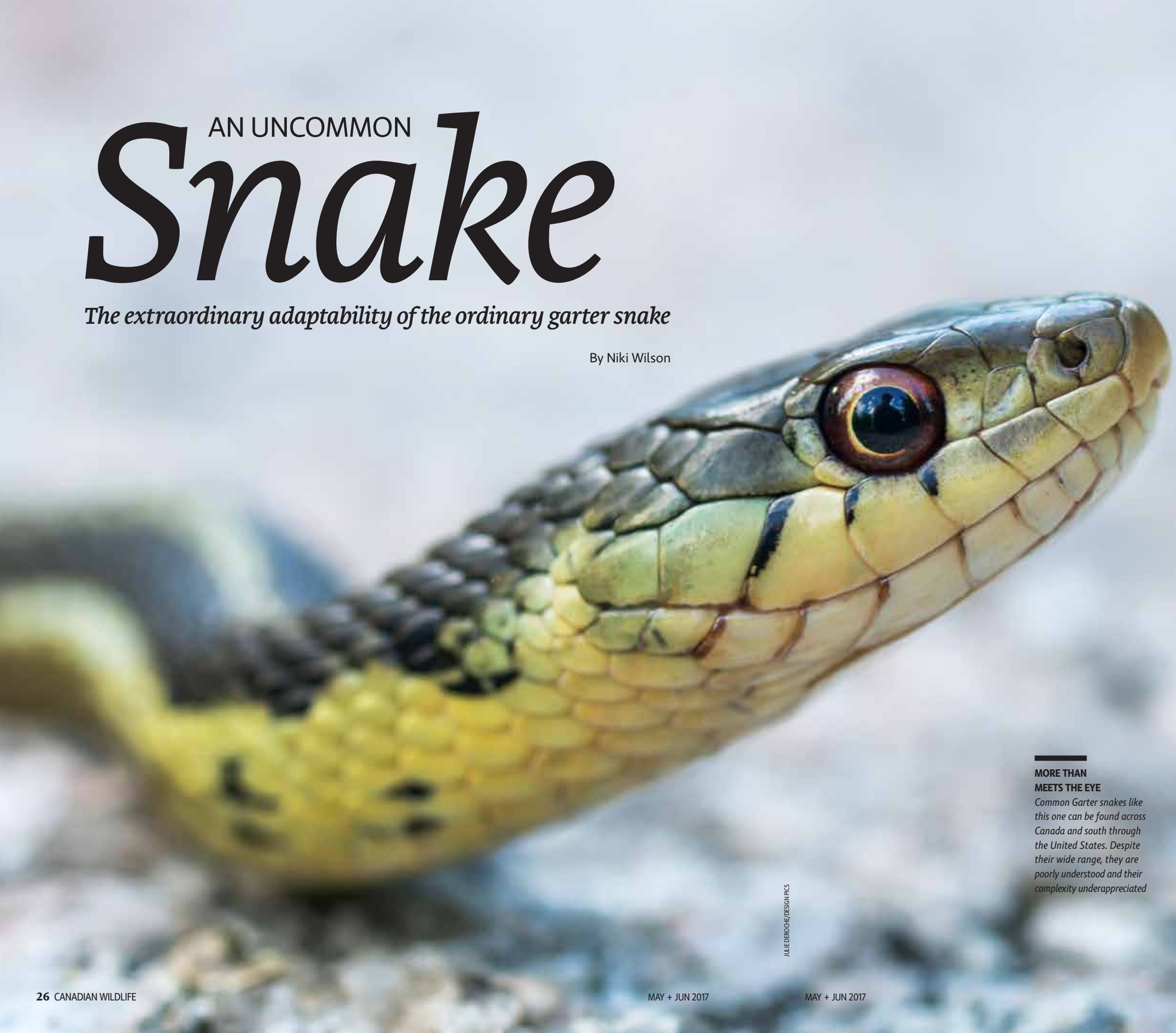
AN UNCOMMON

Snake

The extraordinary adaptability of the ordinary garter snake

By Niki Wilson



MORE THAN MEETS THE EYE
Common Garter snakes like this one can be found across Canada and south through the United States. Despite their wide range, they are poorly understood and their complexity underappreciated

JULIE DEROCHE/DESIGN PICS

Most of us, at some time or another, have seen a garter snake winding its way through the grass, its tongue flickering up and down rapidly. Perhaps you are one of those people who loves holding one in your hands, who enjoys the sensation of a wriggling snake. Or maybe they make you a bit uneasy, and the thought of holding one in your hands makes you nervous. In Canada, we see garter snakes everywhere — from coast to coast and into the Northwest Territories. Yet despite our familiarity with them, many aspects of their physiology and behaviour remain unknown.

The common garter snake that lives in N.W.T. can also thrive in southern California, right down to the border with Mexico. How does the same species survive the extremes of these vastly different environments? It turns out garter snakes are much more adaptable than anyone previously thought. The same species can have different eating habits and grow at different rates from one population to another. They're keeping scientists on their toes, trying to figure out the connection between genetics, behaviour and environment.

We're taught in school that snakes and other reptiles are "cold-blooded": scientists call them ectotherms, from the Greek terms for "outside" and "hot." Their internal heat sources are small or negligible, so snakes require external sources to generate heat. "If you put a sweater on a snake, it's not going to warm up because it's not generating enough metabolic heat," says Patrick Gregory, a biologist at the University of Victoria.

But snakes still play an active role in regulating their body temperature. "People tend to think that a snake's body temperature goes up and down with the temperature of the air, and that's really not true," Gregory says. "If it's 15 C outside and very sunny, a snake may be able to get its temperature up to 25 C."

Likewise, snakes will hide out in the shade of a cool rock if it's too hot. Indeed, garter snakes don't like a 35 or 40 C day as much as we might think. "If a snake sits out for too long in that kind of weather, it's going to cook," says Gregory.

Snakes can also survive significant drops in body temperature. At a fish hatchery on Vancouver Island, Gregory studied a population of common garter snakes (*Thamnophis sirtalis*) known to plunge into frigid water to hunt and eat young fish. Gregory attached sensors to their bodies to monitor their body temperature. "When they go into water, their body temperature drops like a stone." We humans, he says, "can't drop our body temperature 15 degrees — we'd die."

However, the snakes don't hunt every day. They tend to wait for hot weather so they can warm up rapidly when they emerge from the water. In contrast, a nearby population of the same species that does not hunt fish shows itself far less often on the same hot days, perhaps maintaining cooler body temperatures elsewhere.

It's an example of how differently members of the same species can behave, even when living in roughly the same ecosystem. While warm-blooded animals like birds and mammals constantly consume calories to stay warm, if things get tough for snakes, they can go into energy-saving mode. "During periods where the weather isn't favourable or food is not available, they can simply find a cool spot, lower their body temperature and save energy," says Gregory.

In California's Sierra Nevada mountains, the pace at which western terrestrial garter snakes (*Thamnophis elegans*) live varies dramatically, depending on their specific environment. Some of these snakes are found high in mountain meadows, where it's colder and water and food aren't always available. "The snakes there have this really slow pace of life where they take longer to mature, have smaller litters, but generally live a lot longer," says Eric Gangloff, a post-doctoral research associate at Iowa State University working on a long-term study headed by Anne Bronikowski. Meanwhile, the populations that live around lakes at lower elevations "essentially live fast and die young," says Gangloff. By hunting and eating the plentiful minnows living in the shallows near the shoreline, the snakes grow quickly and produce large litters. However, they don't live as long as their cousins higher up.

Gangloff and his colleagues are interested in the physiological and behavioural traits that evolve along with these different life histories. Snakes with a longer lifespan, for example, may need to evolve a stronger immune function in response to greater exposure to potential pathogens. They need different defence mechanisms to go with living longer.

Other links to life history are less clear. Lake populations tend to have different colouration than mountain meadow populations, but those who study them aren't sure why. Is it something in their environment, like the ability to survive different predators, or something they eat that affects colour? Or is it simply the way the genetics have expressed themselves in different populations? By studying populations that have been monitored consistently for 30 years, the research team hopes to discern and unravel the many perplexing relationships between life histories and traits.

While the snakes of the Sierra Nevada show fast and slow life histories that make sense given their environments, the plains garter snakes (*Thamnophis radix*) of central Alberta play by different rules. Gregory got some unforeseen results when he compared them with a population in Illinois. While the Illinois population had an active season that was two months longer (that is, less cold and therefore with a shorter hibernation period), the females in Alberta grew more rapidly and reached larger body sizes. One explanation might simply be that the Alberta population has more small frogs available to young, and this was enough to catapult their growth beyond what was predicted. However, says Gregory, "We don't know. The point is that the result is the opposite in many ways from what we expected." Chalk up another mystery for the snakes.

Scientists know even less about other garter snake behaviours. For example, "We don't know much about their anti-predator behaviour," says Gregory. Some speculate garter snakes have a host of predators, including hawks, crows, ravens, bears, bullfrogs, snapping turtles, foxes, squirrels and raccoons. Gregory even found one garter snake species in the stomach contents of another. However, exactly how they avoid these predators and defend themselves is largely unknown. This is in part because they are difficult to observe in action.

Garter snakes are generally wary of people and spend a lot of time doing nothing. In studies aimed at trying to understand anti-predator behaviour, human proxies are used to simulate predators, and Gregory isn't convinced those results can be extrapolated to the snake's behaviour in the wild. "We know so little about which predators are important for snakes and which behaviours are most effective in evading predators," he says.

While garter snake reaction to natural predators remains largely unknown, their reaction to humans is better documented. Often when they're handled, Gangloff says the snakes will defecate and release urine on their captor. They also excrete a smelly musk. "It stinks and doesn't go away very easily," he says. Both Gregory and Gangloff have been bitten by garter snakes many times over the course of their careers. "Most species will bite occasionally," says Gregory, "but some are more prone to it." He points to the wandering garter snake (*Thamnophis elegans vagrans*) he studies in the Okanagan Valley in British Columbia. "It hangs on and makes you bleed significantly!"

Gregory once had a strong reaction to a bite, in which his hand swelled immediately afterward. Though in the past it was believed garter snakes weren't venomous, some studies suggest they are armed with a mild neurotoxin that helps them subdue small prey. Gregory is not convinced scientists have this figured out. However, he says, "most bites just leave a scratch, and nothing results from it."

There's a tendency for people to think snakes and reptiles are less evolved life forms than birds and mammals, says Gregory. "Their physiology relative to that of a mammal or bird is kind of under-appreciated and not well understood."

However, the incredible adaptability of a single species in populations across its range is reason enough to see garter snakes as every bit as complex as other animals. The mysteries revealed in research to date suggest the world of garter snakes is alive with variety and adaptability — and with many opportunities to learn about their less-than-predictable behaviour. Though they are one of the most common reptile species in Canada, there is still a lot to understand about their role in ecosystems and how changing landscapes might affect their persistence into the future.

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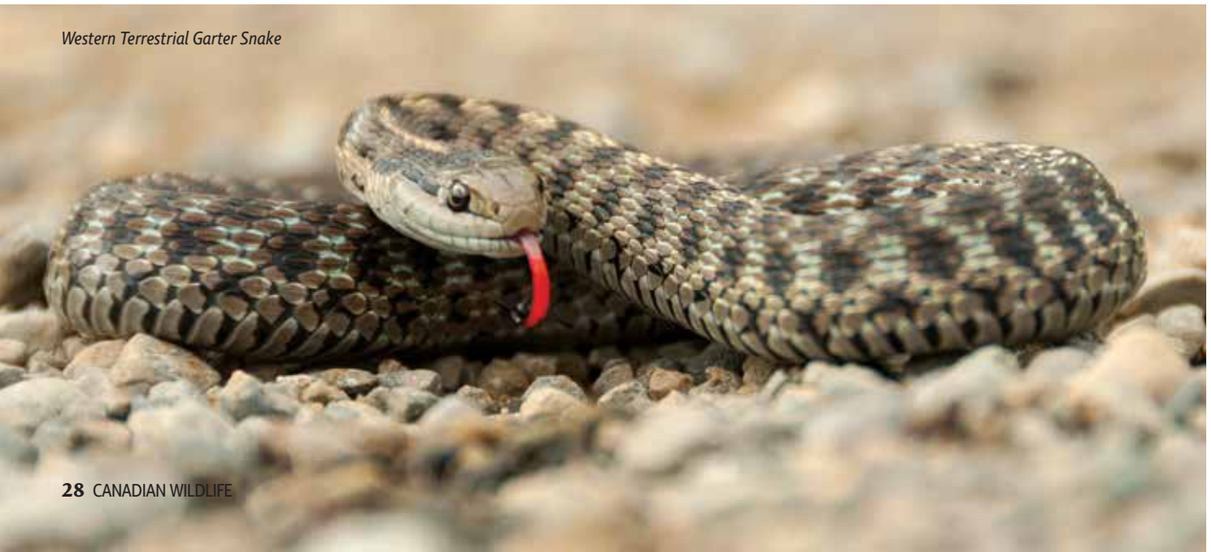
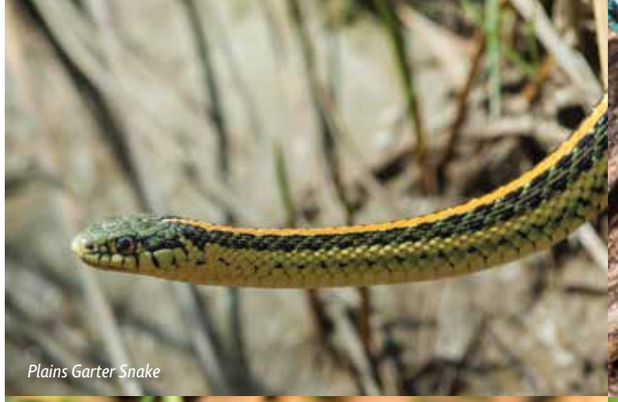
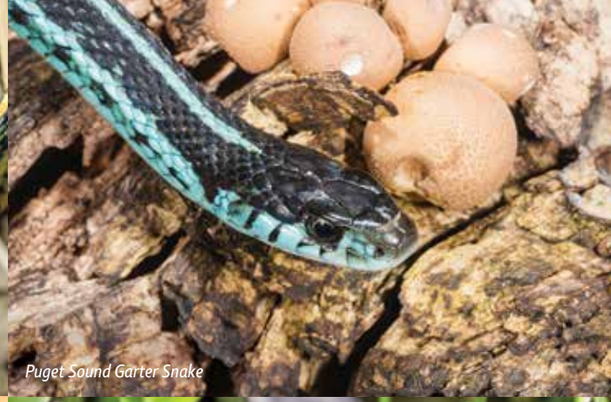


Western Terrestrial Garter Snake

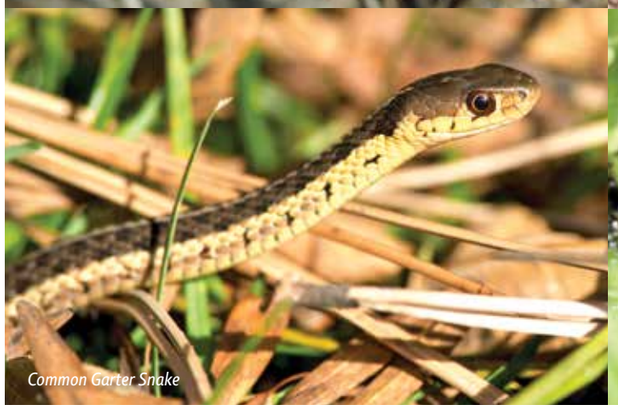
STEVE OGLE



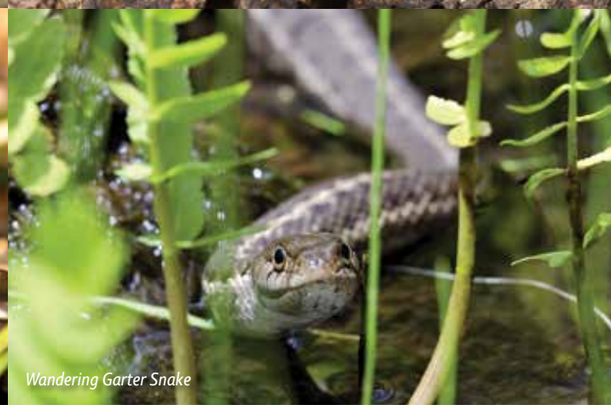
Plains Garter Snake



Puget Sound Garter Snake



Common Garter Snake



Wandering Garter Snake

CLOCKWISE FROM TOP LEFT: MICHELLE GILDERS/ALAMY STOCK PHOTO, MICHELLE GILDERS/ALAMY STOCK PHOTO, BILL GORUM/ALAMY STOCK PHOTO, ISTOCK.