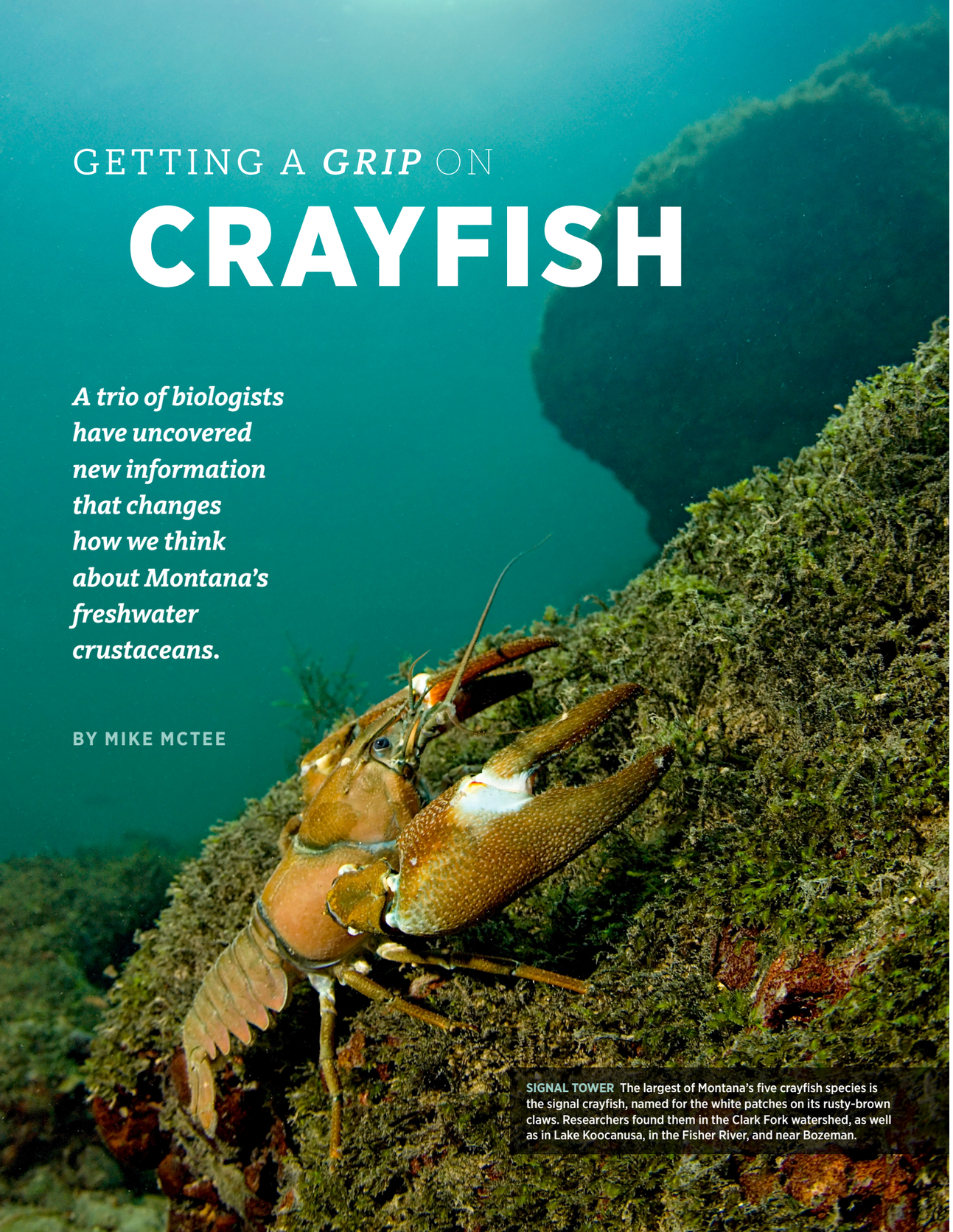
# GETTING A *GRIP* ON CRAYFISH

***A trio of biologists have uncovered new information that changes how we think about Montana's freshwater crustaceans.***

BY MIKE MCTEE



**SIGNAL TOWER** The largest of Montana's five crayfish species is the signal crayfish, named for the white patches on its rusty-brown claws. Researchers found them in the Clark Fork watershed, as well as in Lake Koocanusa, in the Fisher River, and near Bozeman.

OPPOSITE: ERIC ENGBRETSON UNDERWATER PHOTOGRAPHY. BOTTOM RIGHT: LEAH FRYE

As I edged my raft trailer toward a takeout on the Bitterroot River near Florence, I heard a shriek from the shallows. I shot my head out the truck window and saw my four-year-old, thankfully safe, unleashing a stream of giggles and jumping up and down. Beside him my fishing buddy, Sergio, lifted a crayfish from the cobbles and attempted a handoff. The creature swung its rusty claws toward the boy's nervous fingers and dropped into the river amid another burst of giggles.

Without knowing it, my son was witness to a forgotten invasion begun nearly 90 years ago.

"What's really fascinating is we knew in the 1940s that these signal crayfish were introduced," says David Schmetterling, recently retired fisheries research coordinator for Montana Fish, Wildlife & Parks. "And by the '80s, everyone just thought they were native."

The revelation that crayfish might not be native resurfaced as Schmetterling was helping research these crustaceans during the summers of 2021 and 2022 with an "A-Team" of biologists—self-dubbed "the crAy Team." Donning snorkeling gear, they netted and trapped crayfish across Montana. The study followed a sudden uptick in questions about these freshwater crustaceans, also known as crawfish or crawdads.

"There was a growing public interest at the time in foraging for crayfish for food," says Schmetterling. "But we didn't really know about the crayfish we had here."

Their findings are now upending how we think about crayfish in Montana, including in the Bitterroot River.

*Mike McTee lives in Missoula and works as a researcher at the MPG Ranch in Florence.*

## JANE GOODALL OF CRAYFISH

Crayfish, closely related to the much larger saltwater lobster, have an outsize ecological effect because they sit at multiple levels of the food web, says Dr. Susie Adams, a fisheries biologist based at a U.S. Forest Service research station in Mississippi.

They eat plants, scavenge, and prey on other animals while also serving as food for more than 350 species, including river otters, trout, and great blue herons.

Nicknamed the "Jane Goodall of Crayfish," Adams helped kickstart the FWP crayfish research. Before becoming an astacologist (someone who studies crayfish), she earned her PhD at the University of Montana and has collaborated with Schmetterling since 2000.

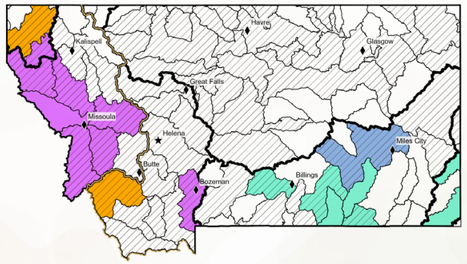
Besides FWP's surveillance for exotic crayfish, the only study of Montana crayfish occurred in 1989, focused on watersheds west of the Continental Divide. For nearly 20 years after that, the crustaceans fell back into the shadows until 2008, when non-native smallmouth bass were illegally introduced into McGregor Lake west of Kalispell. Smallmouth are voracious crayfish predators, and as the bass population grew, biologists worried how it might affect the lake's crayfishery. Schmetterling figured that was reason enough to develop a proper crayfish study.

The crAy Team set a goal to map the distribution of crayfish across Montana, study their origins, and standardize a sampling design for future comparisons. Along the way, the team recruited personnel from tribal and federal agencies to boost sampling, share techniques, and spread awareness. Only later would they come to question which crayfish might be native.

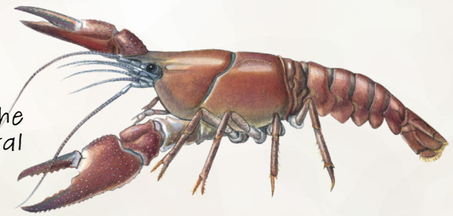
*A lifetime fascination with crayfish often starts with bravely holding one as a child.*

# CRAYFISH AROUND MONTANA

VIRILE: Most common

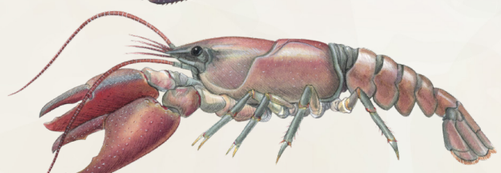



CALICO: Southeastern Montana



SIGNAL: West of the Continental Divide

SOUTHERN PLAINS: Hatchery hitchhiker



OKANAGAN: Commonly confused with signal

ILLUSTRATIONS BY JADA FITCH

Over two summers, the crew identified five crayfish species, most occupying streams and rocky shorelines, but also irrigation ditches, ponds, and even waterbodies that dry up seasonally.

Virile crayfish, also called northern crayfish, made up most of the catch and were found nearly statewide.

In the drier climate of southeastern Montana, calico crayfish predominated in the surveys. All crayfish can burrow, but calicos (also known as papershells) dig especially deep to reach moisture, sometimes several feet down to the water table, says Adams.

Signal crayfish, typically larger than virile crayfish and named for the white patches on their rusty-brown claws, were widespread in the Clark Fork drainage. They were also found near Bozeman, in Lake Koocanusa, and in the Fisher River, which drains into the Kootenai.

***They eat plants, scavenge, and prey on other animals, while also serving as food for more than 350 North American species.***

The crAy Team turned up a couple of noteworthy species, including the Okanagan crayfish, which the science community recognized as a distinct species in 2025. Okanagans are similar to signal crayfish but with a more reddish appearance and less spiky exoskeleton. In Montana, the only detections of Okanagans came from the Big Hole River and one lake high above the Kootenai River, both outside this species' presumed native range in Washington and British Columbia.

"When we caught the Big Hole River specimens in 2021, we noticed they looked different," says Adams. "Once we sequenced their mitochondrial DNA, it was nearly an exact match to crayfish first documented in Okanagan Lake in British Columbia in 2012. They also turned up that summer in Shannon Lake high above the Kootenai River, but the difference didn't jump out at us the way it did in the Big Hole, perhaps because some of the Big Hole specimens were much larger."

Another surprise turned up at the Miles City Fish Hatchery. During a routine invasive species patrol in 2021, Stacy Schmidt, FWP aquatic invasive species supervisor, netted a southern plains crayfish.

Native to the southern and central United States, this species seemed to be contained within the borders of the hatchery. Schmidt wonders if crayfish were accidentally brought in with a truckload of fish from a southern state, perhaps decades ago when fish were relocated more freely.

FWP has since taken steps at the hatchery to thwart further invasion by periodically dewatering the holding ponds, spraying hot water into crayfish burrows, and sealing those burrows with bentonite.

One bright spot, according to Adams, was that the team didn't find any high-profile invaders, including rusty crayfish, red swamp crayfish, or marbled crayfish, a species that reproduces without mating, meaning a single individual can spread a new population. Once these aggressive species gain a foothold, they can outcompete native crayfish and destabilize shorelines with their burrows.

## QUESTIONS OF ORIGIN

Sometimes it's clear when a species doesn't belong, like southern plains crayfish hundreds of miles from their native range.

Other cases are murkier, even when Montana waterbodies flow into species' native habitat downstream. Frigid water, cascades, and other barriers might have thwarted crayfish from moving upstream into Montana waters. For instance, western Montana's Clark Fork and Kootenai rivers drain into the signal crayfish's native range in the Columbia River basin, yet there's no evidence the species historically extended into Montana. The same goes for virile crayfish, which are native to the lower Missouri River, but may have stopped short of Montana.

To help determine which crayfish species might be native to Montana, Adams first turned to DNA analysis. Both the virile and calico crayfish caught in Montana exhibited low genetic diversity, a pattern expected for introduced populations where few individuals originally contributed genes.

Signal crayfish in western Montana also appeared exotic, with genetics most closely matching populations from western Washington and Oregon.

If any crayfish were native to western Montana, the Okanagan crayfish would be the best candidate, since it has the closest native range in central Washington and southern British Columbia. But isolated detections in a high mountain lake and in the Big Hole River east of the Continental Divide make a native origin unlikely.

Adams also considered the biogeography west of the Divide. During the last ice age, Glacial Lake Missoula submerged much of western Montana's low elevations. "A gigantic glacial lake is not conducive to signal crayfish because they don't like super cold water or silty bottoms," says Adams. "Then you have catastrophic floods when the ice dams break and it would just scour the entire area.

"Once glaciers receded, waterfalls formed barriers to fish migration (that's why there are no native salmon in Montana), which could have also prevented the passage of crayfish."

Seeking additional clues, Adams used a Forest Service grant to hire Hampton Kennedy. Kennedy is a high school history teacher with experience using historical documents to understand the native range of a wildlife species. Together, they mined historical travel journals, newspapers, early biological surveys, and native languages for any mention of crayfish in Montana.

They combed native language dictionaries and reports of interactions with tribes in or near Montana. The languages often had words for water-dwelling creatures such as beaver and most fish, but Montana tribes didn't appear to have any words for crayfish. The Cree Indians did, but their traditional lands extended as far east as Quebec and only reached the eastern edge of Montana.

Lewis and Clark never wrote about crayfish in their Montana journals, but they did find them shortly after crossing the Bitterroots into present-day Idaho.

In 1868 and 1887, newspapers mentioned crayfish near Bozeman, with one article suggesting that the crustaceans were introduced from Oregon, probably from a population of signal crayfish.

Adams and Kennedy found no early mentions of virile crayfish in the headwaters of the Missouri and Yellowstone rivers.

The first credible report from western Montana came in a 1934 *Missoulian* article after a newcomer to the state complained about not finding "craw-daddies." A coworker later brought one to his cubicle from the Ninepipe area in the Mission Valley north of Missoula. Those lakes currently hold virile crayfish, suggesting an introduced population from east of the Continental Divide.

**SUB-AQUATIC SPECIAL FORCES**
**Montana's "crAy Team" of researchers included Dr. Susie Adams (right), the "Jane Goodall of Crayfish," FWP aquatic invasive species supervisor Stacy Schmidt, (below right), and now-retired FWP fisheries research coordinator David Schmetterling (below).**

SUSAN ADAMS/USFS

A decade later, another *Missoulian* article offered clues on signal crayfish:

"Hamilton, Sept. 18. – Lawrence Humble and Fred Ward, fishing in the Bitterroot River near Florence, hooked a lobster-like 'critter of the deep' that is said to be a Columbia River crayfish. How the crayfish ever found its way into the Bitterroot is a mystery."

A follow-up story the next day suggested the crayfish escaped from bass ponds between Florence and Stevensville, where 1,000 crayfish had been planted seven years earlier to feed the planted bass.

Signal crayfish at the time were commercially harvested in the Lower Columbia River to be sold for human consumption and bait, shipped as far as St. Louis.

***All evidence pointed to the same conclusion: Crayfish are likely newcomers to most if not all of Montana.***

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"If crayfish are native to Montana, my guess is they occurred only in the very eastern part of the state," says Adams.

## RED FLAGS AND A PLAGUE

Where signal, red swamp, and other crayfish have been introduced in Europe, Asia, and other new places, studies have shown that the invasive crustaceans damage ecosystems.

As they rapidly reproduce and forage the bottoms of lakes and rivers for vegetation and whatever protein they can snatch, crayfish can strip thickets of aquatic plants bare and wipe out some insect and snail populations.

"We really don't know what the landscape looked like before crayfish," says Schmidt. But long hours of snorkeling and netting did turn up anecdotal trends.

For instance, the crAy Team found western pearlshell mussels, a native "species of concern" because of declining populations, tend to thrive in places *without* crayfish such as in the Yaak River.

The effects likely thread across the food web. "A cutthroat trout isn't going to eat a 5-inch signal crayfish," says Schmetterling. "But it might have eaten the thousands of stoneflies, mayflies, and caddis flies that the crayfish replaced."

To some predators, though, crayfish provide a valuable meal. The presence of crayfish could even be helping certain fish species become more abundant, according to Schmetterling. "One of the reasons crayfish have been moved around so much in this country is to feed smallmouth bass." Walleye and large brown trout also eat crayfish.

Adams thinks crayfish are still spreading in places like the Blackfoot and Bitterroot headwaters. Where cold water once limited crayfish, warming streams may widen their range.

During the study, researchers also made another unexpected discovery. "We noticed crayfish in a lot of places had rusty-colored lesions," says Schmidt. "Some had deformities on their body parts and holes in the carapace with gills hanging out through the shell."

Adams suspected crayfish plague, an infection caused by a fungus-like microorganism that decimated native crayfish populations in Eurasia after an accidental introduction of infected North American crayfish in the 1800s. In foreign populations, crayfish die within days of exposure without developing lesions. Adams shipped tissue samples to collaborators in Spain, who confirmed it to be plague using microscope analysis and genetic testing.

Although the disease originated in North America, Montana now has the first confirmed outbreak on the continent. But based on conversations with other biologists, Adams suspects it's more widespread following reports of crayfish with similar lesions in other states. She says that extensive research has shown that the disease is not transmissible to humans or other animals.

Despite the malady, Schmidt says crayfish are surviving well enough to reproduce, likely from co-evolving with the plague. "We'd be snorkeling to catch them and they were hiding and evading capture just as you'd expect, putting their claws up to fight us."

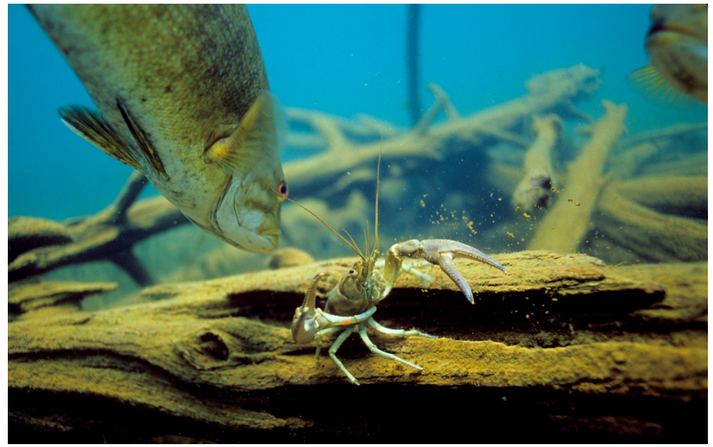
For wild foods enthusiasts wondering if crayfish are safe to eat, Schmidt recommends all crayfish be cooked completely to protect from parasitic lung flukes, which can be transmitted to humans as well as dogs.

Crayfish are hardy and difficult to eradicate, so plague or not, they're likely here to stay. Adams says new arrivals of new species are a concern even where crayfish are already present, reinforcing the importance of FWP's Aquatic Invasive Species Program.

"When I look at our map of crayfish distribution now," says Schmetterling, "I don't look at where they are. I look at where they're not. I think keeping them out of new waters should be one of our priorities."

Though the crayfish now prowling the depths of many Montana waters may not be native, they nonetheless have a knack for stirring the imagination. After my son's first encounter on the Bitterroot, his curiosity was kindled. We returned with traps and caught one to boil with salt and lemon. Taking his first bite, he grinned and giggled once again.

"It's pretty magical the way crayfish bring joy to people's faces, no matter what your age," says Schmetterling.



HUNTING THE DEEPS Researchers donned snorkeling gear to survey crayfish (also known as crawdads or crawfish) in Montana lakes and rivers. Crayfish are a popular food item for smallmouth bass (below). The illegal introduction of smallmouths into McGregor Lake led to launching a study after biologists wondered how those voracious fish might affect the lake's crayfish population.

FROM TOP: SUSAN ADAMS/USFS; ERIC ENGBRETSON UNDERWATER PHOTOGRAPHY

SHUTTERSTOCK

# Crawdad boil

Preparation time: 30 minutes | Cooking time: 40–45 minutes | Serves: 2–4

**CRAYFISH ARE FUN TO CATCH *AND* TO EAT,** making for a hearty meal with proper preparation. You can collect them using snorkeling gear, by hunting the shallows along the banks of lakes or big rivers at night with a flashlight, or by trapping them using fresh cut-up fish as bait. Tie bait in a cheesecloth bag and use wire to suspend it inside a minnow or crayfish trap so the bait doesn't touch the sides and crayfish have to enter inside to get the bait. **Before you go, make sure to check the Montana fishing regulations and bring your fishing license.** ■

### INGREDIENTS

**20 fresh crayfish, cleaned**
**1 (4 oz.) package crab boil seasoning (Zatarain's or other)**
**1/4 c. Old Bay seafood seasoning**
**1 c. kosher salt**
**4–6 bay leaves**
**3–4 lemons, halved**
**3–4 garlic heads, halved crosswise**
**3 yellow onions, halved**
**6–8 red potatoes, halved**
**1–2 lbs. andouille sausage, cut into chunks**
**4 ears corn, shucked and cut into 3–4 pieces each**

### DIRECTIONS

Bring 2 to 2.5 gallons of water to a rolling boil in a large stock pot. Add crab boil and Old Bay seasonings, salt, bay leaves, lemons, garlic, and onions. Stir until spices are dissolved, then add potatoes and return to a boil.

Boil 15 minutes. Add sausage and reduce to a simmer for 5 minutes. Add corn and simmer 10 minutes, then add crayfish and simmer 5 minutes, being careful not to overcook.

Pour mixture through a large colander. Discard lemons and seasoning pouch. Serve with any commercial hot sauce.