Exploring The Salamander Capital Of The World

By Jennifer Bain
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Ben Fitzpatrick, an ecology and evolutionary biology professor at the University of Tennessee, Knoxville carefully (and briefly) holds a baby Southern zigzag salamander. He discovered it along the road to the Great Smoky Mountains Institute at Tremont in Great Smoky Mountains National Park./Jennifer Bain

On a recent trip to Tennessee, I lost count of how many people told me the same strange and unusual thing about Great Smoky Mountains National Park. If you stacked up all of the park's salamanders against its roughly 1,900 black bears, the salamanders would weigh more. Or was it salamanders versus all of the mammals and birds, or even all the wildlife?

Nobody could point me to a definitive source for this fun fact (although it seems to be rooted in a famous 1975 study about terrestrial salamanders in a New Hampshire forest), but for argument's sake let's call it true-ish.

"The Great Smoky Mountains are known as the Salamander Capital of the World," is how the National Park Service puts it. "Salamanders are an especially abundant and diverse group in the Great Smokies. In fact, the great majority of vertebrate (backboned) animals, including human visitors, in the park on any given day are salamanders."

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Biodiversity scientist Ben Fitzpatrick, from the University of Tennessee, Knoxville, looks for salamanders along Tremont Road./Jennifer Bain

By the time I saw my first Smokies salamander, I was weirdly glad that it wasn't the Eastern hellbender (North America's largest salamander can grow to 29 inches) but rather a baby Southern zigzag salamander that was all curled up and barely the size of a dime.

"This guy's so chill and quiet," said Ben Fitzpatrick, the ecology and evolutionary biology professor at the University of Tennessee, Knoxville who found the salamander along Tremont Road that morning. "He's a little cold and just trying to stay wrapped up."

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The egg mass of a spotted salamander floats in a shallow pond along Tremont Road./Jennifer Bain

With a worm-like head, this little brown beauty with metallic flecks showed "subtle colour after the first impression of drabness" and was probably eight or nine months old. A terrestrial salamander, it happened to be resting under a rock near a shallow pond where Fitzpatrick saw two spotted salamander egg masses.

"Salamanders have a certain amount of charisma," the biodiversity scientist allowed.

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A visitor center gift shop item conveys that Great Smoky Mountains National Park is known for its black bears and wildflowers./Jennifer Bain

I had gone to Townsend — a gateway town that calls itself "the Peaceful Side of the Smokies" — in early March just ahead of the Spring Break crowd.

Not everyone realizes that this national park, which straddles Tennessee and North Carolina, is the most visited one in the U.S. It logged almost 12.2 million people last year, significantly more than the 4.9 million who descended on Grand Canyon National Park or the 4.7 million who crowded Yellowstone National Park. Unfortunately, this park can't charge entrance fees for historic reasons to do with road transfers, but there are parking and camping fees plus Friends of the Smokies donation stations if you want to help out.

Anyway, it was still too early in the year for the three top draws — black bears, wildflowers and synchronous fireflies — but it was perfect weather to hike, drive the Cades Cove scenic loop (famous for its "bear jams" and "deer jams") and do a deep dive into salamanders. Why should megafauna get all the love?

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An adult Southern zigzag salamander was discovered at the Great Smoky Mountains Institute at Tremont./Jennifer Bain

Park staff weren't available to discuss the wonders of their salamanders so I connected with Fitzpatrick because he's giving an Apr. 25 talk about salamander diversity for the 75th annual Spring Wildflower Pilgrimage. (Others will lead salamander safaris in the park.) Understandably, Fitzpatrick wasn't game to snorkel the icy rivers for hellbenders, but agreed to drive around looking for winter-active salamanders.

"It's a little bit of a treasure hunt," he warned.

After finding that baby salamander right off the bat, we parked at the Great Smoky Mountains Institute at Tremont. It delivers experiential learning to "celebrate ecological and cultural diversity, foster stewardship, and nurture appreciation" of the park. Not far from a gaggle of students, we carefully turned over "tree cookies" and logs.

"Perhaps it goes without saying, but a lot of things really do get a lot of benefit from downed woody debris," Fitzpatrick noted. "It makes a refuge with a nice microclimate."

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You can tell from the mental gland on this Southern zigzag salamander's chin that it's a male./Jennifer Bain

He quickly found an adult Southern zigzag salamander, saying "it's remarkable how we tend to photograph them in such a way that you see bright color and contrast, but when you see them in place, they look very well-camouflaged."

It's hard to gender salamander, unless you can pop them in a Ziploc bag (something researchers use to safely handle salamanders) and turn them over. With this group, the Plethodon genus, the males develop a gland on their chin called a mental gland that they use to smear pheromones on females.

The second salamander we found was indeed male. The next three included one that "swam" away in the leaf litter, one that was missing a good chunk of its tail, and one that looked gravely ill and might have had Ranavirus.

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In a park that can't collect entrance fees, purchases from gift shops run by Smokies Life help./Jennifer Bain

We didn't luck into any other species, but a camera-toting stranger turned out to be a salamander-seeking university student from Texas. It's a small world secretly filled with salamander enthusiasts.

I'm always curious about what creatures wind up on interpretive signs and merchandise. Salamanders did appear in passing on some signs around the park. At the gift shop in Tremont's tiny visitor center, I bought salamander postcards and stickers, and giggled with Fitzpatrick over a comical-looking hellbender in a five-piece set of phthalate-free plastic Great Smoky Mountains National Park wildlife toys.

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On Middle Prong Trail, Clayton LaPrees of Smoky Mountain Guides shows a hemlock afflicted by the invasive hemlock woolly adelgid (HWA)./Jennifer Bain

"Does anybody know what a hellbender is?" Phillip Bateman had asked the day before on a van tour of Cades Cove with Smoky Mountain Guides. "This will sound like a bad drunk story, but it is the largest species in the park. They really don't look like a salamander. If you remember the original *Aliens* and the thing that came out of their stomach, it's like that just not with the teeth. It has a rectangular head, the eyes are small so you don't even perceive them, but they are extremely docile which makes them vulnerable."

It was Bateman's fellow guide, company owner/director Clayton LaPrees, who first told me about salamanders outweighing black bears. He said it's illegal to stack river rocks here to protect hellbender breeding territory, and confided that he sees salamanders at Grotto Falls on summer nights when "it feels like the waterfall is moving because there's so many on the back of the waterfall on the rocks. LaPrees, who once worked for the park, was nervous to say more about salamanders since he knew I would soon be going out with an expert.

"Come back and tell us what we're lying to you about," Bateman teased.

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In the Sugarlands Visitor Center museum, you can learn about salamanders./Jennifer Bain

Well, here are a few facts. The park boasts 31 salamander species (both terrestrial and aquatic) from five families (*Cryptobranchidae, Proteidae, Salamandridae, Ambystomatidae* and *Plethodontidae*).

As the NPS explains, there are 24 species of lungless salamanders here that "breathe" (exchange oxygen and carbon dioxide) through the walls of tiny blood vessels in their skin and linings of their mouths and throats. They can be found in and along streams and under rocks, logs and leaf litter.

Locals call salamanders "spring lizards," but they're actually amphibians — like frogs and toads — whose moist, slimy skin lacks scales and whose eggs are surrounded by clear jelly. Lizards, on the other hand, have scales on their dry skin and lay eggs with leathery shells.

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It's not quite as cute as a pink axolotl from Mexico, but this red-cheeked salamander plush toy represents one of the species found in the Great Smokies./Jennifer Bain

"Kids usually know that the salamander is not a lizard, and then they usually forget by the time they're 37," said Fitzpatrick.

Sure enough, the well-meaning volunteer at the Sugarlands Visitor Center got all kinds of things wrong when answering my salamander questions.

He directed us to red-cheeked salamander plush toys in the gift shop but didn't know the small museum had displays about mountain spring, pigmy, spotted and marbled salamanders, plus red-spotted newts (which are salamanders) and hellbenders.

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University of Tennessee, Knoxville ecology and evolutionary biology Professor Ben Fitzpatrick stands at the Newfound Gap Overlook in the Great Smokies by a sign that features a salamander./Jennifer Bain

As we drove up to the Newfound Gap Overlook in search of high-elevation species — with a "Park it Forward" tag on our windshield showing a salamander — I asked Fitzpatrick why salamanders are important.

"One answer is why is football important?" he replied, explaining that as per the salamander/bear/wildlife weight factoid, if there's so much biomass in salamanders here, they are obviously an important part of the ecosystem.

"Are they important to people? They are important to me. They enrich our lives. Learning about the way the world works is important. It's part of what makes us human and happy as humans, and so I don't know if it needs to be anything more than that. Other than just sure, everything that's alive is important in some sense. Salamanders have intrinsic worth. They're doing things with energy from the sun."

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Along the Appalachian Trail in the Great Smokies, Professor Ben Fitzpatrick looks for salamanders in early March./Jennifer Bain

We strolled briefly along the Appalachian Trail, past snow patches, searching the cloud forest in vain for red-cheeked, imitator and pigmy salamanders that clearly thought it was too cold to emerge from the frozen ground. On a hot summer's night, though, this is the place to be.

"There's nothing quite like salamanders doing their thing at night, especially when there's a lot of them," said Fitzpatrick. "They're out looking for food. They're looking for each other. Their food is anything wiggly that fits in their mouths — worms, ants, termites, soft-bodied things."

We gave it one last (futile) shot at the Chimneys Picnic Area, one of the lowest elevation spots where you can still find high-elevation salamanders, before heading home.

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Professor Ben Fitzpatrick didn't find any salamanders at the Chimneys Picnic Area in early March, but there were plenty of logs to carefully look under./Jennifer Bain

I heard how anything that harms the forest impacts the forest floor where salamanders want to be. A chestnut blight decades ago drastically changed things here. So have forest fires. Invasive hemlock and balsam woolly adelgids are an ongoing concern. But being in a national park, with all the protections that brings, is a blessing.

"So climate change is very popular but the big threat, still, for anything, is habitat destruction," Fitzpatrick pointed out. "And so, being on protected land, like the entire range of *Plethodon jordani* is in the national park, you can't do much more than that."

Now factor in the Catch-22 that people care about things they can interact with (hence all the "bear jams" at Cades Cove), but probably should just leave salamanders alone. The park doesn't encourage visitors to flip logs, downed woody debris and rocks, but researchers like Fitzpatrick can "disturb cover objects" because they can be trusted to gently put things back how they found them.

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Visitors to the museum at the Sugarlands Visitor Center can learn how Eastern hellbenders are an aquatic salamander found in Great Smoky Mountains National Park./Jennifer Bain

Which brings us back to hellbenders, those giant aquatic salamanders sometimes called water dogs or snot otters.

Gray to reddish brown with darker indistinct spots, they often look like submerged rocks. Males choose nesting sites under rocks and logs and defend them aggressively against other hellbenders once females lay strings of pea-sized eggs. By day, hellbenders hide beneath large rocks and logs, sometimes with their wide, flattened heads protruding. At night, they walk slowly over the stream bottom, foraging for crayfish and other aquatic animals.

"There's nothing really threatening about them at all — they're just weird and ugly," said Fitzpatrick. "They're sit-and-wait predators. They're not doing anything super obnoxious and dramatic."

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To protect Eastern hellbenders, you can't move or stack rocks in streams or creeks in Great Smoky Mountains National Park./NPS

But Eastern hellbender populations are on the decline, so the U.S. Fish and Wildlife Service has proposed that it be listed as an endangered species. With a two-year research project that starts this summer, Great Smokies wetlands biology technician Jonathan Cox hopes to discover whether hellbenders are reproducing in the park's streams.

Hellbenders can live to 30. They need cool and clear water because they breathe through their skin, which contains numerous folds to increase oxygen absorption. Threats include stream sedimentation, poor water quality, disease, habitat loss and pet trade collection.

"Thank you for not moving rocks," park signs urge visitors, explaining that hellbenders live under rocks and lay eggs there. To protect this sensitive species, please are warned not to build dams, stack rocks or create channels in the shallow water.

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In 2020, this Eastern hellbender was spotted in Little River at Little Arrow Outdoor Resort. Usually they hide under rocks and logs by day and wander around at night./R and R Fly Fishing

For a moment I regretted not braving the cold water to snorkel for hellbenders, but when I heard that this big beauty had been spotted at the place where I was staying on the edge of the park, I crossed my fingers and strolled along the river. Hellbenders usually stay within a 200-foot stretch of river.

"They don't just wander out and get seen," Fitzpatrick had warned before we parted ways.

Well, almost never. Little Arrow Outdoor Resort CEO Carmen Simpher had photos and video to prove one had done just that in June 2020. That extra-unusual hellbender didn't show itself to me, but walking along Little River dreaming it might was a memorable way to end my time in the Salamander Capital of the World.

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