

Bats to the wall

Can a bizarre treatment halt the disease wiping out North America's bats, wonders Sharon Oosthoek

JARED HOBBS / ALL CANADA PHOTOS / ALAMY

THINK yogurt for bats," says Cori Lausen. "We're working with probiotics." But instead of eating this cocktail of "good" microbes, they get doused with it. The plan sounds a bit, er, batty but it could be a lifesaver.

Right now, bats across North America are emerging from hibernation. They are the lucky ones. Over the past decade, a fungal disease has killed millions during their winter slumber. The death rate from white-nose syndrome can be between 90 and 100 per cent, there is no cure and it threatens to annihilate entire species. That is not only terrible news for them, but also for us, because bats eat insects that spread diseases and their voracious appetite means farmers use far less pesticide. With a race on to stop the deadly fungus spreading, Lausen, a biologist with the

Wildlife Conservation Society Canada, is pinning her hopes on a probiotic brew.

White-nose syndrome is caused by a fungus aptly named *Pseudogymnoascus destructans*, which originated in Europe long enough ago for most bats there to have evolved resistance. Not so in North America, where it was first spotted in 2006 in eastern New York state. The disease has since spread westward across 31 US states and five Canadian provinces, killing an estimated 7 million bats along the way.

Infection results in a white fungal growth that creeps across the muzzle and wings.

"Most European bats have evolved resistance. Not so in North America"

Fly by night: Cori Lausen uses a tall net to catch bats before studying them

If bats can make it to spring, they have a good chance of surviving because *P. destructans* dies in temperatures above 20°C. However, the disease repeatedly rouses them from hibernation so they burn precious fat stores and most end up wasting away. Currently, the majority of treatments rely on experimental antifungal agents applied directly to hibernating bats as they cling to cave or mine walls where the fungus lurks. Results have been mixed and there are concerns that these chemicals may damage cave ecosystems. Nevertheless, with the threat to bats so great, conservationists continue to apply fungicides. But this isn't a viable approach in western

North America, where the locations of hibernation sites are often unknown.

“Good” bacteria might seem like a toothless alternative to combat such a rampant killer, but there is more to probiotics than a tasty breakfast. In recent years, it has become clear that the microbes living on and in an organism – its microbiome – are essential for well-being. Just as manipulating our microbiome can have health benefits, so too in nature. Studies indicate that bacteria found naturally on the skin of frogs could help defeat the chytrid fungus that is responsible for dramatic declines in amphibian populations around the world. Consuming probiotics might also work as a prophylactic treatment to reduce the amount of pesticides that we and wildlife absorb from the environment. And birds at some rehabilitation centres are fed probiotics to combat stress.

In fact, Lausen isn't the first to try probiotics in the fight against white-nose syndrome. Admittedly, previous attempts have had disappointing results. But she says that's because they zeroed in on a single bacterium and applied it in one dose during the winter hibernation, rather than in the summer when the bats do not also have to deal with the fungus. Her team is taking a different approach.

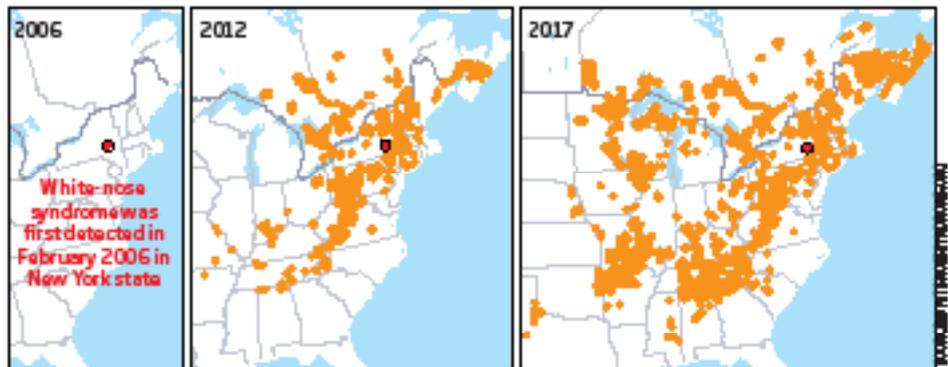
Marvellous medicine

They began by hunting for suitable microbes to make into a probiotic cocktail. European bats might seem like an obvious place to look because, after long exposure to the fungus, their microbiome is likely to have adapted to it. However, mindful of the dangers of introducing non-native bacteria to North America, Lausen and her colleagues instead took swabs from the wings of four local bat species. They then cultured dozens of the microbes from these in petri dishes along with *P. destructans*. So far, they have found 14 that inhibit its growth. “The two best are from healthy big brown bats, a species that has shown lower mortality from white-nose syndrome,” says microbiologist and team member Naowarat Cheeptham of Thompson Rivers University, Canada.

The next challenge is to boost the number of these bacteria on bats' bodies. That is what the researchers are trying to do right now with the help of bats living in outdoor cages at the British Columbia Wildlife Park in Kamloops. They have produced their probiotic in powder form and are experimenting with delivery methods. These include using pumps to spray

Murder in the bat cave

In just a decade, white-nose syndrome has spread across half a continent, killing 7 million bats



it throughout bat boxes, and slathering it on “welcome” mats the bats must crawl over to enter. Both methods could work in the wild in western parts of North America, where bats often use buildings, including the attics of old homes, as their summertime roosts.

“The question is, can you modify the microbiome and have it remain effective long enough to be a treatment?” says Jonathan Reichard from the US Fish and Wildlife Service (USFWS), which is partly funding the research. Lausen thinks the key is to make sure bats sport a thick coat of disease-battling bacteria before they hibernate, to crowd out the deadly fungus. “Even if they have a bit of fungi, the

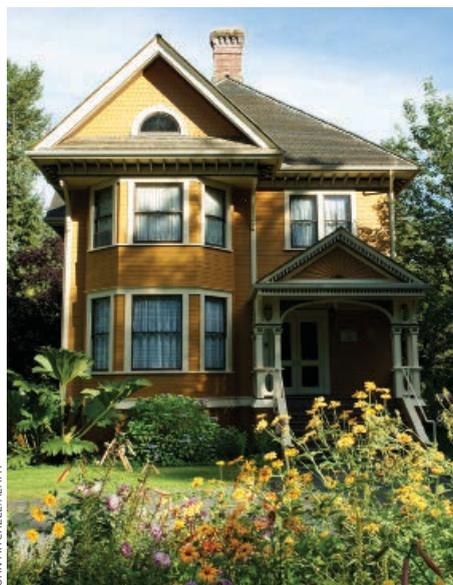
probiotics will help them fight it off until they leave their hibernation cave,” she says.

It could be too much of a good thing, however. At high densities, the bacteria may no longer be benign for the bats, according to microbiologist Chris Cornelison at Kennesaw State University in Georgia, who has also tried using probiotics against white-nose syndrome. Nevertheless, he thinks the risk is worth taking. “If the trend holds true to what we are seeing in the east, the clock is ticking,” he says. “In the absence of some mitigation efforts, you’re going to lose the vast majority of the western population.”

With so much at stake, the USFWS is supporting other initiatives too, including an oral vaccine and fungus-killing UV light. Reichard describes Lausen’s approach as “promising”. Project collaborator Craig Willis at the University of Winnipeg in Canada agrees, but he thinks probiotics alone won’t be enough. He wants more done to help those bats that are genetically predisposed to beat the disease, such as protecting and enhancing summertime habitats where they reproduce.

In July, Lausen hopes to launch a pilot project in Deas Island Regional Park in southern British Columbia, where a colony of 3000 bats roosts in the attic of an old house. In 2016, white-nose syndrome was discovered just 200 kilometres away across the border in Washington state, so the fungus is coming. If the probiotic treatment helps this colony survive next winter, the plan is to administer probiotics as widely as possible to bats across western North America.

There are no guarantees, but the situation is desperate. “If it doesn’t work, they’re probably going to die,” says Lausen. ■



The plan is to douse bats roosting in the attic of this heritage house with probiotics this summer

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