, Deer Lodge, is a naturalist specializing in birds and odonates.



**BEAUTY IN MOTION** Top row, from left to right: boreal bluet damselfly, cherry-faced meadowhawk dragonfly, river jewelwing damselfly. Above row: widow skimmer dragonfly, paddle-tailed darner dragonfly, pale snaketail dragonfly. Below row: band-winged meadowhawk dragonfly, spiny baskettail dragonfly, eastern forktail damselfly. Bottom row: chalk-fronted corporal dragonfly, eight-spotted skimmer dragonfly, blue dasher dragonfly.



flying. They subdue prey with a bite from the powerful mandibles, stripping off the wings before devouring the unlucky insect. Many dragonfly species perform this midair.

Despite having powerful legs, dragonflies cannot walk; they are only able to perch.

#### THE EYES HAVE IT

A dragonfly has huge eyes containing up to 30,000 lenses. Its curved eyes give the insect a nearly 360-degree field of vision, with only a small blind spot directly behind its head. Dragonflies may perceive more colors than humans can even imagine. We have three light-sensitive proteins, called opsins, in our retinas. Each opsin absorbs one color—in our case red, blue, or green. Dragonflies have as many as 30 opsins. These are not evenly distributed like ours but instead are arranged in ways that optimize their vision for hunting.

The dragonfly has one more trick in its hunting arsenal: camouflage. Though the brightly colored, constantly moving insects seem conspicuous to humans, they are far less so to their prey. Even more effective is the specific technique that dragonflies employ known as motion camouflage. The hunter chooses a path that makes it appear stationary to its target. It does this by moving in a perfectly straight line toward the prey. Human hunters sometimes use this

method to close the gap between themselves and big game animals like elk.

#### DRAGONFLY WATCHING

Despite their physical beauty and aerial acrobatics, dragonflies haven't attracted much attention from wildlife watchers. One exception is the annual Dragonfly Festival at Bitter Lake National Wildlife Refuge in New Mexico; the festival will celebrate its 18th year in September 2019. Watchers at the small desert refuge have seen more than 100 species of dragonflies and damselflies.

Great dragonfly watching is likely closer than you think. Look for the insects in any relatively open area near water. If you see mosquitos or other flying bugs, hungry

dragonflies will be nearby.

Field guides help with identification. My favorite is *Dragonflies and Damselflies of the West* by Dennis Paulson. Online, try [odesforbeginners.com](http://odesforbeginners.com). Smartphone apps like "Dragonfly and Damselfly Field Guide" also are handy. Note that there are many diverse dragonfly species, including cruisers, darners, skimmers, emeralds, and hawks.

Dragonflies and damselflies are important beyond their captivating appearance and behavior. For instance, they indicate the health or weakness of ecosystems. Currently six dragonfly and one damselfly species are listed as "species of concern" by the Montana Natural Heritage

Program. This is primarily a result of habitat loss, entomologists say.

Then there's the fact that mosquito-borne viruses like West Nile and Zika are spreading through parts of the United States. A healthy dragonfly population helps control mosquito numbers and potentially reduce disease transmission. Dragonflies are a mosquito's worst nightmare.

To paraphrase the marine biologist played by Richard Dreyfuss in the movie *Jaws*: Dragonflies are the perfect predators. All they do is fly, eat, and make little dragonflies. Fortunately for us, they are also beautiful, fascinating, and easily observed creatures that direct much of their bloodlust toward insects that we'd rather not have around. 🐚

## DRAGON OR DAMSEL?



Paddle-tailed darner dragonfly

Dragonflies and damselflies are closely related and similar looking. How to tell them apart:

- ▶ Dragonflies have much larger eyes, with no gap in between. A damselfly's eyes are smaller and separated.
- ▶ Dragonflies have slightly heftier bodies. Damselfly bodies look like slender twigs.
- ▶ The back wings of dragonflies are broader at the base, while those of a damselfly are narrow at the base.
- ▶ At rest, dragonflies hold their wings perpendicular to their body, like an airplane. Damselflies fold their wings and hold them together on their back.



Above: dragonfly



Below: damselfly