



CANADIAN
WILDLIFE HEALTH
COOPERATIVE



GOT BATS?

**A GUIDE FOR CONSERVATION-MINDED BAT EXCLUSION IN NEW
BRUNSWICK**

October 2020

Tessa McBurney

(Select sections from the complete guide: *HOW TO MANAGE BATS IN BUILDINGS IN NEW BRUNSWICK*)

**CREATING A WORLD
THAT IS SAFE AND SUSTAINABLE
FOR WILDLIFE AND SOCIETY**



Acknowledgements

Cover Photo by Jordi Segers

This document was adapted with permission from *Got Bats? A BC Guide for Managing Bats in Buildings* (Juliet Craig and Mike Sarell) and *Got Bats? Alberta Guide for Managing Bats in Buildings* (Cory Olson). A special thank-you to Cory Olson of the Alberta Community Bat Program and Mandy Kellner of the BC Community Bat Program for their permission to use the original material and formatting of the British Columbia and Alberta documents.



A profound thank-you to Dr. Scott McBurney of the Canadian Wildlife Health Cooperative (Atlantic Region) for thorough editorial guidance and project support. Thank-you to Jordi Segers of the Canadian Wildlife Health Cooperative (National Office) for additional editorial guidance and for the use of his spectacular photos. Thank-you to Dr. Megan Jones of the Canadian Wildlife Health Cooperative (Atlantic Region) for additional project support. Thank-you to Alyssa Bennett of the Vermont Fish and Wildlife Department for permission to use the decontamination table found in this guide in addition to the slogan “Got Bats?”



A big thank-you to our provincial collaborators: Garry Gregory and Brad Potter of the Prince Edward Island Department of Environment, Water and Climate Change (Fish and Wildlife Section), Mary Finch of the Prince Edward Island Watershed Alliance, Jessica Humber and Shelley Moores of the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture (Forestry and Wildlife Branch), Mary Sabine and Steve Gordon of the New Brunswick Department of Natural Resources and Energy Development (Forest Planning and Stewardship Branch), and Donald Sam and Donna Hurlburt of the Nova Scotia Department of Lands and Forestry (Wildlife Division). An additional thank-you to: Dr. Jacqueline Badcock of the New Brunswick Department of Public Health, Dr. Nicole Wanamaker of the New Brunswick Department of Agriculture, Aquaculture and Fisheries (Veterinary Field Services Unit), Dr. Jim Goltz and Dr. Steven Scott of the New Brunswick Department of Agriculture, Aquaculture and Fisheries (Veterinary Laboratory and Pathology Services Unit), Jonathan Cormier of the Department of Energy and Natural Resource Development (Big Game, Furbearers, and Fisheries Section), Dr. Leighann Hartnett and Dr. Erin Leonard of the Nova Scotia Department of Agriculture, Dr. Gaynor Watson-Creed of the Nova Scotia Department of Public Health, and Jolene Laverty, Pam Mills and Mike Boudreau of the Nova Scotia Department of Lands and Forestry (Wildlife Division).



Thank-you to the following people who provided the funding that made this project possible: Kim Mawhinney, Isabelle Robichaud and Nadine LeBlanc of Environment and Climate Change Canada (Canadian Wildlife Service). Additional financial support was provided by the Canadian Wildlife Health Cooperative (Atlantic Region).



Thank-you to the following individuals and companies for their valuable insight and editorial remarks: Dan McAskill of *Island Naturalist*, PEI Pest Control (ORKIN Canada), Atlantic Graduate Pest Control, Abell Pest Control, Ben Legault of Legault Pest Management, Louis O’Brien of Sharpline Pest Control, Dave Buell, Dave Dowling, Jeremy Southgate of Rentokil, Dwayne Shears of Northern Pest Control, Sonia Lear of ORKIN Canada, Ken Pretty of Cabot Pest Control, Dave Jameson of Island Wildlife Removal, Mark Ashley of Wintermoor Orchard, Barry Hanaveld of Maple Farms, and Dr. David Allison of the Newfoundland and Labrador Department of Health and Community Services.





Table of Contents

Section 1. Executive Summary	3
Main Messages	3
Background	3
The Importance of Bats	3
Human Health Concerns	4
Section 2. Excluding Bats from an Existing Roost	5
Steps for Excluding Bats from Buildings	5
Step 1. Assess the Situation	6
Step 2. Bat-proof the Human-occupied Living Space	9
Step 3. Identify the Entry and Exit Points	11
Step 4. Install Bat Houses	12
Step 5. Evict the Bats	12
Step 6. Exclude the Bats by Sealing the Roost	16
Section 3. Other Options for Managing Bats in Buildings	17
Section 4. Conservation Measures and Landowner Stewardship	17
Section 5. Resources	18
5.1 Definitions	18
5.2 Exclusion Decision Tree	19
5.3 Helpful Resources	20
5.3.1 Bat White-nose Syndrome (WNS)	20
5.3.2 Excluding Bats from Buildings	21
5.3.3 Bat Monitoring, Conservation, and Ecology	22
5.3.4 Bat Houses	23
5.3.5 Bat-related Human Health Concerns	24





FULL DOCUMENT “HOW TO MANAGE BATS IN BUILDINGS IN NEW BRUNSWICK” CAN BE FOUND AT:
[HTTP://WWW.CWHC-RCSF.CA/WNS_RESOURCES.PHP](http://www.cwhc-rcsf.ca/wns_resources.php)

Section 1. Executive Summary

Main Messages



- Bats are critical to the agricultural industry but many species are listed as endangered. Thus, it is crucial to protect the bats that remain.
- When working with bats, be mindful of the human health risks they potentially pose including rabies virus and histoplasmosis, even if they are low risk in the province.
- When excluding bats, the timing of evictions is very important. Bat exclusions should only take place in September and April, otherwise the bats will likely die.
- When excluding bats, use one-way exit devices for a minimum of 5-7 nights, with at least 3 consecutive nights of good weather (*i.e.*, temperature above 10°C, winds less than 16 km/h, and no rain).
- There are many other options besides exclusions for dealing with bats in human-made structures. Try to encourage property owners to coexist with bats by creating bat-friendly habitat and putting up bat houses.

Background



The Importance of Bats

Ecosystem services are the worldwide benefits that are provided to humans by the natural environment, including wildlife. Bats provide many ecosystem services including: insect control, pollination, and seed dispersal. The roles of bats in pollinating crops and agricultural insect pest control result in huge economic savings. **It has been estimated that the ecological services of bats are valued at somewhere between \$3.7 and \$53 billion for the U.S. agricultural industry each year.** This can be important for New Brunswick (NB) farmers, where potato farms alone can bring in \$272.5 million a year. Potatoes have at least nine common crop pests in NB, including the eastern field wireworm (*Limonius agonus*, Elateridae). Research has found that 31.2% diet of the big brown bat (*Eptesicus fuscus*) can include Elateridae species. However, in 2014, three bat species were federally listed as endangered in Canada: the little brown myotis (*Myotis lucifugus*), the northern myotis (*Myotis septentrionalis*), and the tri-colored bat (*Perimyotis subflavus*). These species were all listed after experiencing large population declines from bat white-nose syndrome (WNS). WNS is a disease caused by a cold-resistant fungus called *Pseudogymnoascus destructans* (*Pd*). In a 2012 study, it was estimated that **at least 5.7 to 6.7 million bats had died from WNS in North America since its introduction in 2006, that number is likely much higher now but total loss is difficult to quantify.** Once infected, *Pd* appears to lead to rapid dehydration and electrolyte loss in bats, resulting in bats arousing more frequently from hibernation which causes them to burn their limited energy reserves and emerge from hibernation too early. However, there are few insects available in winter, even on warm days, so the affected bats often starve to death or die from cold exposure. Seven bat species have been identified in NB: the little brown myotis, the northern myotis, the tri-colored bat, the big brown bat, the silver-haired bat (*Lasionycteris noctivagans*), the hoary bat (*Lasiurus cinereus*), and the eastern red bat (*Lasiurus borealis*).



Human Health Concerns



There are two primary human health concerns associated with bats: rabies virus and histoplasmosis. Rabies is a deadly infectious disease that can occur in any mammalian species and is caused by rabies virus. There are several different variants of rabies, including those found in terrestrial mammals (*e.g.*, foxes (*Vulpes* spp.), striped skunks (*Mephitis mephitis*), and common raccoons (*Procyon lotor*)) and those found in bats. Cases of bat variant rabies have been reported in bats and domestic animals (*i.e.*, domestic cats [*Felix catus*] and domestic horses [*Equus ferus*]) in NB. **Rabies prevalence in natural bat populations is approximately 1%.** However, bats exhibiting abnormal behaviours are more likely to have rabies. **The simplest and best way to prevent rabies exposure is to never touch or hold a bat with bare hands.** Therefore, if it is necessary to remove a bat from a property, then it is crucial they are handled wearing thick gloves that cover the hands, and if possible, the forearms. Wounds caused by bats can be very hard to find because the bite puncture marks are very small (less than 1 mm in diameter) and scratches are generally less than 1 mm long. **Thus, if there is any possibility that a human or domestic animal was bitten or scratched by a bat, it is very important that the provincial Tele-Care Line (811) and/or a local veterinarian are contacted in order to assess the situation.** If a bat bite or scratch does occur, immediately wash the wound for fifteen minutes with soap and water, 70% ethanol, or a povidone-iodine solution, and promptly seek medical attention. If a bat bite or scratch is identified, then rabies post-exposure **prophylaxis** (PEP; preventative treatment) will likely be recommended as a course of action. **If possible, safely collect the bat so it can be submitted for rabies testing.** You can find more details about the proper steps to take after potential exposure to bat variant rabies at the following website: <https://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Rabies-LaRage/ProtectYourselfAgainstRabiesBrochure.pdf>.

Histoplasmosis is an infectious fungal disease of humans and animals caused by *Histoplasma capsulatum* (*H. capsulatum*) that most often causes a noncontagious (*i.e.*, cannot be spread from an infected individual to uninfected individuals) pneumonia when spores of the fungus are accidentally inhaled by a susceptible individual. There have been no human cases of locally acquired histoplasmosis in NB; however, there has been one case of histoplasmosis in a dog in NB that came from a breeder in ON. The range of the fungus extends up into northern New Brunswick, so *H. capsulatum* is present within the province. Bats can become infected with *H. capsulatum* and thus carry the fungus and deposit it in their guano (bat droppings). Therefore, when working in areas with large amounts of bat guano, it is possible to breathe in the fungal spores when the guano is disturbed, especially when the guano is dry and spores become airborne. The best strategy to reduce the likelihood of an infection is to minimise the dust that becomes airborne while working in areas contaminated with bat guano. One way to do this is to thoroughly dampen the guano by spraying a 10% household bleach solution (1 cup bleach and 9 cups water) on it before it is shovelled or swept. **It is also strongly recommended that personal protective equipment (PPE), especially a Canadian Centre for Occupational Health and Safety (CCOHS)-approved respirator (TC 84A-XXXX N95), is worn to decrease the chance of inhaling the fungal spores.** Ultimately, it is recommended that removal of any accumulated bat guano be done by professionals that have the proper equipment and knowledge to minimise the biosafety risk associated with this activity.

Bat bugs, or **ectoparasites** of bats, may be an additional health concern. A bite from a bat bug is not painful but it may become itchy and develop a small welt due to a common allergic reaction. However, bat bugs do **NOT** transmit any known human diseases, such as rabies virus or Lyme disease.



Section 2. Excluding Bats from an Existing Roost

The best management option for bats is to leave them in their **roost** site. However, sometimes this is not possible, either due to human concerns, due to other circumstances (*e.g.*, unoccupied structurally unsound building that needs to be torn down for public safety reasons), or if the bats themselves are consistently put at risk (*e.g.*, if they are under constant threat of predation from a cat). In such cases, it will be necessary to exclude bats from a building. **In this situation, it is essential to contact a local Department of Natural Resources and Energy Development office to obtain a Wild Animal Control permit and an appropriate Pest Control Operator (PCO) that has the license and training to do bat exclusion work.** In consideration of exclusion, it is important to understand the following terminology:

Eviction is removing bats from a building using one-way eviction devices.

Exclusion is the process of sealing entry and exit points once bats have left the building, to prevent them from re-entering the roost site.

*Remember that under the **New Brunswick Fish Wildlife Act** it is illegal to catch and kill bats without a permit issued by the Minister of the Department of Natural Resources and Energy Development.*

Steps for Excluding Bats from Buildings

The following are the steps that should be followed when determining how to exclude bats from a building:

Step 1. Assess the Situation

Step 2. Bat-proof the Human-occupied Living Space

Step 3. Identify the Entry and Exit Points

Step 4. Install a Bat House

Step 5. Evict the Bats

Step 6. Exclude the Bats by Sealing the Roost

Eviction is removing bats from a building using one-way eviction devices.

Exclusion is the process of sealing entry and exit points once bats have left the building, to prevent them from re-entering the roost site.



Photo by J ssica Humber

Figure 1. Sometimes human concerns, such as unoccupied structurally unsound buildings that need to be torn down for public safety reasons, do not permit bats to remain in a building.



Step 1. Assess the Situation

A. Solitary bat or maternity colony?

Determining whether there is a solitary bat or a maternity colony roosting in a building is important because it will result in very different exclusion methods. A solitary bat in a human-occupied space of a building should be removed immediately. Generally, a solitary bat found in a home is there because it is confused or accidentally gained access. So, if you open the windows and doors, it will usually fly out on its own. Make sure to close the doors to other rooms to prevent the bat from going further into the house. Any ceiling fans or fans with blades should be turned off to avoid bats flying into them and becoming injured. Turning off the room and outside lights will further help the bat find its way out of the house, and **all people and pets should exit the room until the bat leaves**. If the bat does not leave on its own, it may require physical assistance (*i.e.*, wearing thick gloves and placing a small container gently over the bat once it lands, and then releasing it outside onto a tree limb or other elevated position [refer to *Section 2.3.1.1.1 Solitary bat or maternity colony?* in the full document [76 p.] for detailed directions]).

If you are uncomfortable or unsure about having to remove a bat on your own, please get in touch with a professional (Pest Control Operator or [Nuisance Wildlife Control Operator \[NWCO\]](#)). If it is even a possibility that someone has been bitten, scratched, or touched by a bat in the process of removing it from a building, it is imperative that the provincial Tele-Care Line (811) is contacted. In this case, the captive bat should NOT be released until a provincial health official has been contacted and it has been determined whether the bat is required for rabies testing. Additionally, if a bat has been found in a room with an unattended child, or a sleeping, mentally impaired, or intoxicated person, the bat should be captured and kept for rabies testing, and provincial health officials should be immediately contacted for further instructions. Please get in touch with the provincial Tele-Care Line (811) as soon as possible.



Photo by Cory Olson

Figure 2. Maternity colony.



B. Day roost or night roost?

The key difference is that day roosts are roosting sites where bats spend an extended period of time during daylight hours, mainly during summer and early fall. In contrast, night roosts are temporary resting spots that bats use in the night between feeding excursions. Bats that use night roosts are rarely problematic for people as the bats remain outdoors and have minimal human interaction. If possible, it is recommended that night roosting bats are left alone, but if necessary, there are methods to humanely discourage bats from night roosting (e.g., pinning curled pieces of ribbon to the roost site so that they can sway in the wind). As always, it is **NEVER** recommended that bats are directly handled by people. However, there are several options to indirectly discourage bats from night roosting, although **these deterrents must be put in place when bats are NOT present** (see *Section 2.3.1.1.2 Day roost or night roost?* in the full document [76 p.] for more information).



Figure 3. Summer day roost (or maternity colony).



Figure 4. Summer night roost.

Products that should NOT be used include aerosol dog or cat repellants, as they often contain the mildly toxic pesticide methyl nonyl ketone. Moth balls are also not suitable as deterrents for bats because in order for them to be effective naphthalene (the active ingredient) would be required in such large quantities it would pose a health hazard to humans. Ultrasonic devices are also not recommended as deterrents because they have not been proven to be overly effective. **Pesticides, smoke, and other chemical repellents are all dangerous deterrents for bats and are not recommended.** While artificial lighting is a suitable deterrent for a night roost, it is not recommended as a deterrent for bats day roosting in a maternity colony because if light is shone at the roost entrance, the bats will not use it and become trapped inside their roost if other exits are not available. **If it is suspected that there is a maternity colony in a building, do not use artificial lighting as a deterrent while excluding bats.**



C. Little brown myotis or big brown bats?

Physical Appearance

The **big brown bat** looks similar to the little brown myotis, with one main difference: it is bigger. The big brown bat is approximately twice as heavy as the little brown myotis. Its forearm length is 41-52 mm and its weight is 15.0-29.6 g. The forearm length of the little brown myotis is 33-41 mm and its weight is 7-14 g. Another difference based on appearance is in relation to the facial **sebaceous glands** of both species. These glands are observable as small bumps along the nose. Big brown bats have a much larger, more prominent facial sebaceous glands than little brown myotis. A final observable difference is in relation to the appearance of the **tragus** in both bat species. The big brown bat has a shorter, rounded tragus, whereas the little brown myotis has a longer, rounded tragus.

Guano Appearance

Big brown bats and little brown myotis can also be distinguished by the size of their guano pellets. Big brown bats have guano pellets that are wider and rounder than little brown myotis (refer to *Figure 3*).

Echolocation Calls

By recording the echolocation calls of bats using a bat detector and then reading the acoustic sonograms with special software, it enables you to differentiate between big brown bats and Myotis species. Big brown bats have calls that typically begin around 20-30 kilohertz (kHz). In comparison, several Myotis species, including little brown myotis, have calls that generally start around 40 kHz.



Figure 5. Big brown bat (top) and little brown myotis (bottom).



Figure 6. Droppings of big brown bats (left) and little brown myotis (right). Small squares are 2 mm²; larger squares are 10 mm².

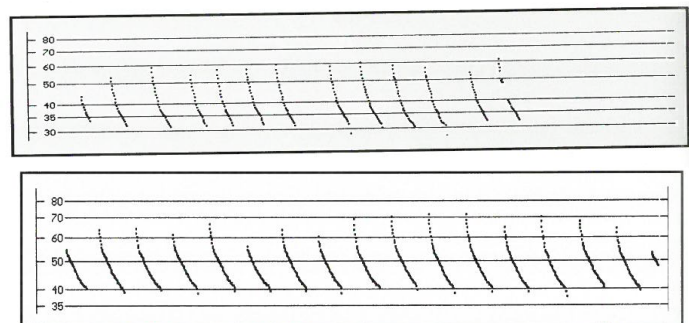


Figure 7. Acoustic sonogram of a big brown bat (top) and little brown myotis (below).

Images from Adams 2003



If there is a maternity colony of bats day-roosting in a building and they need to be removed, after the situation is assessed please continue with the following steps to exclude them:

Step 2. Bat-proof the Human-occupied Living Space

Direct human-bat contact should be prevented, when possible, to protect human health from diseases such as rabies and histoplasmosis that are known to be associated with bats. This means that bats found in spaces occupied by humans cannot remain there, and further action will be required to exclude them from these areas. This does not include bats that are roosting in attics that are not accessed regularly or bats that forage outside around the house. Preventing bats from entering a living space can take place at any time of year provided that the area is not part of a maternity colony. Unlike rodents, bats are not looking for food in buildings, so they are not exploring these structures but simply using certain points to enter and exit their roost. If a bat is in a living space, it is likely accidental, either resulting from a fall down a chimney or chute, or from a pup that has lost its way to the roosting area.

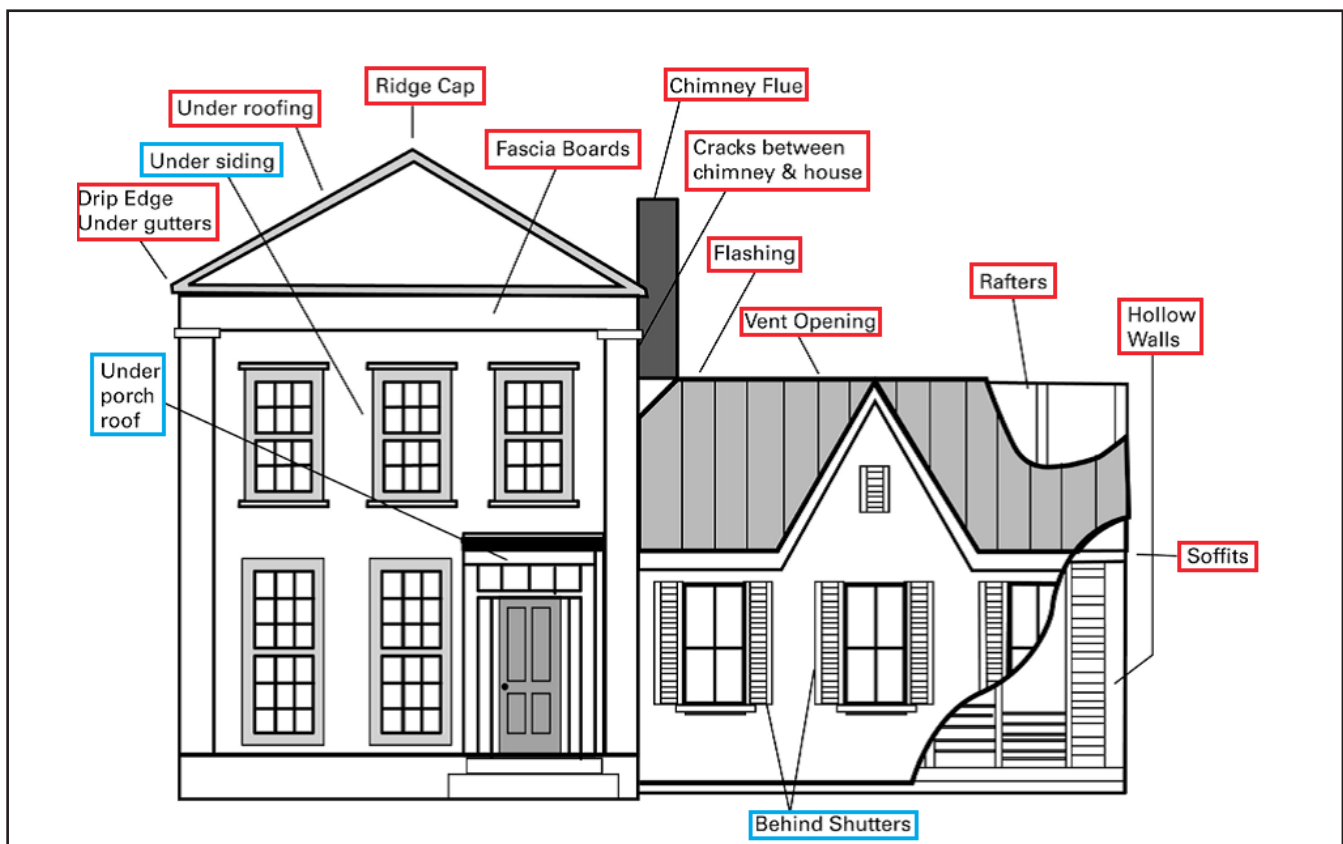


Figure 8. Common roost sites for bats in buildings (general maternity colony roosts are in red and solitary roosts are in blue, although some of these are interchangeable).

Image by Julianne Leekie for the Kootenay Community Bat Project, based on original image by Dr. Stephen C. Frantz, Global Environmental Options, LLC



The first step in bat-proofing the interior of a building is to locate any spaces connecting the living space to the roost site. Provided you do not enter the actual roosting area, this does not disturb the bats and can be performed at any time of year. **Bats can enter or exit a space as small as 15 mm in diameter (which is approximately the size of a dime), or 6 mm wide and 19 mm long (which is close to the size of a small safety pin [Size 000]).** Some common openings may include:



Photo by Tessa McBurney

Figure 9. Chimneys and fireplaces provide common openings for bats to access the living space.



Photo by Jordi Segers

Figure 10. Prevent rodents (e.g., squirrels) from chewing through caulking.

- the space around the frame of attic hatches and doors
- the flues of chimneys and fireplaces
- the spaces around piping or plumbing
- open windows and doors
- openings in windows, unscreened windows, or loose windowsills
- openings associated with air conditioners, fans, and ducts
- tears or defects in screens
- improperly sealed pet doors

The second step is to seal the openings. The spaces can be temporarily sealed using newspapers or rags, or the openings can be permanently sealed with wood, flashing, weather stripping (including draft sweeps), screening, copper mesh, or galvanised (steel) wire mesh. The galvanised wire mesh can be attached with screws. Copper mesh can be a good option, but it should not come in contact with galvanised metal, as it can cause rapid corrosion of the metal when wet. All types of mesh and screening should have mesh smaller than 1 cm (0.5"). Once in place, the mesh can be covered by a latex (water-based) caulking. Latex caulking is safest for bats, but the sealed openings should be checked periodically as this type of caulking may shrink and crack over time. The mesh can also be covered by aerosol foam. **Silicone, polyurethane, or other non-water-based caulking materials should never be used as they often have higher volatile organic compound (VOC) content.** Aerosol foam should never be used as a sealant or to cover mesh unless it can be verified that **bats have left the structure for the season (between November 1st and March 31st for *Myotis* spp.)**. First, ensure **bats are not in the space by sticking a long object into the space, such as a stick or a straw.** Expandable foam can entomb bats, thus it **should NOT be used if there is even a slim possibility that bats are still around and may return to the structure.** Backer rod foam insulator can be placed behind the aerosol foam as an extra precaution to prevent any entombment. Aerosol foam also breaks down in heat over time, especially when exposed to weather and UV light, so it may not be the best option for external holes. If using aerosol foam, make sure to wear gloves to protect your hands. **When sealing off access points associated with ducts and chutes, it is imperative that they are sealed off at the top of the chute, rather than at the bottom.**



Sealing the chutes at the bottom has been found to lead to high bat mortality, because the bats fall down the chute and then are unable to climb up the slippery surface and become trapped. Since bats cannot fly straight up, they rely on their ability to climb rough surfaces to escape ducts and chutes. Not only is the associated bat mortality an issue, but a collection of dead bats in a duct may create odour problems as well. If the access point for bats is louvres or covers of ducts that are still functioning, screens that allow for proper air movement but have a mesh size smaller than a bat is able to crawl through can be installed to prevent bats from getting in. **Do NOT place mesh or spark arrestors over fireplace flues that are still in use.** Only certified products tested by a third party should be used with your fireplace to prevent fire hazards. It is possible to purchase certified manufactured flues with caps that meet the CSA standard (e.g., Selkirk models). Outside heating season, it may be possible to close the dampers on fireplaces and flues as long as they are opened prior to use. It is also important to ensure that entry and exit points to the roost site are not affected by any alterations at this time (for more information see *Section 2.3.1.6 Step 6. Exclude the Bats by Sealing the Roost* in the full document [76 p.]). While bats are unable to chew through any of the recommended sealants, rodents may be able to accomplish this (especially with aerosol foam) and reopen the entry or exit point. For this reason, if rodents have access to these areas, it would be prudent to layer copper mesh or steel wool between applications of caulking, which hinders their ability to chew through the caulking material. Steel wool can be used but it can rust and degrade over time.

Step 3. Identify the Entry and Exit Points

When assessing the exterior of buildings, it can be difficult to detect all possible entry and exit points where bats gain access to interior spaces in the building. Therefore, the best way to identify these entrances and exits to day roosts in buildings is to conduct an emergence survey at dusk (see *Section 2.3.2 Emergence Survey* in the full document [76 p.] for more information).

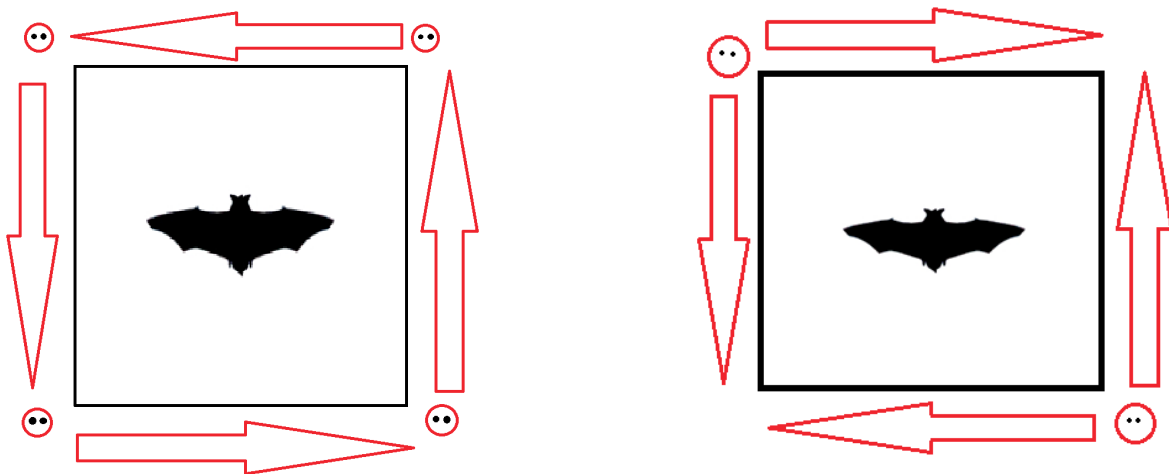


Figure 11. Diagrams of how best to conduct an emergence survey with four people (left; depicted as circles) and two people (right). The arrows are the direction(s) each person is looking.

Image by Tessa McBurney



Step 4. Install a Bat House

To provide bats with an alternative, safe roosting space prior to or after exclusion from their original roost, a bat house can be installed nearby. While there is little evidence that bats will choose bat houses over suitable alternative roosting sites, and it may take years for bats to adopt a bat house as a roost, it is still recommended to provide these bat houses for bats when they are being excluded from an existing roost. More detailed instructions on using bat houses can be found in *Section 2.4.2 Create a New Roost (Bat Houses)* in the full document (76 p.).



Figure 12. Install a bat house.

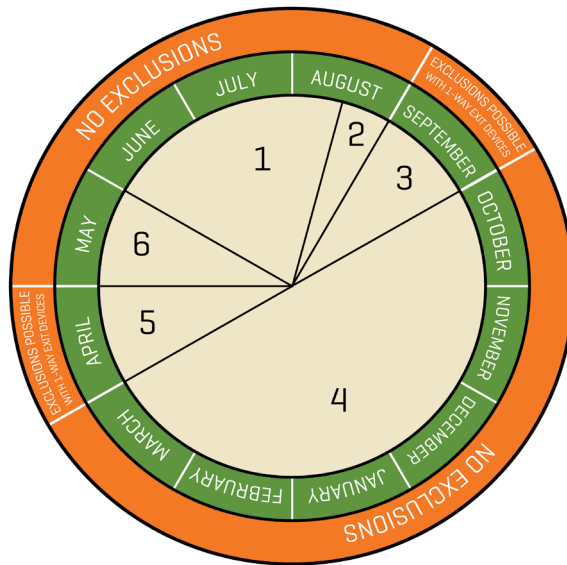
Step 5. Evict the Bats

It is crucial to consider the time of year when evicting bats from a building. In NB, you have predominantly two bat species that may be roosting in buildings: the little brown myotis and the big brown bat. These bat species have different roosting behaviours that will affect the recommendations for exclusion. If you are unable to distinguish between the two species, then the following general guidelines should be followed to prevent bat mortality.

Both little brown myotis and big brown bats give birth to their pups in the summer, anywhere between early June and mid-July. After birth, it takes approximately three weeks for pups to learn how to fly, or become “**volant**”. Since most aggregations of bats in NB buildings are maternity colonies, if bats are evicted prior to the pups becoming volant and feeding on their own, **the pups will be trapped inside the building without their excluded mothers to feed them, and they will likely die**. Therefore, this should never be done, not just for the conservation of bats, but also to avoid human health issues related to having many dead and decomposing animals sealed in a house. Due to this, bat exclusions **should NOT take place from May 1st until August 31st**.

In addition to summer roosting in buildings, big brown bats also have been found to roost in buildings in the winter. Most big brown bats begin their hibernation when the outside temperature averages approximately 5.6°C, in NB, this can be as early as October. When bats emerge from hibernation depends primarily on their body condition, or how much fat they were able to store away for the winter months. Ideally if big brown bats are found hibernating in a building in the winter, they can be left for the winter and excluded in April when the temperature consistently remains above 0°C. Bats produce little guano throughout hibernation and create little disturbance. **It is extremely likely that if a bat is excluded from a building during hibernation, it will either freeze to death or die of starvation**. Due to this, bat exclusions **should NOT take place from October 1st until March 31st**. Please call the toll-free number 1-833-434-BATS (2287) or the Department of Natural Resources and Energy Development at 506-453-3826 to speak to the appropriate regional biologist if you find any bats in the winter.

The only safe time for exclusions for both little brown myotis and big brown bats is in either **September** or **April**. The best time for exclusion is September when the young are able to fly, and bats are not yet hibernating.



Calendar Legend

1. pups born and in maternity roost
2. pups are able to fly
3. bats begin to move to hibernation site
4. bats hibernate (mines, wells, caves, rock crevices, and buildings)
5. pregnant female bats begin to move to maternity roost
6. pregnant female bats in maternity roost (buildings, bat houses, trees, rock crevices)

Figure 13. Calendar demonstrating when it is appropriate to exclude bats from a structure and when they should not be excluded.

Image adapted from Craig and Sarell 2016

Using one of the identification techniques described in *Step 1. Assess the Situation*, it may be possible to identify whether a summer maternity colony is comprised of mainly big brown bats or little brown myotis. If there is a high level of confidence in the species identification, it may be possible to follow the below guidelines after approval from the Department of Natural Resources and Energy Development (506-453-3826).

Little Brown Myotis

Bat exclusions should only take place from the beginning of September until the end of April. Bat exclusions should NOT take place from May 1st until August 31st. The best time for exclusion is from mid-to-late October when the young are able to fly, and bats have left their summer residence but are not yet hibernating. If the summer roosting little brown myotis have already left for the season or have not yet returned for the summer (generally between **November 1st and March 31st** in NB), then it is **not necessary to use eviction devices**. However, the roosting area should be carefully checked with a flashlight to ensure that all bats have left the maternity colony. Again, make sure all crevices, corners, and cracks are thoroughly examined and wear an approved respirator (TC 84A-XXXX N95).

Big Brown Bats

The guidelines for big brown bats are the same as the general guidelines listed above. **Bat exclusion should only take place in the months of September and April. Bat exclusions should NOT take place from October 1st until March 31st and from May 1st until August 31st.** Due to the possibility of big brown bats roosting in buildings year-round, **it is always necessary to use eviction devices when excluding big brown bats.**

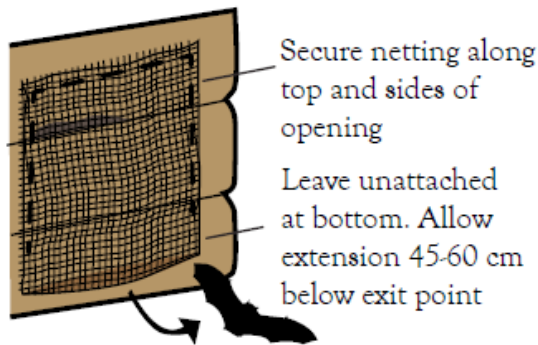


Figure 14. How to position a one-way mesh exit device on a vertical surface. Use lightweight polypropylene netting with mesh smaller than 1.0 cm.

Image from Craig and Sarell 2016

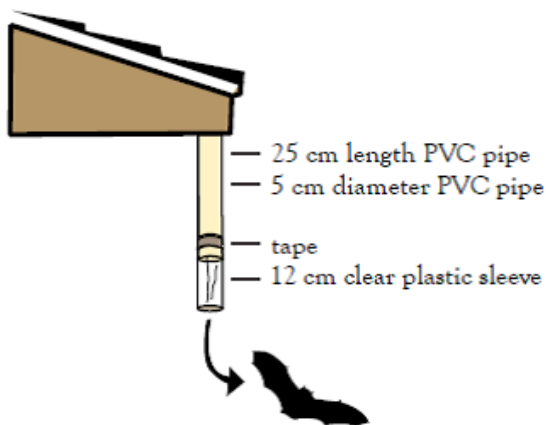


Figure 15. How to position a one-way exclusion tube on a horizontal surface. Use PVC pipe, a clean caulking tube, or flexible tubing.

Image from Craig and Sarell 2016

If the exclusion takes place when bats are still roosting in the building, then it will be necessary to use eviction devices that allow bats to exit the structure but prevents them from re-entering. If there is uncertainty on whether all bats have vacated a space (*i.e.*, the roost site cannot be accessed and visually checked), then eviction devices should also be used.

For an entrance or exit on a vertical surface, like a wall, a one-way exit device can be constructed from lightweight polypropylene netting (bird netting) that has mesh smaller than 1.0 cm (1/2"; 4x4 strands per inch). **It is sometimes suggested that plastic sheeting can be used as well; however, this will block ventilation and can alter the temperature and humidity of the roost. It is not recommended to use any methods that result in structural changes that block natural ventilation.** The netting should be secured along the top and sides of the opening with the bottom left detached. The bottom should extend 45-60 cm below the exit point. The mesh will prevent the bat from flying back inside the building. Flexible exclusion tubes can also be used on vertical surfaces, just ensure that the tube is not so long that it will twist in the wind.

For an entrance or exit point on a horizontal surface, like the edge of a roof, an exclusion tube can be custom-built to act as a one-way exit device. The tube can be made from polyvinyl chloride (PVC) pipe, a caulking tube that has been cleaned out, or flexible tubing. If a caulking tube has not been properly cleaned out, the rough surface will allow bats to climb up and re-enter the structure if a plastic sleeve is not used. The tube should be at least 5 cm (2") wide and 25 cm (10") long, and placed over the opening. A clear plastic sleeve attached to the end of the pipe will ensure that bats do not re-enter. Bats will leave their roost by sliding down the tube, but they will not be able to re-enter because it is too slippery to climb and too narrow to fly up. Some stores sell "bat cones" that can be used as exclusion tubes (see *Section 4.3.2 Excluding Bats from Buildings* in the full document [76 p.]).

It is important to ensure that eviction devices do not have any sharp edges or features that could potentially injure, entrap, or entangle a bat.



Additionally, it is not recommended that eviction devices are attached with duct tape or similar adhesives that have a chance of falling off because bats can become attached to the exposed adhesive or possibly re-enter the building where the tape has fallen off.

The one-way eviction devices should remain in place for a minimum of 5-7 nights, with at least 3 consecutive nights of good weather (*i.e.*, temperature above 10°C, winds less than 16 km/h, and no rain). Depending on weather and other factors, bats do not exit their roost to feed every night, so by letting the eviction devices remain for an extended interval, it gives all of the bats sufficient time to leave the building at some point during the eviction period. Bats are unlikely to feed in bad weather conditions and will often remain in their roost, which is why it is important to have at least three consecutive nights of good weather during the eviction process. On the last night the eviction devices are in place conduct a second emergence survey (see *Section 2.3.2 Emergence Survey* in the full document [76 p.] for more information). If no bats are observed emerging, it will indicate that all of the bats have been evicted from the building. As with the first emergence survey, make sure that this one is conducted on a night with good weather (*i.e.*, no rain, winds less than 16 km/h, and temperatures higher than 10°C). If possible, the bat roost should also be physically checked if it is able to be accessed. Use a flashlight to carefully see if there are any bats still roosting in crevices or cracks. If you enter a roost site, proper PPE (*i.e.*, a CCOHS-approved respirator [TC 84A-XXXX N95]) and a Tyvek suit should be worn. Ensure that you are always conforming to the necessary safe work practices.

If bats are somehow able to re-enter the building at any point during the exclusion process, then one-way eviction devices need to be re-implemented for another 5-7 nights minimum (with at least 3 consecutive nights of good weather).



Figure 16. One-way eviction device in place for an exclusion.



Step 6. Exclude the Bats by Sealing the Roost

Once bats are successfully evicted from a building, it is essential to tightly seal all entry and exit points to prevent re-entry. At this time, the one-way eviction devices can be removed, and all entry and exit points can be sealed using wood, flashing, weather stripping (including draft sweeps), screening, copper mesh, or galvanised (steel) wire mesh.

(Only use aerosol foam as a sealant after bats have left for the season.)

(Do NOT use silicone, polyurethane, or other non-water-based caulk materials.)

To ensure that the exclusion is successful, it is additionally important to seal all other gaps and spaces that bats could use to enter the building. This is ideally also done after the bats have left for their hibernacula in mid-to-late October.

After exclusion, the roosting area should be cleaned. If it is possible to access the roosting area, remove the guano and urine-stained insulation, address any issues with the vapour barrier, check wood for rot, and reapply insulation. Prior to cleaning, thoroughly dampen the guano with a 10% household bleach solution (1 cup bleach and 9 cups water) and wear an approved respirator (TC 84A-XXXX N95) to prevent histoplasmosis. Wear gloves while handling guano-stained materials or dead bats. If any dead bats are found, please contact the Department of Agriculture, Aquaculture and Fisheries- Veterinary Laboratory and Pathology Services Unit (506-453-5412), a local **Department of Natural Resources and Energy Development office**, or the Canadian Wildlife Health Cooperative (CWHC) (1-833-434-2287/902-628-4314) for assistance. Handle dead bats carefully ensuring there is no direct contact (*i.e.*, wear gloves), and store in a leak-proof container with: contact information, date, and location. Ensure that if any building alterations are made that they are in accordance with provincial building and fire codes.

It is recommended that licensed Pest Control Operators or Nuisance Wildlife Control Operators are contacted to assist with or complete the entire exclusion process. Once bats are evicted from a structure, they may attempt to re-enter the building through new access points. It might take several attempts to successfully exclude bats from a building.

See *Section 2.3.3 Decontamination Guide* in the full document (76 p.) for instructions on how to decontaminate equipment to prevent the unintentional spread of WNS.

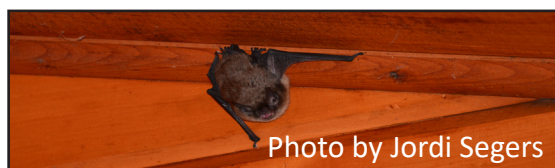


Photo by Jordi Segers

Figure 17. It may take more than one attempt to successfully exclude bats from a building.

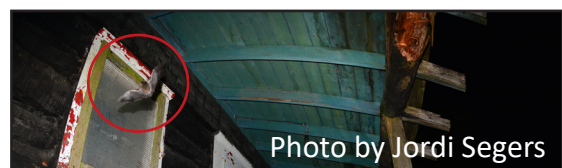


Photo by Jordi Segers

Figure 18. To ensure that the exclusion is successful, it is important to seal all other gaps and spaces that bats could use to enter the building.



Section 3. Other Options for Managing Bats in Buildings

Rather than excluding bats, the ideal situation would be to leave bats in an existing roost whenever possible. If the bats are roosting in a non-residential building or unused structure, such as an old shed or barn, then the best approach is to leave the bats without any alterations to the structure. The most important considerations occur when bats are able to enter a living space that is used by humans. Bats cannot remain in spaces occupied by humans, and further action will be required to exclude them from these areas and to protect the human living area from contact with the bats. As long as bats are unable to access the living space, they can safely remain in other areas of the structure. **It should be noted that ANY structural alterations or improvements should only be made when bats are no longer present.** Additionally, if the property owner is receptive to the idea, bats can be encouraged to roost on a property, which has the added benefit of natural insect control. This can be done in the following ways:

- Enhance current roosting conditions by creating dark spaces with lots of small crevices for bats. This should only be done if there are no human health-related concerns associated with the bats in the building and bats are unable to gain access to the human living space.
- Create new roosting opportunities by providing bat houses (refer to *Section 2.4.2 Create a New Roost (Bat Houses)* in the full document [76 p.] for detailed instructions).
- Enhance bat habitat by keeping dead or dying trees and rock formations for roosting, planting hedgerows, and supplying a water source such as a small pond. Ensure all artificial lighting is removed.
- Improve food availability by planting a garden with native plants that attract the insects bats like to eat.



Section 4. Conservation Measures and Landowner Stewardship

There are opportunities for landowners to get involved in bat conservation in NB. The most important thing for people to do is to **REPORT any bat sightings by calling the Canadian Wildlife Health Cooperative (CWHC), Atlantic Region's Bat Conservation Program Technician at 1-833-434-BATS (2287) or e-mailing atlanticbats@cwbc-rcsf.ca. Sightings can also be reported to the New Brunswick Museum (Zoology Section) by contacting 506-643-2300.** Whether a solitary bat is spotted or there is a maternity colony in a building, it is crucial to identify where bats are hanging out. This is especially important for bat white-nose syndrome (WNS) surveillance season (November 1st-May 31st), and locating maternity colonies in the summer. By providing this information, you are contributing to bat research that is essential in conserving bat populations. The toll free number can be used to report any bat-related activities you observe on your property as well as to ask any questions you might have in relation to the bats living in your province.



Section 5. Resources

Document should be cited as the following:

McBurney, T. 2018. Got bats? A guide for conservation-minded bat exclusion in New Brunswick. Tech. Rep. Charlottetown, PE: Canadian Wildlife Health Cooperative, Canadian Wildlife Health Cooperative Atlantic Office. 26 p.

5.1 Definitions

ectoparasite: a parasite that lives outside of its host (*i.e.*, on the outside of the skin; *e.g.*, ticks)

eviction: removing bats from a building using one-way eviction devices (should only take place from the beginning of September until the end of April)

exclusion: the process of sealing entry and exit points once bats have left the building, to prevent them from re-entering the roost site

Nuisance Wildlife Control Operator (NWCO): someone who relocates, traps, or removes wildlife considered a nuisance

Pest Control Operator (PCO): someone who uses a variety of methods to remove or kill pests or nuisance animals

prophylaxis: measures taken to prevent the spread of a disease (*e.g.*, rabies)

roost: where a bat rests

sebaceous gland: a group of cells that connect to a hair follicle and secrete sebum (an oily fluid) to lubricate the hair and skin

tragus: a protrusion on the inner side of the external part of the ear

volant: able to fly



Photo by Brock Fenton

Figure 19. Little brown myotis in flight.

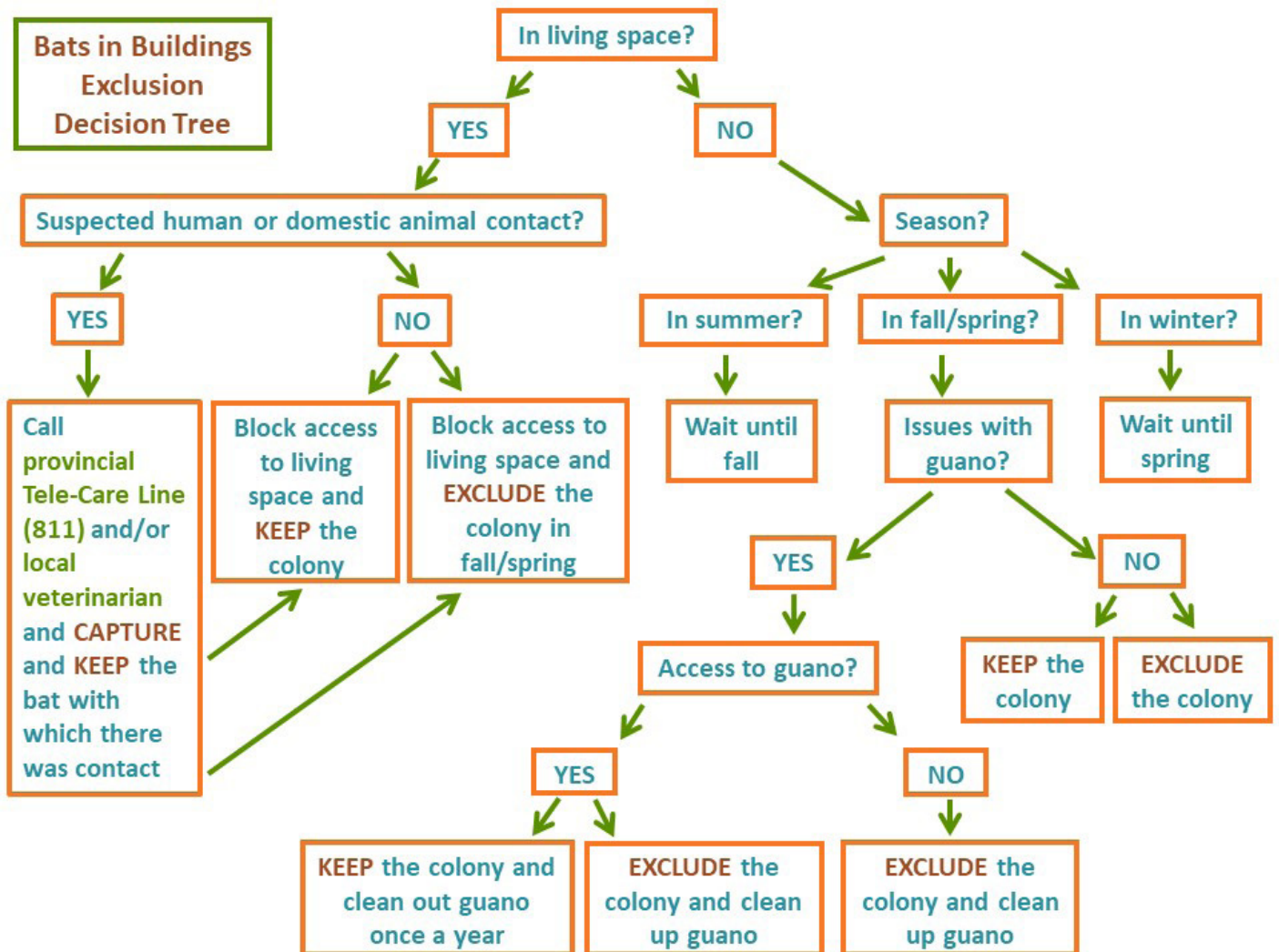


Photo by Jordi Segers

Figure 20. Northern myotis hanging out.



5.2 Exclusion Decision Tree





5.3 Helpful Resources

5.3.1 Bat White-nose Syndrome (WNS)



Canadian Wildlife Health Cooperative

Bat White-nose Syndrome Resources:

http://www.cwhc-rcsf.ca/wns_resources.php

Bat White-nose Syndrome Surveillance:

<http://www.cwhc-rcsf.ca/wns.php>

Canadian National White-nose Syndrome Decontamination Protocol:

<https://www.youtube.com/watch?v=kQjALbixJKY>

Decontamination Protocol for Entering Bat Hibernacula (full):

http://www.cwhc-rcsf.ca/docs/WNS_Decontamination_Protocol-Mar2017.pdf

Decontamination Protocol for Entering Bat Hibernacula (2-pager):

<http://www.cwhc-rcsf.ca/docs/BatWhiteNoseSyndrome-DecontaminationBrief-Dec2016.pdf>

Submission Protocol for White-nose Syndrome Specimens:

http://www.cwhc-rcsf.ca/docs/WNS_Specimen_Submission_Protocol.pdf

US White-nose Syndrome Conservation and Recovery Working Group

National White-nose Syndrome Decontamination Protocol (US):

<https://www.whitenosesyndrome.org/mmedia-education/united-states-national-white-nose-syndrome-decontamination-protocol-april-2016-2>





5.3.2 Excluding Bats from Buildings

Alberta Community Bat Program

Bats and Buildings:

<http://www.albertabats.ca/gotbats/>

Got Bats? Alberta Guide for Managing Bats in Buildings:

http://www.albertabats.ca/wp-content/uploads/Alberta_Bats_in_Buildings.pdf

Batcone

Retailer of Bat Eviction Devices:

<http://www.batcone.com/>

Bat Conservation International

Bat Conservation International- Bats in Buildings:

<http://www.batcon.org/resources/for-specific-issues/bats-in-buildings>

Community Bat Programs of BC

Got Bats? 7 Steps for Managing Bats in Buildings in British Columbia (BC) (full):

http://www.cwhc-rcsf.ca/docs/7_Steps_for_Managing_Bats_in_Buildings.pdf

Got Bats? 7 Steps for Managing Bats in Buildings in BC (2-pager):

http://www.cwhc-rcsf.ca/docs/7_Steps_for_Managing_Bats_in_Buildings_-_2_pager.pdf

Got Bats? Frequently Asked Questions Regarding Bats in Buildings in BC:

http://bcbats.ca/attachments/bat_FAQ.pdf

New Brunswick Department of Natural Resources and Energy Development

Nuisance Wildlife Control Operators by Region:

https://www2.gnb.ca/content/gnb/en/departments/erd/natural_resources/content/wildlife/content/NuisanceWildlifeControlOperatorsByRegion.html

Québec Bat Group

Practical guide for the conservation of bats in an agricultural setting (in French) :

<https://mffp.gouv.qc.ca/guide-pratique-conservation-chauves-souris-milieu-agricole/>





US White-nose Syndrome Conservation and Recovery Working Group

Acceptable Management Practices for Bat Control Activities in Structures:

<https://www.whitenosesyndrome.org/mmedia-education/acceptable-management-practices-for-bat-control-activities-in-structures-a-guide-for-nuisance-wildlife-control-operators>

5.3.3 Bat Monitoring, Conservation, and Ecology

Canadian Wildlife Federation

Help the Bats Resources:

<http://cwf-fcf.org/en/explore-our-work/endangered-species/help-the-bats/>



Canadian Wildlife Health Cooperative

Shipping and Handling Instructions for Wildlife Specimens:

<http://www.cwhc-rcsf.ca/docs/CWHC%20Shipping%20and%20Handling%20Instructions.pdf>

Submission Protocol for Wildlife Specimens:

http://www.cwhc-rcsf.ca/forms/cwhc_atlantic_submission_form.pdf

Submission Protocol for Wildlife Specimens (in French):

http://www.cwhc-rcsf.ca/report_submit.php

Merlin Tuttle's Bat Conservation

Worldwide Bat Conservation:

<http://www.merlintuttle.com/>

Neighbourhood Bat Watch

Citizen Science Bat Monitoring in Canada:

<http://batwatch.ca/>

Instructions for Bat Colony Counts:

http://batwatch.ca/sites/default/files/pdf/Bat_Colony_Validation.pdf

New Brunswick Department of Natural Resources and Energy Development

506-453-3826

https://www2.gnb.ca/content/gnb/en/departments/erd/natural_resources/content/Regions.html



New Brunswick Museum (Zoology Section)

506-643-2300

1-888-268-9595

<https://www.nbm-mnb.ca/>



Nova Scotia Bat Conservation

Report Bat Sightings in Nova Scotia (NS):

<http://www.batconservation.ca/index.php?q=node/add/batreport>

The Natural History of Canadian Mammals- by Donna Naughton

5.3.4 Bat Houses

Alberta Community Bat Program

Bat House Information for Alberta (including bat house designs):

<http://www.albertabats.ca/bathouses/>

Building Homes for Bats- Alberta Bat House Guidelines:

<http://www.albertabats.ca/wp-content/uploads/ACBP-Bat-Houses-in-Alberta.pdf>

Bat Conservation International

Bats Magazine- Bat Houses:

<https://www.batcon.org/issue/volume-11-issue-1/>

Canadian Bat Houses

Canadian Retailer of Bat Houses:

<http://canadianbathouses.com/>

Canadian Tire

Nature's Way Cedar Bat House:

<https://www.canadiantire.ca/en/pdp/cedar-bat-house-1421964p.html>

Community Bat Programs of BC

Building Homes for Bats- A Guide for Bat Houses in British Columbia:

http://www.bcbats.ca/attachments/Bat_houses_in_BC_2015.pdf





Information on Where to Install Bat Houses in BC:

<http://www.bcbats.ca/index.php/bat-houses/where-to-install-a-bat-house>



Lee Valley

Organization for Bat Conservation:

<https://www.leevalley.com/en-ca/shop/garden/wildlife/houses-and-habitats/70692-bat-house?item=AG138>

Québec Bat Group

Practical guide for the conservation of bats in an agricultural setting (in French) :

<https://mffp.gouv.qc.ca/guide-pratique-conservation-chauves-souris-milieu-agricole/>

The Bat House Builder's Handbook- by Merlin Tuttle

5.3.5 Bat-related Human Health Concerns

Histoplasmosis

Centers for Disease Control and Prevention (CDC)

Histoplasmosis- Protecting Workers at Risk (full):

<https://www.cdc.gov/niosh/docs/2005-109/pdfs/2005-109.pdf>

Histoplasmosis- Protecting Workers at Risk (2-pager):

<https://www.cdc.gov/niosh/docs/2005-109/pdfs/2005-109FS.pdf>

NIOSH-approved N95 Particulate Filtering Facepiece Respirators:

https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/n95list1.html

Government of Canada

Pathogen Safety Data Sheets: Infectious Substances – Histoplasma capsulatum:

<https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/histoplasma-capsulatum.html>





Rabies Virus

Centers for Disease Control and Prevention (CDC)

Compendium of Animal Rabies Prevention and Control:

(Part 1. Rabies Prevention and Control C. Prevention and control methods related to wildlife)

<http://nasphv.org/Documents/NASPHVRabiesCompendium.pdf>



New Brunswick Department of Agriculture, Aquaculture and Fisheries

Protect Yourself Against Rabies Brochure:

<https://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Rabies-LaRage/ProtectYourselfAgainstRabiesBrochure.pdf>

University of Prince Edward Island

Medical Surveillance Plan for Research Involving Biohazardous Materials (rabies safe work practice):

<https://www.upei.ca/policy/adm/ord/gnl/0012>

New Brunswick Department of Agriculture, Aquaculture and Fisheries

506-453-3826

Fredericton District Office

506-453-5412

850 Lincoln Road, Building #700A

Fredericton, New Brunswick

E3B 5H1

Bathurst District Office

506-547-2089

1425 King Avenue

Bathurst, New Brunswick

E2A 1S7





Grand Falls District Office

506-473-7755
P.O. Box 5001
Grand Falls, New Brunswick
E3Z 1G1

Moncton District Office

506-856-2278
381 Killan Drive
Moncton, New Brunswick
E1C 8R3

Sussex District Office

506-432-2001
701 Main Street
Sussex, New Brunswick
E4E 7H7

Wicklow District Office

506-392-5101
39 Baker Lane,
Wicklow, New Brunswick
E7L 3S4

New Brunswick Department of Health

506-457-4800

New Brunswick Tele-Care Line

811



Figure 21. Bat and bat house.





CANADIAN
WILDLIFE HEALTH
COOPERATIVE

CREATING A WORLD
THAT IS SAFE AND SUSTAINABLE
FOR WILDLIFE AND SOCIETY



CONTACT us

Toll-free: 1.800.567.2033

Fax: 1.306.966.7387

Email: info@cwhc-rcsf.ca

www.cwhc-rcsf.ca

