

VOLUME 21, NO. 3 Fall 2003

The Mine in My Life
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The surreal thermal image of Sir David Attenborough looking at a cluster of hibernating bats is one of the most striking scenes in the BBC series *The Life of Mammals*. Sir David glows yellow and orange, positively radiating heat. The bats are much darker – deep blue, approaching black. Some are even darker than the rock ceiling from which they hang: Their bodies are colder than the stone.

I have studied hibernating bats for many years, but I had not expected this, which demonstrates how air circulation can have a tremendous impact on bats during hibernation. The spellbinding footage was shot with a thermal-imaging camera in an abandoned molybdenite mine that has yielded a treasury of new information about bats. The old mine near Renfrew, Ontario, is vital to the lives of many bats of several species, and it has played a recurring role in my professional life for nearly 40 years.

Attenborough, perhaps today's most honored maker of natural history films, visited the mine in February 2002 for the series that aired late last year. The mine had opened 90 years earlier and yielded some 46 tons of molybdenite (MoS₂), 85 percent of it at least 95 percent pure, before it closed. To a mining geologist, the deposit is a typical "contact zone metamorphosis," but to bat biologists the mine is entrancing for other reasons.

The key to the mine's availability to bats is the original adit (an entrance excavated to a horizontal passage) that serves as a drain. In Ontario, underground mine tunnels accessible only by shafts (vertical passages) typically flood to the level of the water table, which almost always makes them unavailable to bats.

A mine full of bats

I first saw the mine on a Saturday in May 1965, when I should have been at convocation to receive my Bachelor of Science degree. My supervisor at the University of Toronto, Professor Randolph L. Petersen, had heard about a mine full of bats near Renfrew. Miners, who were exploring the possibility of reactivating the mine, discovered the bats and notified the Royal Ontario Museum. The prospect of a mother lode of bats was much more enticing than a convocation.

On my first visit, I found a few torpid male little brown myotis (*Myotis lucifugus*). Whether these bats were still hibernating or just taking a break from the spring weather remains unknown. The miners said they had seen many more bats three months earlier. Fortunately for the bats – and for me – the remaining molybdenum deposit was too small to warrant further exploitation. The miners abandoned the site. I seem to have adopted it. Though I had no idea at the time, here was a place that would draw me back year after year, as it still does.

By May 1966, we had learned a lot more about the bats and the mine. Five species hibernated there: little brown myotis, big brown bats (*Eptesicus fuscus*), eastern small-footed myotis (*Myotis leibii*), northern myotis (*Myotis septentrionalis*), and eastern pipistrelles (*Pipistrellus subflavus*). The little brown myotis were by far the most abundant,



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numbering perhaps 10,000, while eastern pipistrelles were the most rarely encountered.

Banding studies revealed that bats treated the mine as two separate sites. Until the 1964 effort to reopen the mine, two stretches of upper-level passages were separated by flooded workings. Bats could reach one area via the original adit and the other through a shaft. When the would-be miners drove a new adit into a lower level of the mine, it served as a drain for the flooded section, opening new areas for bats and connecting the two previously isolated passages.

Flapping wings and busy bats

By the time of Attenborough's visit, some little brown myotis were hibernating in the once-flooded passages. Big brown bats and eastern small-footed myotis had been using some of these previously flooded, well-ventilated, cooler passages since winter 1965-66.

The mine soon became a central site for my studies of swarming behavior. Visit the mine on a summer day, and you will see virtually no bats. Visit it at night in August, and the passages are filled with the sounds of flapping wings and the shrill vocalizations of busy bats – swarming behavior.

Between the summers of 1966 and 1968, we banded more than 5,000 little brown myotis at the mine during swarming. The swarms included about the same numbers of adults and subadults, with about 60 percent of them males. Males account for more than 85 percent of the mine's bat population in the winter. Recoveries of banded bats showed that a different group visited the mine every night during swarming, and that only about 10 percent of bats caught during swarming used the site for hibernation.

I also visited other mines and caves during this study. One notable band recovery reinforced my impression that swarming little brown myotis covered large distances. In August 1967, we caught a male at the mine that had been banded in December 1966 at an old mine on the north shore of Lake Superior. By late September 1967, this individual was back at the north shore site. The straight-line distance between these two mines is about 500 miles (800 kilometers).

By mid-August each year, the little brown myotis swarming at the mine begin to mate. I think the swarming behavior familiarizes young bats – those born earlier in the year – with places to hibernate, and also sets the stage for mating. In late summer, hibernation sites like the Renfrew mine might be thought of as bat discos.

A biologist's bonanza

By 1969, when I finished my Ph.D. dissertation, it was obvious that the old mine was a mother lode if you were a bat – or a bat biologist. The site served a central role in the theses of other graduate students, as well. Burleigh Trevor-Deutsch, now a lawyer, used the mine as the principal study site for his Ph.D. dissertation on the role of hibernating bats in the diet of white-footed mice. Donald Thomas, now a professor of biology at the University of Sherbrooke, did his master's thesis on the mating behavior of little brown myotis. Robert Barclay, now a professor of biology at the University of Calgary, studied vocalizations of little brown myotis for his master's thesis. Virginia Wai-Ping, now working in finance, did her master's thesis on mate selection by little brown myotis at the mine.

More than 300 students have visited the Renfrew mine since 1969 on field courses or workshops designed to introduce bats to people, and people to field biology. We visit during the swarming season, when our work causes minimal disturbance and we can take

advantage of the presence of banded animals. I especially enjoy the reactions of university students when they discover that some of the bats they are handling are older than they are.

Television discovers the mine

The Life of Mammals was not the first Attenborough film that featured the mine. In the acclaimed *Life on Earth* series filmed in 1979, the opening footage of bats is the winter landscape around the entrance to the mine. The mine has figured in other documentaries as well, including the Canadian Broadcasting Corporation's *Piercing the Dark*, which first aired in the late 1980s.

As we studied the Renfrew bats over the decades, we also worked to protect them. In the early years, the old mine's splendid isolation protected it. From 1965 to 1968, we visited the mine in winter to monitor the bats, and we spent three Augusts studying their swarming behavior. On winter visits, getting to the mine from Toronto meant a five-hour drive. We typically arrived around midnight on Fridays, shoveled out a parking place in the snow, then snowshoed to the mine, usually staying in Tom Guiney's cabin on a nearby lake. But by 1970, the area was becoming popular among snowmobilers and its remote location no longer offered much protection.

When the would-be miners left in 1965, they wedged a piece of plywood into the old adit to keep people out. Bats and bat biologists could pass this obstacle. The following summer, we built a wooden gate on the mine. About 1980, we sold our aging mobile laboratory and used the proceeds to build a better gate from old rails that lay about inside the mine. This gate was good for a year or two, but then it was repeatedly breached by unwelcome visitors, usually by breaking the lock.

A series of gates

A few years later, Fred Hehn, then working for the Ontario Ministry of Natural Resources, convinced the ministry to install a new gate rather than seal the mine with explosives. Fred also convinced the ministry to declare the site a Nature Study Area. The new gates, one at the entrance and one farther in, turned out, however, not to be vandal-resistant.

Finally, in the early 1990s, the Macnamara Field Naturalists Club, working with Bat Conservation International and the Ontario Ministry of Natural Resources, installed the current angle-iron gate. This one has withstood all attacks.

The Renfrew mine shows how important such sites are to bats, to bat biologists, and to those who take bat conservation to the public. The site reminds us how gates on old mines can protect both bats and people. And it illustrates how some study sites can become an integral part of a scientist's life.

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All articles in this issue:

- ▶ [The Mine in My Life](#)
- ▶ [Bats & Mines](#)
- ▶ [Bats at Last!](#)
- ▶ [Vampires in the House](#)
- ▶ [Learning the Secrets of Bats](#)
- ▶ [Members In Action](#)

- [Solar-powered Bats](#)
- [A Rare Bulgarian Bat](#)
- [Gating Idaho's Risky Mines](#)
- [Conserving Borderland Caves for Migratory Bat](#)