



Species Spotlight

Dragonflies

Odonata spp.

There are a handful of creatures that rubbed shoulders with dinosaurs that we can still enjoy today. Crocodiles, bees, snakes, cockroaches, duck-billed platypuses, etc. Well, maybe “enjoy” is a stretch for some of these, but one that falls into that category more often than not are the dragonflies. Unparalleled masters of flight and fen, they have thrived for millions of years. In fact, the dinosaurs were the new kids on the block compared to dragonflies.

Bygone Bi-winged Behemoths

The ancestors of modern dragonflies go back a long way - 300 million years in fact, which is an amazing 100 million years before the first dinosaurs trundled the terrain. The ancient supercontinent Pangaea was the lay of the land, and massive swamps pumped high levels of oxygen into the atmosphere. Insects abounded, and could achieve out-sized proportions in air that contained about 14% more oxygen than today. The largest of them all, and still to this day the largest that has yet been found in the fossil record, were the extinct dragonfly ancestors known as griffenflies. Some had an ~2.5 foot wingspan, putting them on par with today's Pileated Woodpeckers. Though their morphology hasn't changed much over those unfathomable reaches of time, today's dragonflies reach a mere fraction that size.

Game over, man! Game over!

Though best known for their aerial abilities, dragonflies actually spend the majority of their lives not in the air, but under water. Adults live for only about one month while the pond-bound larval stage of dragonfly and damselfly species range anywhere from several months to several years. In temperate areas, they hatch in spring from tiny eggs their mothers meticulously deposited around the edges of ponds, on aquatic plants, or directly in the water the previous summer or early fall.

Once they hatch they go through anywhere from 6 to 15 molts (depending on species) growing in size each time. These nymphs are incredibly adept at catching prey. A wriggling mosquito larva, newly hatched tadpole, tiny fish, and other insect larvae hardly stand a chance against a jet-propelled shadow darter nymph. In a flash they can extend their lower mandible, grab prey with attached pincers, and bring it directly to its mouth for a tasty meal. It is so reminiscent of the extendable mouth of the titular Alien creature in classic film series, many wonder if that terror was inspired by these miniscule macroinvertebrates.

The Hatch Act

Once their final molt is complete, they are ready to hatch out into full-fledged dragonflies. To accomplish this, the

nymph finds a sturdy plant stalk or other object near the water's edge to climb. Once secure, the adult dragonfly literally crawls out of a split its exoskeleton (again, not unlike the Xenomorph did from that poor fellow's chest in the movie - albeit with less speed and gore), leaving behind a hollow husk still clinging to the stalk. Then it takes several hours to inflate its body, pump up its wings with blood, and harden its exoskeleton. After that it's off on its maiden flight, ready to wreak havoc on the insect world.

Aerial Acrobatic Assassins

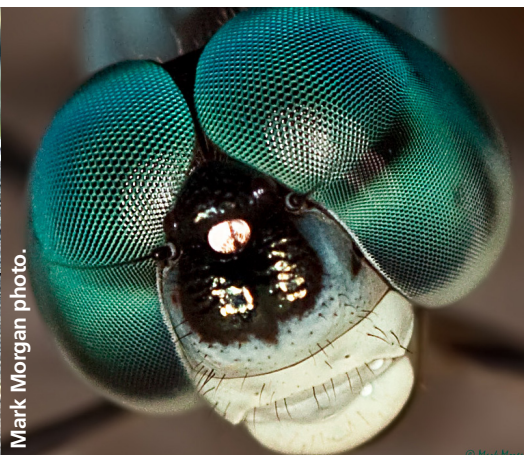
At first blush, the arsenal an adult dragonfly brings to the table sounds humbly ho-hum. They have no sense of hearing, can't smell, can't vocalize, and although they sport six legs - can't even walk. All of this is powered by a brain about the size of a grain of rice. Not exactly a description to strike fear. So it may be surprising that they are among the most successful predators on the planet today, capturing prey at a staggering 97% success rate on each meal-seeking sortie. For perspective - other skilled aerial predators like hawks, falcons, and owls can't break above a 25% success rate. Even lions, the supposed “kings of the jungle”, can only boast a rate just under 30%.

Masters of Sight and Flight

The reason for this is dragonflies have taken the powers of flight and vision to extreme levels. They own the superlatives of both the “worlds fastest insect” and the “largest eyes of all insects.” A dragonfly's head is almost completely covered with eyes, and what they lack in acuity they make up for in many other ways. They actually have five eyes: 2 large compound eyes composed of 30,000 facets all facing slightly different directions, each with a lens and multiple opsins (light gathering proteins), and 3 simple eyes pointing forward. These peerless peepers take in the world in an ultra-multicolor. For comparison, human eye-opsins are sensitive to three types of light: green, red and blue, giving us color tri-chromatic vision. Depending on species, dragonflies have anywhere from 11 to 30 types of opsins giving them the superpower-like ability to perceive ultraviolet and polarized light. This is combined with an almost complete 360 degree field of



A colorful Shadow Darter rests on a twig. Wikipedia/Zvkemp photo.



From left to right: A dragonfly nymph patrols the bottom of a pond. Once it bursts through its exoskeleton for the last time, the empty husk of the nymph is all that remains. A dragonfly's compound eye is made up of more than 30,000 light absorbing facets. Students help gather dragonfly larvae for the Dragonfly Mercury Project at the Lewis and Clark National Historical Park.

vision processed at 200 images per second. To humans, this would appear as HD slow-motion vision, compared with our relatively choppy definition of 60 fps.

A Miraculous Microprocessor.

It is easy to understand why their rice-sized brain uses 80% of it's computing power to process all that those eyes take in - and incredibly quickly too. An object need only pierce 1-degree, equal to two or three eye facets, across their plane of vision and be in view for less than 5-hundredths of a second before the brain decides to pursue or flee from it. It will also decide in that sliver of a second whether and how to track, or intercept a prey item. A feat more impressive than it may sound at first. Hockey hall-of-famer Wayne Gretzky is famous for saying: "I skate to where the puck is going, not where it has been." Whether you are a predator-in-pursuit or a prolific puck-handler, putting yourself in the right place at the right time greatly increases your chances of scoring. This requires the brain to do some fancy on-the-fly math involving target trajectory, and the speed of themselves, and that of their target. The Great One had a ~1350 gram brain to figure this learned skill out, a dragonfly's 0.021 gram brain instinctually knows how to do this.

They of course possess the speed and ability to chase down a meal from behind if needs be, but the intercept method saves a significant amount of energy. Nonetheless they need to put the pedal to the medal on occasion, and some species can reach the incredible top speed of about 37 miles per hour. They are not just super fast, but singularly manoeuvrable. Dragonflies can hover, fly sideways, upsidedown, backwards (only hummingbirds can also do this in the animal world), and spin 360 degrees on axis.

They can prey upon things like butterflies, moths, bees, flies, even other dragonflies, but mosquitos and midges are most often targeted. According to multiple online articles they chomp anywhere from "several dozen" to "hundreds of mosquitos" per day. Considering 12 mosquitos will fill a

large dragonfly's stomach, the true number is likely closer to the lower end of that scale. Regardless, both as nymphs and adults dragonflies help control mosquitos in your yard.

Harbingers of Hg.

The Navajo culture of the American Southwest have long believed dragonflies to be a symbol of water purity, and it is true that many species require good water quality to thrive. Seeing this as an opportunity to involve people with their parks, since 2011 over 100 national parks and more than 4,500 citizen scientists have participated in the National Park Service's Dragonfly Mercury Project. Many northeastern, as well as national parks across the country, have welcomed school students and volunteers to help collect dragonfly larvae for mercury analysis. Mercury is a toxic pollutant harmful to humans and wildlife alike, and often enter parks as air pollution originating from distant sources such as coal-burning power plants. As dragonfly larvae feed for years on prey containing mercury, it builds in their cells. Scientists test mercury levels in these larvae and provide insight into the health of national park waters. Ongoing analysis of the study is showing that mercury levels vary greatly even in nearby locations, indicating that things like elevation and/or vegetation could have important influences on mercury risk in parks. Of all sites sampled so far, most fall into the moderate to low risk category, but a significant 12% are at high or severe risk for mercury pollution that harms fish, wildlife, and people. The continuation of the Dragonfly Mercury Project in parks will help researchers predict potential risk to other animals and track how well efforts to reduce mercury (in the U.S. and internationally) are working.

For more information.

- [Learn](#) more about the NPS Dragonfly Mercury Project.
- [Watch](#) dragonfly larvae snatch prey using their amazing extendible jaws.