is using several methods to measure fish populations in Horizon Lake and determine how species are using the habitat.

One technique uses hydro-acoustics — a technology Poesch calls "a very expensive fish finder" — to measure the biomass of the lake and identify fish species. That work is supported by "environmental DNA" sampling, that is, using scales and tissues shed by fish in the water instead of handling the fish to obtain samples.

Poesch's team is also using hydro-acoustics to determine the hardness of the lake bottom and correlate that data with underwater photography and snorkelling to map habitat structures, such as the size and location of gravel beds and sandbars. Combined with data from fish tagging, this process provides detail on how species are using their habitat.

Poesch and his team began their work last summer and are now focusing on food webs at Horizon Lake, especially sharp reductions of particular species — known as bottlenecks with the system — and determining what metrics are most valuable in assessing compensation lakes. "The advice we'll be giving back will cover the bottlenecks that are occurring in this lake compared to others, how that compares to natural systems and what kind of metrics are important for looking at fisheries productivity in the region," he says.

The results of his work will be valuable beyond Horizon Lake itself. Compensation lakes are becoming more common in the oilsands region — and in other industrial areas — under federal "no net loss" regulations for habitat conservation in development projects. To build on his current research, Poesch is also working with other oilsands companies to bring them into the project.

It's important work. Creating a compensation lake involves more than digging a hole and filling it with water. A successful lake — one that becomes self-sustaining habitat — requires detailed understanding of the species that live there and what they need to thrive.

In many respects, it can be considered an emerging science in its own right. It's still in its early days, Poesch says. But he's optimistic about the benefits the project will deliver. "We're the first to look at this on a broad scale and to try to define the research idea."

First Responders

Emergency crews were on the front line to save Fort McMurray from a devastating wildfire this spring. Beetles will be matching their work in the forest

By Jay Ingram

GETTY IMAGES/ ANADOLU AGENCY

Right now — and for some time to come — our attention is correctly centred on the human tragedy of Fort McMurray, and the Canadian response to it. Environmental issues raised by the forest fire that destroyed swaths of the northern Alberta city will be discussed in time. But in the short term, most people only want their lives back as quickly as possible.

They also want their forest back. And with several hundred thousand hectares burned, any encouraging whiff of forest regeneration gets big play. One idea in circulation is that the local environment will benefit as beetles rush towards Fort McMurray en masse, attracted by the odours of bitumen, other beetles and burnt wood. As the beetles' eggs hatch and larvae chew through the newly fallen trees — dragging fungi and nematode worms with them — the wood will break down faster and release nutrients to foster new growth.

Among those insects will be the so-called "tar sands beetle," a fascinating little creature also known as *Monochamus scutellatus*, and sometimes as the white-spotted sawyer.

CALL TO ARMS
Male tar sands beetles will use their antennae as whips in mating battles

Both males and females of this species are indeed attracted by chemicals found in smoke, burnt wood and exposed bitumen. Receptors on the insects' antennae react specifically to those substances. The males also produce a pheromone that both males and females detect.

When females arrive on a burnt log — and they don't hesitate to land even if the wood is still hot to the touch — males are likely already there, protecting choice pieces of real estate. These tend to be on the side of the log, especially where it is thickest. Then a struggle begins.

For males, finding a female and mating with her is just the beginning of the breeding process. Once he's inseminated her, he will try to hang on in what entomologists call a "half-mount," even as the female begins to dig her trademark elliptical slit in the wood where she will deposit one or two of her newly fertilized eggs.

Needless to say, hauling a male around on her back slows a female's search for ideal egg-laying sites. But the male clings to the female for a good reason. Female tar sands beetles have definite preferences when it comes to mates. They prefer bigger males. They are also choosy about the quality of territory a given male is defending. Females like to lay their eggs where a tree's bark is most wrinkled. And since you can't always get what you want, they will mate with more than one male.

In this case, last is best: the sperm of the most recent male fertilizes the majority of the eggs. So it's in the male's interests to cling to the female to prevent other males from gaining access to her. This doesn't necessarily prevent other males from trying, however. Tyler Cobb of the Royal Alberta Museum has actually seen two or even three additional males piled on top of one that's clinging to a female.

(Males are easily distinguished from females. Their antennae are enormous, sometimes double the length of the body. They use them not only to detect attractive odours but also to joust, confronting other males and even antenna-whipping them.)

Once a female's eggs are fertilized, she will quickly begin depositing them in the slits she has cut in the bark. The resulting larvae cut their way through the bark down into the underlying tissue of the tree. Once there, they spend some time wriggling back and forth and feeding. Eventually, they drill down into the wood itself.

As the larvae chew through the wood, they dig a tunnel that heads straight into the trunk, makes a U-turn and then returns to near the surface. There, the larvae become pupae and emerge as adults in the spring.

It is difficult to estimate total number of these beetles, but they are common in the Fort McMurray area — although perhaps not as common as you'd expect for an insect that spends most of its life safely hidden from predators in a dead tree. Self-destruction is part of the reason: sometimes two larval tunnels intersect, one crossing the other. When that happens, one larva will simply chew its way through the other. And that chewing is pretty robust. The Royal Museum's Cobb says if you walk through a recently burned forest you can actually hear it. The sound reminds him of a creaking rocking chair.

But in Fort McMurray, it will be welcome. The devastating fire the city has endured will provide an unprecedented opportunity for these beetles. Although their destruction of wood is usually the bane of the lumber industry, in this instance the breakdown of charred trees will help the forest come back.

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