Welcome to the fifth newsletter for the Canadian Bat Box Project! This summer will be the final field season for this project. We have a range of topics in this issue, including updated preliminary results based on data collected last summer, though we do not expect to get results from the guano analysis until this June. We have certainly been kept busy this past winter getting the large volume of data organized and analyzed! Thank you for getting us to this point!

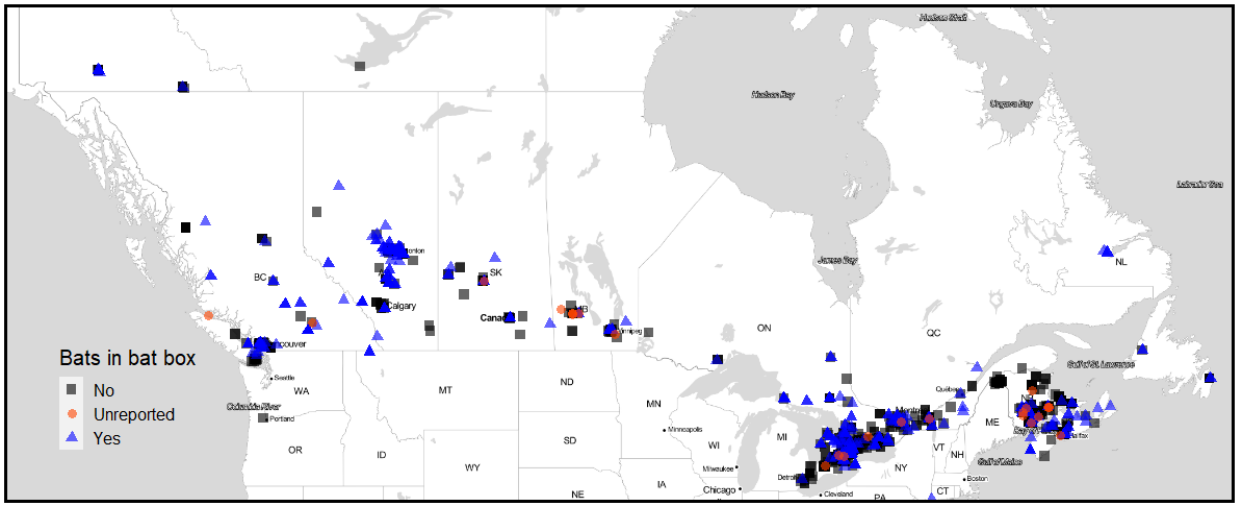
Bats have been in the news lately, with an article about our project in the Ecology Action Centre's spring magazine, an article by a participant in our project, mention of the tracking project in the Ottawa Citizen, and big news that the fungus causing white-nose syndrome in bats has been detected in British Columbia for the first time. The Ontario Bat Network held a conference in Hamilton on March 25, 2023 and posted all talks to youtube. The talks include one about the tracking study and one on the bat box project.

In this Issue:

To date we have received 1,407 survey responses from across Canada, including all provinces and almost every territory. Very impressive – thank you to all who submitted!

For those who have not yet registered your bat box with the program, please do – your information adds a valuable component to this nation-wide project! Please consider contributing an article, pictures, or an article idea to this newsletter by emailing Karen Vanderwolf: *kjvanderw[at]gmail[dot]com*

Map of Bat Boxes



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Thanks to Cori Lausen and James Page for editing the newsletter.

Preliminary Results Part 2 by Karen Vanderwolf

Thanks to your contributions to date, we had a busy winter doing *preliminary* analyses using information from 1358 boxes. As more participants become involved and we continue to receive information for our database, our results will become more robust. Information from your bat box each year is important for our study, so be sure to keep that information coming our way! The number of participants and bat boxes in the project is broken down by province in Table 1.

One of the main questions we ask in this project is what characteristics of bat boxes are related to occupancy by bats. So far, a few variables seem to be important, such as the number of bat boxes at a site, years since installation, and whether boxes were installed as mitigation when colonies are excluded from buildings. Installing multiple boxes gives bats a choice, as different boxes will have different microclimates depending on size and sun exposure. Participants with multiple bat boxes often comment that their bat colonies move around among the bat boxes depending on the weather. Older boxes are more likely to be occupied, so don't be discouraged if your box is not

used by bats in the first few years after installation. Boxes are more likely to be used by bats when they are installed near a known colony, such as when bats are excluded from building roosts.

We analyzed 83 swabs of the interior surfaces of bat boxes 2021 – 2022 for the presence of the fungus that causes white-nose syndrome. Of those, two boxes tested positive for the fungus in the spring, both in Nova Scotia. We are expanding our sampling of bat boxes for the fungus this summer. If you have bats in your box and would like to have it tested for the fungus, please get in touch!

For occupied boxes, data on the number of bats in each box are available for 255 boxes nationally. Of those, the maximum number of bats observed in each box at one time was 1-10 bats for 60.4% of boxes, 11-50 bats for 21.2% of boxes, 51-100 bats for 12.9% of boxes, 101-200 bats for 2% of boxes, and >200 bats for 3.5% of boxes.

Bats do not use bat boxes during the winter and the timing of when bats return in the spring varies by location (Table 1). You can report your bat counts and the earliest and latest dates you see bats in your box here.

Thank you to all our participants - your input and enthusiasm is fundamental to this project, and I look forward to receiving more data to include in this analysis!

Table 1: Responses to multiple choice survey about the physical characteristics of bat boxes. Not all participants indicated their province or whether they had bats. The earliest and latest date participants reported seeing a bat in their bat box(es) is indicated.

Province	Number of participants	Number of boxes	Number of boxes with bats	% of boxes with bats	Earliest Bat	Latest Bat
British Columbia	59	82	34	41.5	Mid-March	October
Alberta	52	162	118	72.8	Early May	Early October
Saskatchewan	35	48	23	47.9	Early May	Late September
Manitoba	25	47	11	23.4	May	September
Ontario	364	577	191	33.1	Late March	Early November
Quebec	48	79	18	22.8	Late May	Early September
New Brunswick	113	200	26	13	Early May	Late September
Nova Scotia	49	78	37	47.4	Early May	Mid-October
Prince Edward Island	25	43	18	41.9		
Newfoundland & Labrador	5	13	8	61.5	June	August
Yukon	13	25	15	60	Late April	September

Northwest Territories	1	1	0	0
Nunavut	0	0	0	0
Totals	789	1358	499	36.7%

Bats: Birds & the Bees by Lucas Greville

Lucas is a NSERC Postdoctoral Fellow at the University of Waterloo researching flight energetics and field endocrinology in bats. He completed his PhD at McMaster University on reproductive physiology and behavior in big brown bats. lucasgreville.com Twitter: @Grev16

As children, many of our first observations and conversations about reproduction stem from interactions with animals. What's that dog doing to my leg? Why's the cat suddenly so affectionate and rubbing against the furniture? Or maybe the chimpanzees put on more of a show than you expected during that trip to the zoo. While we gradually learn about the birds and the bees, how often do we stop to ask "what about the bats"? Given the nocturnal nature of bats and their affinity for confined spaces, researchers know very little about the reproductive behaviours of most species. But what we do know tells us that the world of bat reproduction is unusual, diverse, and full of surprises!

Bats display a wide array of mating behaviours encompassing all known mammalian mating systems. In Canada, all species with documented reproductive behaviour have multiple mating partners each year. Mating in temperate bats occurs in the late summer and into the autumn; and while not common males are known to arouse from hibernation to mate with hibernating females! Mating patterns can look quite different between species. Many species of hibernating bats (e.g. species of the genus *Myotis*) congregate in large numbers at potential hibernacula (structures in which bats spend the winter) during the late summer and early autumn. This behaviour is known as swarming, and while it likely serves multiple functions for the bats it also brings individuals together for mating in caves, trees, and artificial roosts. Migrating species, including the eastern red (*Lasiurus borealis*) and hoary bats (*Lasiurus cinereus*), initiate mating "on the fly" during flight that leads to the couple falling to the ground during the act.

Pregnant Big Brown Bat, by Sherri & Brock Fenton

Lactating Big Brown Bat, by Sherri & Brock Fenton

Despite autumn mating, it is not until spring emergence from hibernation that gestation occurs. While sperm can survive over multiple days in many mammals, female bats have the amazing ability to store sperm in their reproductive tracts for months throughout hibernation. Following arousal from hibernation female bats quickly ovulate and fertilization occurs. Gestation in temperate bats ranges from ~40 – 90 days, but environmental factors including ambient temperature and food availability can lengthen or shorten the gestational period. During this time non-migrating female bats form maternity colonies, whereas males roost individually away from maternity colonies or in small bachelor colonies. Pups are born between mid-June and mid-July annually and weigh up to 30 – 40% of the mother's weight (think of a 120 lb woman birthing a 40 lb baby…no wonder bat mothers eat their weight each night during lactation!). Usually bats roost upside down so they can take-off quickly and efficiently, but females orient themselves upwards during birth and catch the pups in their tail membranes. Unlike other animals, mother bats do not prepare a nest for her new pups which are quickly integrated into the maternity colony. Pups are typically left in the roost while mothers forage at night, but occasionally she'll bring them along for the ride.

Bats have a very low reproduction rate for a small mammal. The standard rule is that female bats birth one pup per year, although there are always exceptions in some species. Big brown bats (*Eptesicus fuscus*) are found across North America. In the East, big brown bats often birth twins annually, while bats in the west birth a single pup. Hoary and eastern red bats usually give birth to twins but can birth up to four pups a year, more than any other species of bat. Because females have multiple mates and store sperm, genetic studies demonstrate multiple paternities in siblings born the same year.

9-day old Big Brown Bat pup, by Sherri & Brock Fenton

As Canadian bat populations stabilize and colonies gradually begin to grow following white-nose syndrome, the importance of understanding reproduction in conservation efforts cannot be forgotten. And next time a child asks about the birds and the bees, why not tell them about the bats instead?

Bats & Cats by Olivia Wilson

Olivia is from Oakville, Ontario and received her Bachelor of Science at McMaster University. She is currently doing a Master's in Biology at the University of Northern British Columbia with the Stewardship Centre for British Columbia.

Bats face many threats such as habitat loss, disease, and pesticide use, but one of the greatest threats that is largely undiscussed is domestic cats. Domestic cats with access to the outdoors can be great hunters, even to flying animals like birds and bats. Cats target bats leaving their roosts, which has been reported all around the world. During June and July, female bats congregate to give birth and care for their young in what are called 'maternity roosts'. Maternity roosts can be in bat boxes, buildings, trees, or under bridges. Such congregations of bats create a target for cats. Cats will spend time around roosts, and enter roosts, waiting to catch fallen pups or other exiting bats. Big brown bats are at greatest risk of being eaten by cats in Canada, followed by *Myotis* species such as little brown myotis. Contact between cats and bats also increases human risk for contracting rabies, which can be transmitted between animals.

Carol Phylan, California

Collar from Birdsbesafe

One of the simplest ways to mitigate the impact cats have on bats is by keeping cats indoors. This reduces the risk of cats to bats and other wildlife. Keeping cats indoors also reduces harm to cats as they face many dangers when outdoors, such as disease and injury or death due to vehicles and predation. Additionally, many cat owners may feel their cat is not a strong hunter, but cats only return home with about 20% of the animals they catch, leaving many kills unbeknownst to owners. This is also concerning when considering the number of bats killed by cats, as the impact on bat populations is assumed to be underestimated. Other options to reduce the impact of cats on bats are keeping cats indoors during peak times of the year (June to

August), supervising cats when outdoors, putting collars on your cats that are coloured and white that may help both birds and bats to see them, and keeping cats away from bat boxes and other forested areas.

My research involves using trail cameras to study outdoor domestic cats in the south Okanagan Valley, British Columbia. I deployed 60 trail cameras from March to December 2022 to see where cats are, what habitats they are using, and how many cats there are. I also used 15 trail cameras to see if cats are targeting bat roosts during June and July. I placed trail cameras facing occupied bat boxes in protected areas to monitor for increases in domestic cat activity. I collected over 6 million pictures and am currently processing them. This has been an amazing learning opportunity for me, and I hope to continue sharing what I've learned throughout this project with others!

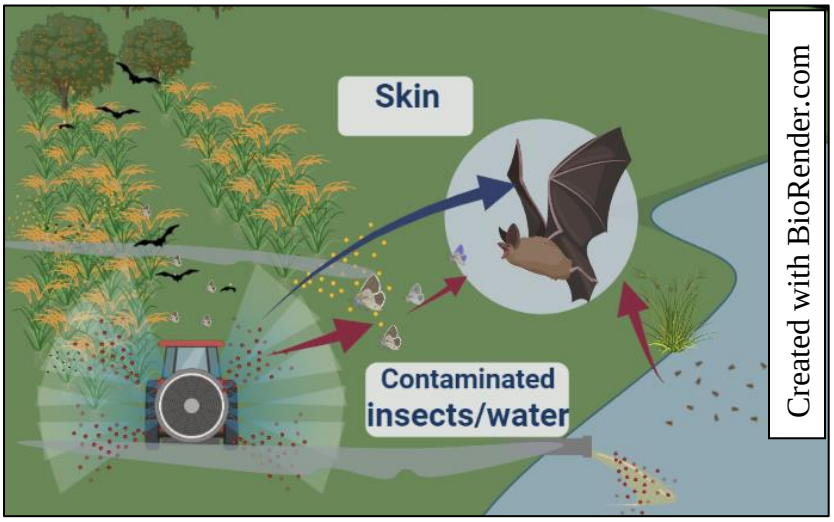
Example picture from a trail camera at Sun-Oka Beach Provincial Park in Summerland, B.C. facing bat boxes with Yuma myotis bats

Pesticides: a silent threat to bats by Natalia Sandoval Herrera

Natalia completed her PhD at the University of Toronto on the effects of pesticides in tropical bats, and her MSc at the University of Costa Rica. She is currently a postdoctoral researcher at the Swedish University of Agricultural Sciences.

Bats are incredibly valuable, not only to the environment but to the economy too. As voracious insect consumers, many bat species work hard for agriculture & forestry, eating crop pests that attack many essential products like corn, rice, apples, coffee, cotton, and tobacco, among others. Bats have a huge appetite; they can feast

on thousands of insects in one night thus becoming great natural pest controllers, reducing crop damage, and lowering the need for pesticides. This service is estimated to save to North American farmers at least $3.7 billion each year, and Canadian bats, which all feed on insects, may well play an important role in this. Bats in Canada eat hundreds of different insects including agricultural pests like spongy (formerly gypsy) moths, cornworms, and tent caterpillars.



Unfortunately, while visiting croplands bats can be exposed to toxic chemicals used in agriculture. Recent studies have shown that exposure to pesticides is one of the major threats to bat populations worldwide. Bats can intake these toxicants by eating insects that have been sprayed with pesticides, by drinking contaminated water, or by getting droplets on their skin when flying while pesticides are sprayed.

Many pesticides used in agriculture and in our gardens can be harmful for these small mammals, even at low amounts. These toxicants can affect bats' immune system, drain their energy reserves, cause loss of coordination, and compromise their ability to fly and to orient. While they may not kill bats right away, these effects can make it more difficult for bats to find food and shelter, making them more likely to be eaten or increasing the risk of suffering a fall. Also, they could be more likely to become sick, which could worsen the already devastating effects of diseases like white-nose syndrome on North American bat populations.

Most information on bats and pesticides concerns compounds used to treat wood that can affect bats roosting in attics. Little information on the effects of pesticide use on bats in Canada is available.

Pesticides are a newly recognized threat to bats, adding to the long list of threats our beloved friends face. More research is needed to understand how this overlooked threat affects bats and what can be done to reduce its impact on their conservation.

What can you do?

Spring is here! and many of us are avid gardeners. During this time, bats are coming out of hibernation and are very eager to eat the bugs in our gardens. To protect bats and other wildlife from the harmful effects of pesticides, it is important to use these chemicals responsibly. This includes reducing the use of pesticides in our household, switching to non-toxic pest control methods, and avoiding the use of pesticides in areas where bats roost. You can also become more environmentally responsible consumers by buying organic vegetables and supporting businesses with organic practices.

Bat Species Profiles by Emina Lai, Co-op student, Laurel Heights Secondary School & University of Waterloo

Three bat species regularly use bat boxes in Canada:

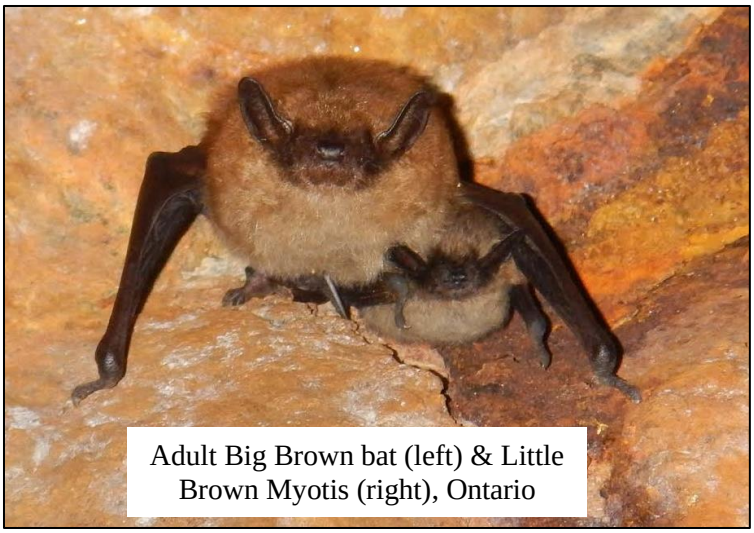
Little Brown Myotis (*Myotis lucifugus*)	- Weighs 4-10 grams - Dorsal fur can range from yellow to olive in populations away from the coast and blackish in coastal populations - Fur on dorsal surfaces is long and dull - Fur on undersides are lighter from tan to brown. - Wing membranes and ears are dark brown - Only eats insects
Big Brown Bat (*Eptesicus fuscus*)	- Weighs 10-21 grams - Big, broad head and snout with prominent face glands - Pale to dark brown long fur; tends to be glossy and oily in texture - Short and round ears - Wings and ears are black - Only eats insects
Yuma Myotis (*Myotis yumanensis*)	- Weighs 5-7 grams - Dorsal fur can be from pale brown to nearly black - Pointed and medium length ears - Only eats insects

Little Brown Myotis

Little Brown Myotis are very widespread across North America, ranging from parts of Alaska and Newfoundland all the way down to Southern California and Northern Arizona. These bats are common and are often found in buildings and houses. Little Brown bats will forage over water and their diet mainly consists of aquatic insects such as mayflies, midges, and caddisflies. Individual bats can catch up to 1,200 in an hour during peak feeding season! The nurseries of little brown bats can be enormous (from hundreds to thousands of bats). During the winter, little brown bats typically hibernate in caves or abandoned mines. Unfortunately, they are heavily affected by white-nose syndrome, a fungal infection that disturbs the bats during hibernation and burns the fat reserves they have for the winter. White-nose syndrome has decimated populations of Little Brown Bats.

Big Brown Bats

Big Brown Bats are bigger than Little Brown Myotis. They are widely distributed throughout North America, the Caribbean, and the northern portion of South America. Big Brown Bats roost in tree cavities but are also commonly found in buildings or under bridges as they are forced out of their traditional habitats. Their maternal colonies are typically smaller than those of the other two bat species (up to 700 bats). Big Brown Bats will forage over water, forests, and clearings. They specialize in eating small beetles and are often great at pest control for humans since they eat many forest and crop pests.



Adult Big Brown bat (left) & Little Brown Myotis (right), Ontario

Yuma Myotis

Unlike Little Brown Myotis and Big Brown Bats that have broad distributions across North America, Yuma Myotis are only found in the western half of North America from British Columbia down to parts of Mexico. Yuma Myotis typically forage over water or in forested areas near water. They eat a variety of insects including moths, grasshoppers, and June beetles. Their maternity colonies can be massive with some found to be over 5000 bats! While some Yuma Myotis do like to roost in mines and caves, most are found roosting in buildings and bridges. Yuma Myotis are threatened by the loss of riparian habitats, a transition zone from aquatic to forested areas, and the loss of permanent water sources.

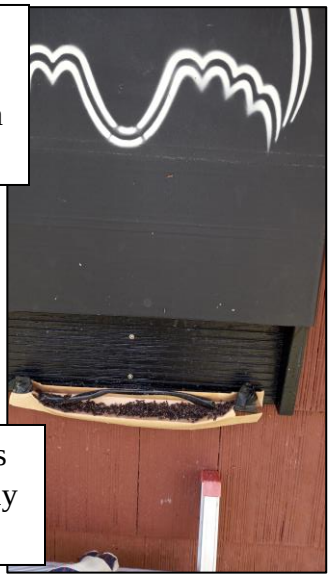
J.N. Stuart

Guano Collection by Karen Vanderwolf

Participants in the project have been using a variety of ways to collect guano (bat poop) from their bat boxes. Some have attached trays directly to their boxes, but more commonly participants install various types of containers below their boxes. An important consideration is to prevent rain from washing away guano while not impeding the flight paths of bats exiting bat boxes.

Joanne Hutchinson, Ontario

It is easier to spot guano against a light background, such as this board placed on the ground below a bat box.



Jasper National Park, Alberta

Here a small tray has been attached directly to the bat box.

Banff National Park, Alberta

The screening placed below bat boxes in these photos allows water through but not guano.

Staffan Lindgren, British Columbia

British Columbia

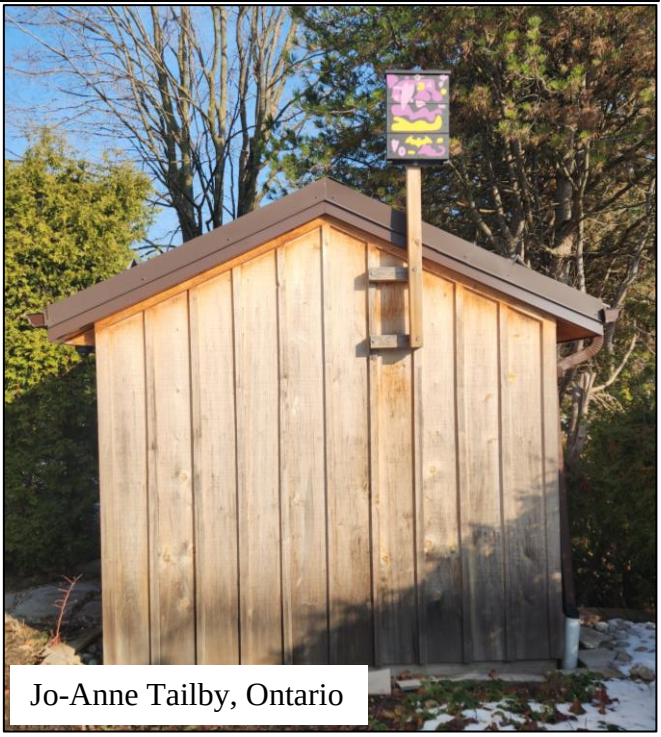
These flower pots have screening inside to catch the guano and holes drilled into the bottom of the pots to allow water to escape.

Banff National Park, Alberta

Bat Boxes Across Canada: pictures with the caption in *italics* are occupied by bats

Kluane Cabins, Yukon

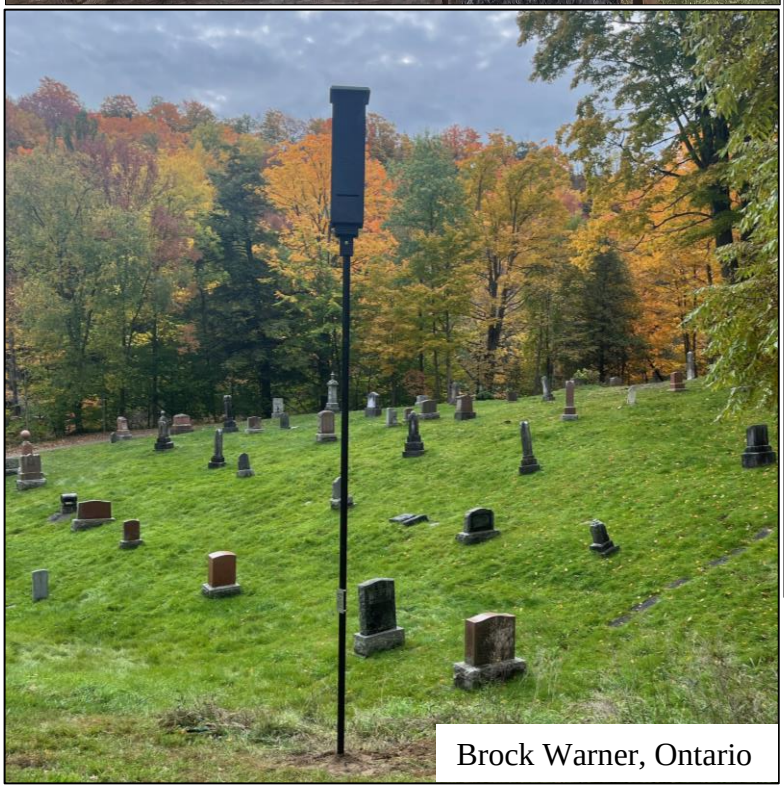
J. Thomson, Alberta



Jo-Anne Tailby, Ontario

British Columbia

New Brunswick



Brock Warner, Ontario

Alyssa Daku, Saskatchewan

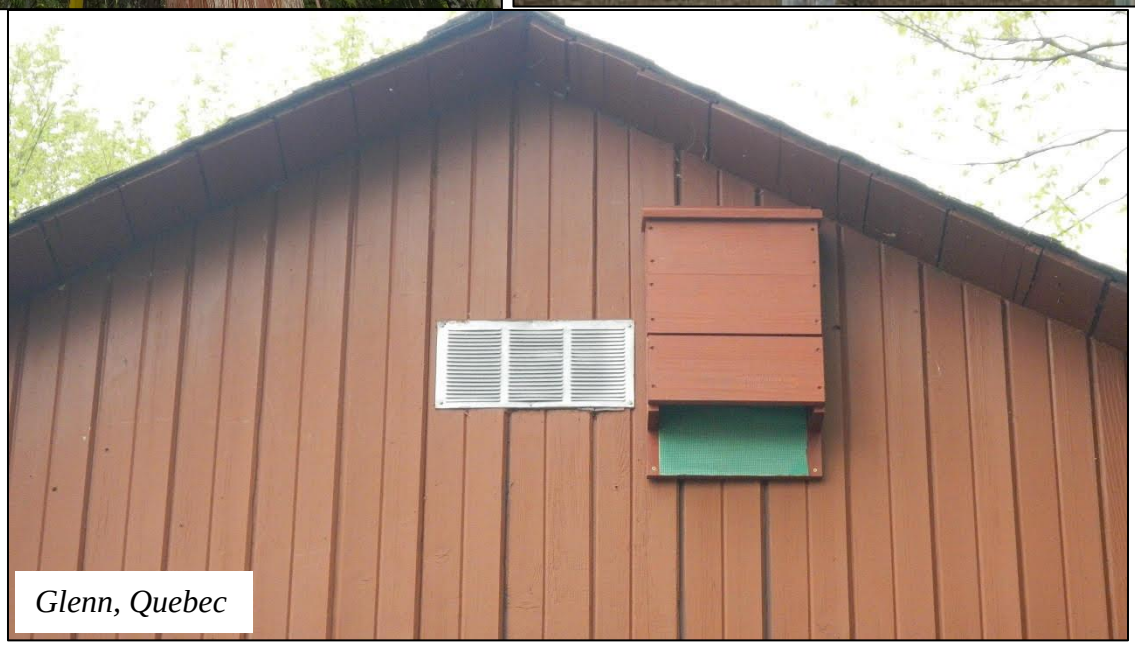
Gord Blize, Alberta

Scott Fleming, Ontario

Yukon

Lori Phinney, Nova Scotia

British Columbia



Glenn, Quebec