MANAGEMENT PLAN FOR BATS

In the Northwest Territories

SPECIES AT RISK (NWT) ACT

Management Plan and Recovery Strategy Series 2020

For copies of the management plan or for additional information on Northwest Territories (NWT) species at risk, please visit the NWT Species at Risk website (www.nwtspeciesatrisk.ca).

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Little brown myotis (*Myotis lucifugus*), credit: Allicia Kelly, ENR
Northern myotis (*Myotis septentrionalis*), credit: Cori Lausen
Long-eared myotis (*Myotis evotis*), credit: Donald Solick
Hoary bat (*Lasiurus cinereus*), credit: MerlinTuttle.org
Eastern red bat (*Lasiurus borealis*), credit: Cori Lausen
Silver-haired bat (*Lasionycteris noctivagans*), credit: Cori Lausen
Big brown bat (*Eptesicus fuscus*), credit: Allicia Kelly, ENR
Long-legged myotis (*Myotis volans*), credit: Donald Solick

This management plan does not commit any party to actions or resource expenditures; implementation of this plan is subject to appropriations, priorities, and budgetary constraints.

This management plan includes, but is not limited to, species at risk. It was developed in part to fulfill the requirement for management plans for little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*) under the *Species at Risk (NWT) Act*. Other NWT bat species do not have this requirement; however, they share several threats in common and there is considerable overlap in their management needs. Therefore, this NWT-wide multi-species management plan was developed to address the needs of all NWT bats.

What is the *Species at Risk (NWT) Act*?
The *Species at Risk (NWT) Act* (the Act) provides a process to identify, protect, and recover species at risk in the NWT. The Act applies to any wild animal, plant, or other species for which the Government of the Northwest Territories has management authority. It applies everywhere in the NWT, on both public and private lands, including private lands owned under a land claims agreement, in accordance with the land claims agreements.

What is the Conference of Management Authorities?
The Conference of Management Authorities (CMA) was established under the Act and is made up of the wildlife co-management boards and governments in the NWT that share responsibility for the conservation and recovery of species at risk in the NWT (referred to as 'Management Authorities'). The purpose of the CMA is to build consensus among Management Authorities on the conservation of species at risk and to provide direction, coordination, and leadership with respect to the assessment, listing, conservation, and recovery of species at risk while respecting the roles and responsibilities of Management Authorities under land claim and self-government agreements. The CMA develops consensus agreements on listing species at risk, conservation measures, management strategies, and recovery plans. Only Management Authorities that have jurisdiction for a species are involved in making decisions.

What is a species of Special Concern?
Under the Act, a species of Special Concern is a species that may become Threatened or Endangered in the NWT because of a combination of biological characteristics and identified threats.

What is a management plan?
Under the Act, a management plan is a document that recommends objectives for the management of a species of Special Concern. It also recommends approaches to achieve those objectives. It includes a description of threats and positive influences on the species and its habitat. Under the Act, a management plan must be completed for species of Special Concern within two years of the species being added to the NWT List of Species at Risk.

PREFACE

This *Management Plan for Bats in the Northwest Territories* has been prepared by the Management Authorities responsible for little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*), in accordance with the *Species at Risk (NWT) Act*. Owing to shared threats and considerable overlap in management needs among bat species in the Northwest Territories (NWT), a multi-species management approach has been taken. In addition to the two species at risk noted above, this includes long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and eastern red bat (*Lasiurus borealis*). This management plan will guide management of these species in the NWT. It also constitutes advice to other jurisdictions and organizations that may be involved in conserving these species.

Background information and threats are mainly summarized from the Species at Risk Committee's 2017 *Species Status Report for Big Brown Bat, Little Brown Myotis, Northern Myotis, Long-eared Myotis, and Long-legged Myotis in the Northwest Territories*[1]. To avoid repetitive citations, it can be assumed that the information was taken from the 2017 report, unless another reference is given.

This *Management Plan for Bats in the Northwest Territories* does not commit any party to actions or resource expenditures; implementation of this plan is subject to the appropriations, priorities, and budgetary constraints of the participating Management Authorities.

Success in the management of these species depends on the commitment and cooperation of the many different groups that will be involved in implementing the recommendations set out in this plan and cannot be achieved by the Management Authorities (Government of the Northwest Territories, Sahtú Renewable Resource Board, Wek'èezhìı Renewable Resources Board, Tłı̨chǫ Government), or any other group alone. All NWT residents are invited to join in supporting and implementing this plan for the benefit of all bat species in the NWT and NWT society as a whole.

ACCEPTANCE STATEMENT

The Sahtú Renewable Resources Board, Wek'èezhìı Renewable Resources Board, Tłı̨chǫ Government, and Government of the Northwest Territories accepted this management plan on April 8, 2020 through a Conference of Management Authorities consensus agreement under the *Species at Risk (NWT) Act*.

ACKNOWLEDGEMENTS

Preparation of this plan was funded by Environment and Natural Resources. We would like to thank the Species at Risk Secretariat for their work preparing this document. The principal preparers of the plan were Michele Grabke (Species at Risk Implementation Specialist), Claire Singer (Species at Risk Implementation Supervisor), and Joanna Wilson (Wildlife Biologist (Species at Risk)).

Background information in this document is mainly summarized from the 2017 *Status Report and Assessment of Big Brown Bat, Little Brown Myotis, Northern Myotis, Long-eared Myotis, and Long-legged Myotis in the NWT*. We would like to thank the Species at Risk Committee for their work on that report, as well as Jesika Reimer and Tracey Gotthardt for their work preparing the drafts of the status report.

Distribution maps in this management plan were made using bat data from the NWT Wildlife Management Information System (WMIS). Various sources contributed data to WMIS. We are grateful to all the individuals and organizations who submitted their bat information and observations to Environment and Natural Resources.

We thank the individuals and organizations who reviewed earlier drafts and provided input that significantly improved the management plan:

- Government of the Northwest Territories, Environment and Natural Resources
- Gwich'in Renewable Resources Board
- Wek'èezhìı Renewable Resources Board
- Sahtú Renewable Resource Board
- Tłı̨chǫ Government
- Cori Lausen, Wildlife Conservation Society Canada
- Jesika Reimer, Taiga Research
- Parks Canada
- Canadian Parks and Wilderness Society - Northwest Territories Chapter
- Inge-Jean Hansen, Zonal Ecosystem and Wildlife Consultants

EXECUTIVE SUMMARY

Bats are a unique and important group of species in our ecosystem. They prey on a wide range of insect types and eat large numbers of insects. Seven bat species are known to occur in the Northwest Territories (NWT): little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*). The presence of eastern red bat (*Lasiurus borealis)* is unconfirmed but suspected in the NWT.

The little brown myotis and northern myotis are listed as species of Special Concern under the *Species at Risk (NWT) Act*. Species listed as Special Concern require management plans within two years of listing. This *Management Plan for Bats in the Northwest Territories* was developed to guide management of these species and fulfill this requirement. The other species of bats that occur, or are suspected to occur, in the NWT do not have this requirement; however, they share several threats in common with the two at risk bat species and there is considerable overlap in their management needs. This management plan therefore uses a multi-species approach to address the needs of all bats in the NWT. It is intended to provide guidance and direction to co-management partners to help with decision-making for bat management. Ongoing communications, cooperation, public participation, and education will be fundamental to the plan's success.

Species Information

Bats are the only mammals capable of true flight. They are most active at night and sleep during the day (nocturnal).

All NWT bats are insectivorous[a] and some can consume the equivalent of their own body weight in insects each night. Bats are long-living and reproduce relatively slowly, which makes them sensitive to population decline. Natural predators of bats include raptors (e.g. owls), small carnivores (e.g. weasels), squirrels, and snakes.

The NWT is at the northern limit of the North American distribution of bats. Habitat requirements vary by species, and depend on sex, age, and reproductive status. In the summer, NWT bats roost in tree cavities or crevices, under tree bark, among the leaves of trees, in caves, in rock crevices, and in buildings. Roosts used by reproductive females and their young are called 'maternity roosts' – these roosts are typically warm, to help promote growth and milk production. In some species, reproducing females tend to gather together in groups to roost in a 'maternity colony'. In the winter, some NWT bat species migrate south to warmer areas. Other species overwinter in hibernacula[b]. Bats require hibernacula with stable, cool temperatures and high humidity levels, such as

[a] Insectivorous bats feed on insects and other invertebrates (e.g. spiders).

[b] Hibernating bat species overwinter in places called hibernacula. They enter a deep sleep (called torpor), which, combined with the protection of the hibernacula, allows them to survive harsh winter conditions. Migrating species, on the other hand, fly to warmer climates during the winter.

deep caves. Many bats roost and/or hibernate together in groups and return to use the same roosts and/or hibernacula year after year.

Threats and Positive Influences

White-nose syndrome (WNS) is the main threat for hibernating bat species in North America. Bats with WNS often die of the disease and rapid population declines have occurred in eastern North America due to WNS. WNS is caused by an introduced fungus that affects bats during hibernation. Affected bats show loss of body fat and unusual behaviour during winter, including flying outside during the day. As of 2019, WNS has not been found in the NWT. However, at the current rate of expansion, WNS is expected to reach the NWT within the next decade.

Human impacts at hibernacula (i.e. activities that change hibernacula conditions, including accessibility, temperature, humidity, etc., or that directly disturb hibernating bats) can have negative impacts on bat populations. Removal of maternity roosts (e.g. building demolition or incidental removal of roost trees), and exclusion of bats from buildings using inappropriate methods (e.g. when bats are still using the roost, or using exclusion methods that can trap bats inside), can also have negative impacts.

Loss of roosting and foraging habitat is also a threat to bats. Changes to habitat associated with climate change affect the availability of roosting and/or foraging habitat for bats. Their use of trees for roosting makes them vulnerable to deforestation, the removal of snags (standing, dead/dying trees), and forestry practices that lead to a decline in the amount of older age forests.

In other areas, wind turbines and large-scale wind energy developments have resulted in many bat deaths. Although the NWT does not currently have any large-scale wind energy developments, future projects are being considered. The effects of wind energy developments elsewhere emphasize the need for monitoring and careful management of these types of developments in the NWT.

Additional threats include environmental contaminants and domestic cats preying on bats.

Research, increased monitoring (of populations and for the presence of WNS), and management interventions (e.g. artificial maternity roosts) in recent years have added to our understanding of bats in the NWT and the challenges they face.

Under the federal *Species at Risk Act* (SARA), the little brown myotis and northern myotis have been listed as Endangered. The listing of these bat species means that they are legally protected in the NWT where they are found on federal lands that are under the authority of the Ministers of the Environment or the Parks Canada Agency. In addition, known hibernacula have been identified as critical habitat under the federal SARA. Various action plans or management plans are also being implemented to assist with the conservation and recovery of bat species and to combat WNS at a North American level.

Management Goal and Objectives

The overall goal of this management plan is for each bat species to maintain self-sustaining, resilient populations across their range in the NWT. This will ensure that bats continue to be an important part of our ecosystems.

In order to accomplish this goal, five objectives have been established, combined with recommended approaches to achieve these objectives. Progress toward achieving these objectives will be evaluated at least every five years.

The plan recommends the following objectives and approaches:

Objective 1: Fill knowledge gaps and enhance understanding of NWT bats, using traditional, community, and scientific knowledge, to inform sound management decisions.

Approach 1.1: Identify knowledge gaps and encourage research and monitoring on bats, including collecting information on distribution, abundance and trends, health, biology, physiology, genetics, habitat, threats, and cumulative effects.

Approach 1.2: Identify, describe, and map key bat habitats (such as hibernacula and maternity roosts).

Approach 1.3: Monitor population and distribution trends.

Approach 1.4: Encourage people to report observations of bats and keep compiled records.

Approach 1.5: Encourage the collection and recording of traditional and community knowledge about bats.

Approach 1.6: Participate in collaborative research and monitoring for bats and white-nose syndrome in Canada.

Objective 2: Monitor, mitigate, and manage white-nose syndrome.

Approach 2.1: Develop and maintain an effective and coordinated surveillance program to monitor for white-nose syndrome, including timely collection, diagnosis, and reporting of test results.

Approach 2.2: Encourage reporting of unusual bat behaviour, such as flying outside during the day, and investigate these observations promptly.

Approach 2.3: Implement precautionary measures to reduce the spread of white-nose syndrome, including preventing accidental human-caused spread.

Approach 2.4: Support national/international efforts and research in disease prevention and mitigation.

Approach 2.5: Implement measures to prevent the spread and mitigate the impacts of white-nose syndrome should they become available and feasible.

Objective 3: Prevent or reduce harm to bats associated with human activities.

Approach 3.1: Complete and implement measures to prevent and mitigate negative human impacts at hibernacula, such as a Cave Management Plan.

Approach 3.2: Prevent destruction of critical habitat for bats identified under the federal *Species at Risk Act*.

Approach 3.3: Develop, promote, and implement best management practices to conserve maternity roosts, including appropriate methods for managing bats in buildings.

Approach 3.4: Promote and implement forestry management practices that maintain trees suitable for roosting.

Approach 3.5: Identify and avoid or mitigate human impacts on key bat habitats through the regulatory process (permitting, screening, and environmental assessment), legislation, land administration and land use planning, conservation areas, stewardship, or other effective mechanisms.

Approach 3.6: Participate in initiatives aimed at addressing threats that may affect bats at a continental scale, such as climate change and contaminants.

Approach 3.7: Ensure that beneficial management practices are used for wind energy developments in the NWT to avoid harm to bats.

Approach 3.8: Work with agricultural producers, gardeners, and others to promote responsible pest control and avoid the use of pesticides and herbicides.

Approach 3.9: Promote and implement best management practices for closing or reactivating underground mines that may be used by bats.

Objective 4: Increase awareness, acceptance, and stewardship of bats and their habitats.

Approach 4.1: Encourage communities to participate in bat monitoring projects.

Approach 4.2: Develop education initiatives to promote public knowledge, understanding, and acceptance of bats.

Approach 4.3: Promote stewardship activities relating to bats and/or bat habitat, such as strategic use and appropriate placement of bat boxes.

Objective 5: Manage bats using an adaptive and collaborative approach, and best available information.

Approach 5.1: Collaborate with co-management partners, other jurisdictions, and researchers on management and conservation efforts for NWT bats.

Approach 5.2: Encourage flow of information among researchers, co-management partners, regulatory boards, and the public.

Approach 5.3: Conduct periodic co-management reviews of new information, management actions, and progress made toward meeting management objectives.

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MANAGEMENT PLAN

1. INTRODUCTION

Bats are an important part of ecosystems in the Northwest Territories (NWT). Not only do they contribute to local biodiversity, they also benefit people by eating mosquitos and insect pests that affect forests and gardens. Worldwide, there are approximately 1,400 bat species, representing more than one-fifth of the world's mammal species. At least seven, probably eight, species of bats are found in the NWT: little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and likely eastern red bat (*Lasiurus borealis*).

White-nose syndrome (WNS) is the most serious threat to bat species in the NWT. This rapidly spreading disease has not been detected in the NWT to date, but at current expansion rates it could reach the NWT within the next decade. WNS predominantly affects hibernating bats (i.e. the four *Myotis* species and the big brown bat). Millions of bats have died from WNS in North America since its initial discovery in 2006/2007[2]. In addition, bats are experiencing global declines due to other important threats, including: human impacts at hibernacula, exclusion from and removal of maternity roosts, loss of roosting and foraging habitat, intentional extermination of colonies, environmental contaminants, wind turbines, domestic or feral cats preying on bats, and changes to habitat associated with climate change.

Little brown myotis and northern myotis were listed as Endangered in Canada under the federal *Species at Risk Act* in 2014, primarily due to population declines associated with WNS. In the NWT, the Conference of Management Authorities listed little brown myotis and northern myotis as species of Special Concern in 2018 under the *Species at Risk (NWT) Act*, primarily due to their vulnerability to WNS. The long-eared myotis, long-legged myotis, and big brown bat were assessed as Data Deficient in the NWT. In 2018, the federal *Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada*[3] was completed.

The main purpose of this multi-species *Management Plan for Bats in the NWT* is to define an overall management goal and to recommend objectives and approaches to guide management and conservation of bats in the NWT. Guiding principles were followed in preparing this management plan. They are provided in APPENDIX C – GUIDING PRINCIPLES.

The management plan recognizes the collaborative and interjurisdictional nature of bat management and the shared responsibility for bat management among Indigenous governments and organizations, federal/provincial/territorial governments, and co-management boards (see APPENDIX B – PLANNING PARTNERS).

2. HOW DO WE KNOW ABOUT BATS IN THE NWT?

Bat research and monitoring efforts have increased in the NWT over the past 5-10 years, allowing for an increased understanding of bat species in the NWT. However, there are many knowledge gaps with respect to their population, distribution, habitat availability, biology, and threats.

Traditional knowledge about bats in the NWT appears sparse, however, there has been limited effort to seek out or document traditional knowledge about bats. Bats are not harvested in the NWT, and public perceptions about bats are mixed. People in southern NWT communities are aware of bats because they have seen or heard about bats roosting in buildings, or flying around at dusk. In the Gwich'in Settlement Area, bat awareness has increased and occasional sightings have been reported, but remain unconfirmed. In recent years, local parks, governments, Indigenous governments and organizations, renewable resources boards, non-government organizations, and researchers have increased public awareness about bats and engaged community members in education events and campaigns. News stories about WNS and the species at risk process have also raised the profile of bats. People have been encouraged to report their NWT bat observations and reporting has increased.

Prior to 2006, scientific information about bats in the NWT was sparse due to the territory's large area, small human population and very few roads, and the relatively low management priority given to bats in the past. Explorers and naturalists in the 1800s and early 1900s recorded occasional bat observations, and ecological surveys in the 1970s recorded bats as part of general wildlife inventories. Since 2006, survey work has included a bat survey in the Nahanni / Fort Simpson area, multiple years of research on bat ecology in the South Slave region, discovery and surveys of some bat hibernacula, maternity roost surveys in some Dehcho and South Slave communities, and acoustic monitoring of bats in various locations of the NWT.

The bat distribution maps in this management plan were made using data from the NWT Wildlife Management Information System (WMIS).[4] The WMIS database includes information from bat surveys, monitoring, research, reports, museum records, and reported observations in the NWT. Data sources up to 2013 are described in Wilson *et al.* (2014).[5] Additional data sources for 2014 to 2019 include: bat and bat roost surveys by Environment and Natural Resources (ENR) (South Slave and Dehcho regions, 2017-2019); bat research by Cori Lausen and the Wildlife Conservation Society, Canada (Little Buffalo River Falls Territorial Park, 2018); bat research by Laura Kaupas, Jesika Reimer, and Robert Barclay (South Slave region, up to 2015); acoustic surveys by the Gwich'in Renewable Resources Board (Gwich'in Settlement Area, 2017-2018), Zonal Ecosystem and Wildlife Consultants (Łutsel K'e area, 2017), Parks Canada (Náats'ı̨hch'oh and Nahanni National Park Reserves, 2014-2019), and ENR (various locations, 2014-2018); and incidental bat observations reported to ENR.

Bat species are hard to tell apart and can have similar echolocation calls. Records in this document are categorized as confirmed or unconfirmed following evidentiary standards used by Wilson *et al.* (2014).[5] Records where species identification could be

confirmed through morphology or genetics, such as captures, specimens, and photos for certain distinctive-looking species, are confirmed. Acoustic recordings identified to species are unconfirmed because of the possibility of misidentification, except for hoary bat acoustic recordings, which are distinctive and therefore considered confirmed. Acoustic recordings that were clearly bats but could not be identified to species were confirmed as a bat, but the species was unknown. All sightings are unconfirmed. On the maps in this document, the records are labeled as 'confirmed' or 'unconfirmed' to reflect this uncertainty.

Bat ranges are depicted using Ecosystem-based Automated Range (EBAR) mapping. EBAR is a method that combines biodiversity data with expert knowledge to describe species occurrences. Ecoshape mosaics (a mosaic of joined ecoregions, ecodistricts, or similar ecological land classifications) are populated with species presence information. Expert knowledge holders then review the EBAR map and modify species presence based on additional data and/or on-the-ground knowledge.[6] The ecological regions used for mapping within the NWT are based on the NWT land classification program.[7]

Information on the four *Myotis* species and big brown bat in the NWT was summarized by the Species at Risk Committee (SARC) in 2017 in their status report and assessment of big brown bat, little brown myotis, northern myotis, long-eared myotis, and long-legged myotis. Some new information has been gathered since then and is incorporated into this management plan. Most information on NWT bats and their ecology is focused on little brown myotis and northern myotis. There is much less information available for the other bat species.

3. SPECIES INFORMATION

All bat species in the NWT belong to the family Vespertilionidae ('vesper bats' or 'evening bats') (Table 1).

Table 1: Common and scientific names.

English Common Name(s)	Scientific Name	French Common Name(s)
Little brown myotis Little brown bat	*Myotis lucifugus*	Vespertilion brun Petite chauve-souris brune
Northern myotis Northern long-eared bat	*Myotis septentrionalis* (classified as *Myotis keenii* prior to 1979)	Vespertilion nordique Chauve-souris nordique
Long-eared myotis Western long-eared bat	*Myotis evotis*	Vespertilion à longue oreilles Chauve-souris à longue oreilles
Long-legged myotis Hairy-winged bat	*Myotis volans*	Vespertilion à longue pattes Chauve-souris à longue pattes
Big brown bat	*Eptesicus fuscus*	Sérotine brune Grande chauve-souris brune
Silver-haired bat	*Lasionycteris noctivagans*	Chauve-souris argentée
Hoary bat	*Lasiurus cinereus*	Chauve-souris cendrée
Eastern red bat	*Lasiurus borealis*	Chauve-souris rousse Chauve-souris rousse de l'est

Common names or terms for bat in Indigenous languages:

Tsáret'áneé (bat)	Chipewyan – Denínu Kue and Łutsel K'e
Gúłǫ́olía dlụą det'onı (bat)	South Slavey - Kátł'odeeche
Dlûâ det'oni (mouse + flying/migrating bird)	Dene Zhatie [Fort Providence][8,9]
Dléa det'ǫne (flying squirrel)	Shúhta/Shíhta Got'ıne or Mountain and K'áalo Got'ıne or Willow Lake dialects [Tulít'a], Déline Got'ıne, K'ásho Got'ıne [Fort Good Hope and Colvılle Lake]
Dl̀ı̨ą k'et'à (flying mouse)	Tłı̨chǫ[10]
Daatsadh natandıt'ee (flying mouse)	Gwichyah Gwich'in
Daatsoo natındıt'ee (flying mouse)	Teetł'it Gwich'in

3.1. Description, Biology, and Habitat Needs of Bats in the NWT

Bats are mammals, and they are the only mammals capable of true flight. Their forelimbs are modified for flight and their wings consist of a thin, double-layered membrane of skin stretching over the arms, hands, and fingers[11] (Figure 1). Bat species can be difficult to tell apart, and even an expert might confuse certain species with each other. Distinguishing characteristics can include body size, fur colour and pattern, length and shape of the ear and tragus[c], and presence or absence of a keel[d] on the calcar[e]. To aid in the identification of bat species in the NWT, the reader may refer to the key in Nagorsen and Brigham (1993)[11].

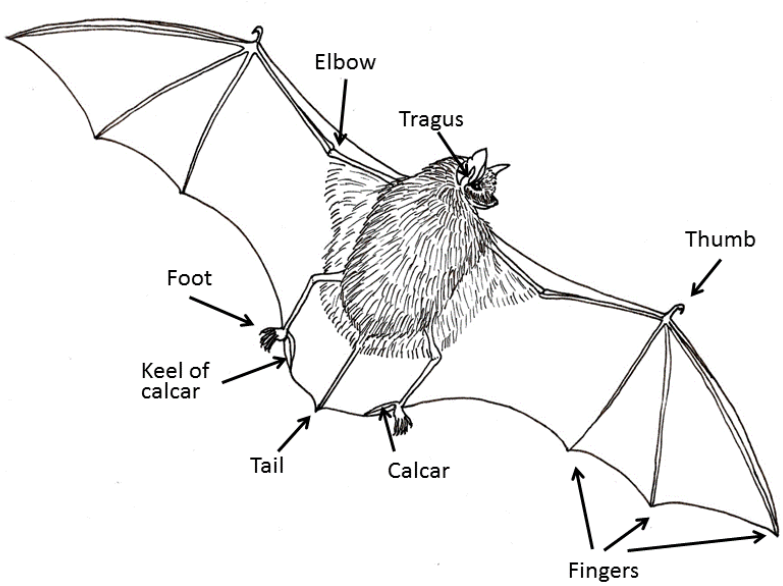

Figure 1: Parts of a bat, as mentioned in the text. Figure courtesy B. Fournier, ENR.

Bats are most active at night and rest during the day (nocturnal). Bats are not blind, but they primarily rely on echolocation[f] to determine shapes, distances, and sizes of objects, and to find food and navigate through the night skies. Echolocation can be used to monitor and study bats, by detecting and recording the ultrasound calls with special acoustic recording devices. Although certain bat species have identifiable calls, there is overlap in call characteristics among some species and calls can vary depending on the surroundings, so it is not always possible to identify bat calls to species. For example, big brown bat calls and silver-haired bat calls are difficult to tell apart.

All NWT bats are insectivorous, meaning they eat insects and other arthropods. Some can consume their own body weight in insects each night. A little brown myotis can eat as many as 600 mosquito-sized insects in one hour. Insectivorous bats forage using

[c] Tragus: a small flap of cartilage in the external ear.
[d] Keel: a flap of skin extending beyond the calcar.
[e] Calcar: cartilage frame for the tail membrane.
[f] Echolocation is the ability to produce pulses of high-frequency, ultrasonic sound and listen for the returning echoes to obtain information on surroundings (Nagorsen and Brigham 1993).

either aerial hawking (capturing flying insects in the air) or gleaning (capturing insects off foliage or other surfaces), or a combination of both techniques.

Food availability determines the timing of birth, survivability of young, and ultimately, reproductive success. Females may forego reproduction in a year of low insect abundance, poor weather, or low fat reserves. Typically, not all mature females reproduce every year, and in some years the majority of females might forego reproduction.

Bats use daily torpor[g] and seasonal hibernation to conserve energy during periods of low prey abundance (e.g. winter) and/or increased energetic exposure (e.g. cooler temperatures). They enter into torpor to survive extreme and/or unfavourable conditions.

Bats are long-living and reproduce relatively slowly, which makes them sensitive to population decline. Globally, the average lifespan for bat species in the family Vespertilionidae (composed of 354 species) is approximately 15 years. For example, the maximum estimated lifespan of little brown myotis based on banding recoveries is 34 years.

Individual bats become sexually mature their first or second year. Mating occurs during the autumn. Females store sperm over winter and fertilization occurs during spring ovulation. In most NWT bat species, the female typically produces only one offspring per year and twinning is rare. However, the silver-haired bat[12] can have one or two pups, and hoary[13] and eastern red bats[14], while typically giving birth to twins, can have up to four pups.

Figure 2: Pre-fledged little brown myotis (Myotis lucifugus) pup on a post below a bat box at Lady Evelyn Falls campground, Kakisa, NWT (photo credit: M. Grabke, ENR).

All eight species exhibit similar life cycle stages, including pre-fledged pup (Figure 2), pre-weaned fledgling[h], weaned fledgling, and reproductive adult. Pups feed exclusively on milk until they fledge. The duration of pregnancy and milk production is affected by the extent of daily torpor use (increased torpor results in slower fetal development and longer pregnancy, as well as delayed and lower milk production in lactating females). The extent of daily torpor use is related to roost temperature, forage availability, and other environmental factors such as precipitation.

In the summer, NWT bats roost (rest) in tree hollows or crevices, under tree bark, among the leaves of trees, in caves, in rock crevices, and in buildings. Roosts provide shelter,

[g] Torpor is a state of lowered activity, metabolism, heart rate, respiration, and body temperature, and is used by individuals to conserve energy.
[h] A fledgling is a juvenile bat that can fly.

protection from predators, and suitable temperature and humidity conditions. Roost preferences vary depending on the species, sex, age, and reproductive status of the bat. Roosts used by reproductive females and their young are called 'maternity roosts' – these roosts are typically warm, to help promote growth and lactation. In some species, reproducing females tend to gather together in groups to roost in a 'maternity colony'. Many bats show strong fidelity to roosts or to a group of roosts, returning year after year to the same roost or to the same patches of roosting habitat.

Large trees, and dead or decaying trees, are often important for summer roosting. This is probably partly why many bat species are more abundant in older forest stands. The relative importance of natural versus artificial roosts is not well studied, but artificially heated roosts in buildings (i.e. attics) seem to be especially important for bats in the north, and one study in the Yukon found that bat activity was higher near communities[15].

In the winter, some NWT bat species migrate south to warmer areas (silver-haired bat, hoary bat, and eastern red bat), but most species overwinter in hibernacula (little brown myotis, northern myotis, long-eared myotis, long-legged myotis, and big brown bat). Bats require hibernacula with high relative humidity (>80%) and stable, cool temperatures above freezing (2-12^{0}C). Hibernation sites are typically re-used by bats year after year. Most known hibernation sites in North America are in deep caves or abandoned mines, but overwintering in rock crevices, buildings, trees, and small cavities in scree fields and tree root wads has also been documented, particularly in the west. There are few large hibernacula known in western Canada and relatively little is known about overwintering of bats in the north.

There are four known bat hibernacula in the NWT, and they are all naturally-formed underground caves. The two hibernacula in the South Slave region, SSR-1 and SSR-2, are shared by little brown myotis, northern myotis, and big brown bats (Figure 3). Winter surveys between 2011 and 2015 found an average of approximately 2,900 bats overwintering in SSR-1 and 700 in SSR-2. Two other bat hibernacula were recently discovered in Nahanni National Park Reserve; the species using these sites and the number of individuals have not been confirmed.[16] Additional hibernacula may exist elsewhere in the NWT.

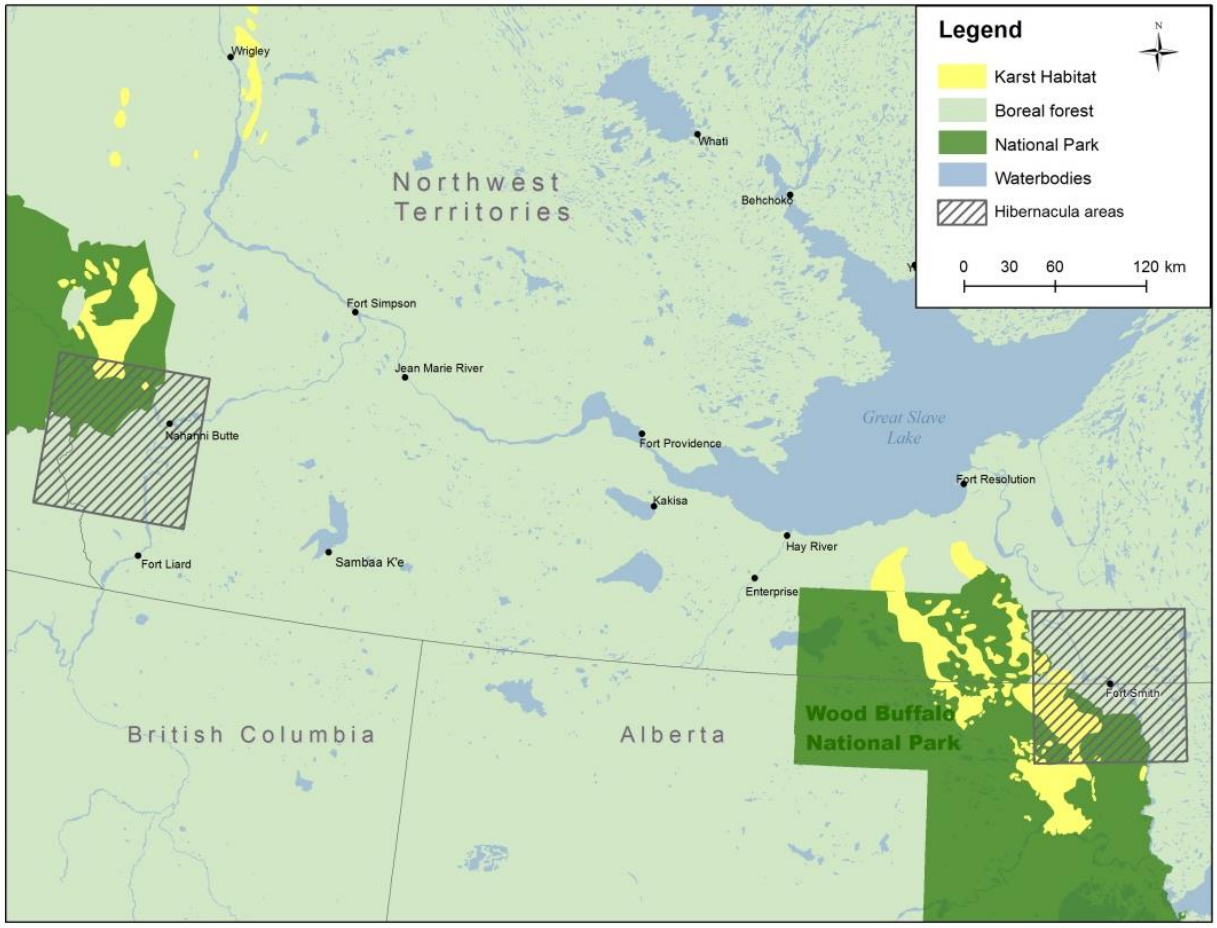

Figure 3: General areas containing known bat hibernacula in the South Slave and Nahanni regions, NWT. Hibernacula are critical habitat under the federal Species at Risk Act and these areas match the grid squares mapped in the national recovery strategy[3] as containing critical habitat for little brown myotis. Specific locations of hibernacula are deemed sensitive information; contact A. Kelly, ENR or S. Arnold, Parks Canada for further information. The karst terrain shape files were provided by the NWT Protected Areas Strategy and Wood Buffalo National Park.

During each spring and autumn, hibernating bat species migrate between their winter hibernacula and summer roosts. At northern sites (NWT, Alberta, and Yukon), the active period (emergence from hibernacula to return in the fall) has been documented to range between April/May to September/October. In the fall, bats gather at or near the hibernation site to mate – this is called 'swarming'.

Bats are widespread in the southern NWT, with all observations occurring below the treeline. The Nahanni National Park Reserve and the Liard valley have high bat species diversity relative to other parts of the NWT. Distribution maps are provided for each species in the sections that follow. However, there are also records of bats that could not be identified to species (from acoustic recordings or photos), as well as sightings of bats that have been reported (as noted previously, sightings are all considered unconfirmed). Some of these sightings are in areas outside of the known ranges of NWT bats (Figure 4), however, the northern distribution limit of bats is not well known, and we still have a lot to learn about their distribution throughout the NWT.

Population abundance and trend information is lacking for bats in the NWT. However, winter surveys performed annually from 2011 to 2015 indicated a stable population of *Myotis* at the SSR-1 hibernaculum, with slight annual fluctuations around a population of about 2,900 bats. In the absence of WNS, there is no reason to suspect declines in the NWT at this time.

Figure 4: Observations of unknown bat species (of the family Vespertilionidae) in the NWT. Map courtesy B. Fournier, ENR. Data from the NWT Wildlife Management Information System.[4]

3.1.1. Little Brown Myotis

The little brown myotis is a small brown-coloured bat, weighing about 7-14 grams or about the same as a toonie ($2 coin). It has a short, blunt tragus and ears that do not extend past its nose when pushed forward (Figure 5). Its calcar does not have a keel.

Figure 5: Little brown myotis (Myotis lucifugus) (photo credit: Allicia Kelly, ENR).

Little brown myotis have flexible foraging behaviour. They primarily capture insects in the air but are also able to glean prey off of plants and other surfaces. They typically forage in relatively open areas such as along trails, over ponds, and along forest edges. Little brown myotis feed on a wide range of insect types typically 4-9 millimeters (mm) in size, including insects associated with water, such as midges, caddisflies, and mayflies. Little brown myotis also eat spiders, more frequently in the north compared to the south.[17,18,19]

The little brown myotis is the most widespread bat in North America and ranges from Newfoundland and Labrador to Alaska at its northern limits, and from Florida to California at its southern limits. In the NWT, the little brown myotis is the most widespread and abundant bat species. The little brown myotis is expected to be present throughout the Dehcho and South Slave regions, and north along the Mackenzie River. The most northern confirmed record is a single specimen found in 2012 in Colville Lake, in the Sahtú region (occurring far outside known range), however, the northern limits of its range are not well known (Figure 6).

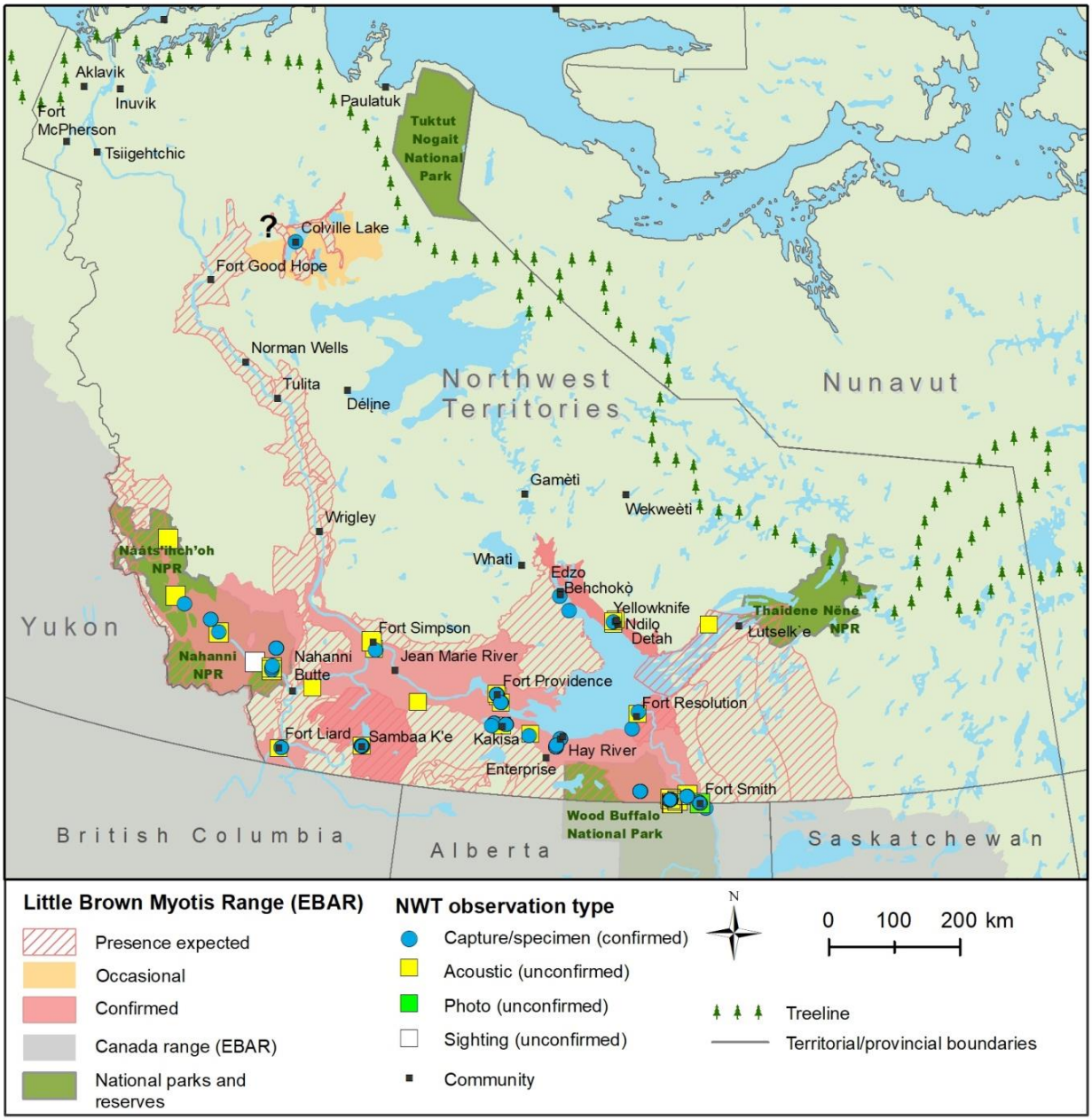

Figure 6: Approximate distribution of little brown myotis (Myotis lucifugus) and locations of species records in the NWT. The question mark represents uncertainty about the extent of northern range. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

Little brown myotis hibernate during the winter. This species has been found overwintering in SSR-1 and SSR-2 (see section 3.1), as well as in Walk-in Cave in Wood Buffalo National Park, just south of the NWT border.

Little brown myotis appear to reproduce across the South Slave and Dehcho regions of the NWT. Maternity colonies are most often observed in human-made structures. These may be especially important in the northern part of their range, although the potential

importance of tree roosts to reproductive females is not well known. Maternity colonies of little brown myotis can typically be quite large; for example, hundreds of individuals. Summer roosts for males and non-reproductive females are typically in trees, rock cliffs, or buildings.

As of 2019, 13 little brown myotis maternity colonies (see section 3.1; summer congregations of reproductive females and their young) have been documented in the NWT, all in human-made structures (buildings or human-built bat boxes) (Figure 7). Colony size ranges from 22 to 272 adult bats, with a median (middle) value of 70.[20]

Figure 7: Locations of known little brown myotis (Myotis lucifugus) maternity colonies and other records of reproductive females for little brown myotis in the NWT (each maternity colony location has multiple colonies). Data from the NWT Wildlife Management Information System.[4] Map courtesy B. Fournier, ENR.

3.1.2. Northern Myotis

The northern myotis is a small brown bat, similar in size to little brown myotis (about 5-10 grams). The northern myotis is distinguished through the lack of a keel on the calcar, a long, wispy tragus, and ears that extend past the nose when pushed forward (Figure 8).

Figure 8: Northern myotis (Myotis septentrionalis) (photo credit: Cori Lausen).

Northern myotis have flexible foraging behaviour, capturing insects from the air and gleaning them off plants and other surfaces, however, they are more specialized for gleaning (see section 3.1). They are generally associated with boreal forests. They often forage within the forest under closed canopy, but also use trails and other open forest corridors. Northern myotis feed primarily on moths, beetles, caddisflies, true flies, and non-flying prey items such as spiders and moth larvae.

The northern myotis is present across Canada and the central and eastern United States. In the NWT, northern myotis are broadly distributed in the Dehcho and South Slave regions (Figure 9).

Northern myotis hibernate during the winter. They are thought to overwinter in SSR-1 because individuals have been captured flying in and out of the cave during spring and autumn. They are also thought to overwinter in Walk-in Cave in Wood Buffalo National Park, Alberta.

Northern myotis typically form maternity colonies in small groups (e.g. 11-65 females). Maternity roosts are typically located in tree cavities and under loose bark. Reproductive females frequently move among roosts in the same general area and show fidelity to patches of roosting habitat. Active maternity colonies have been documented in the Fort Smith area where reproductive females were found to be using cavities or cracks of large, mature, trembling aspen trees. Reproductive females have also been captured at Fort Liard (Figure 10).

Figure 9: Approximate distribution of the northern myotis (Myotis septentrionalis) and locations of species records in the NWT. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

Figure 10: Locations of known northern myotis (Myotis septentrionalis) maternity colonies and other records of reproductive females for northern myotis in the NWT. Maternity colonies have multiple roost trees. Data from the NWT Wildlife Management Information System.[4] Map courtesy B. Fournier, ENR.

3.1.3. Long-eared Myotis

The long-eared myotis is a small brown bat, similar in size to little brown and northern myotis (about 4-9 grams). The long-eared myotis has no keel on the calcar, a long, slender tragus, and the longest ears of all North American *Myotis*, which extend 5 mm or more past the nose when pushed forward (Figure 11).

Figure 11: Long-eared myotis (Myotis evotis) (photo credit: Donald Solick).

Long-eared myotis have flexible foraging behaviour and can capture insects from the air or glean them off plants and other surfaces, but they are more specialized for gleaning. They typically forage near dense vegetation, in forests, and along paths within forests. They typically feed on beetles, moths, and other insects. Throughout their range, they are found in a wide variety of habitats and at various elevations.

The long-eared myotis is a western species. It ranges across most of western North America, occurring only as far east as Saskatchewan and North/South Dakota. In the NWT, the long-eared myotis has been documented in the South Nahanni watershed, including one capture and echolocation recordings at five locations, obtained during a survey in 2006 (Figure 12). Long-eared myotis occur in the Liard watershed in northern British Columbia, so they may also be present in the Liard valley of the NWT, but have not been confirmed there yet. Echolocation calls classified as long-eared myotis have also been recorded at other locations in the southern NWT. However, these records should be interpreted with caution until confirmed with a capture or specimen, because of the potential for calls to be confused with another species. It is likely that this population is smaller and more restricted in range than the little brown and northern myotis.

Long-eared myotis hibernate during the winter, however, overwintering sites for this species in the NWT have not been confirmed. Overwintering behaviour of long-eared myotis is not well known anywhere, but in the United States they have occasionally been seen hibernating in caves.

Reproduction of long-eared myotis has not yet been documented in the NWT. Elsewhere in their range, reproductive females form relatively small maternity colonies (fewer than 30 individuals) in snags, stumps, rock crevices, and human-made structures. They frequently switch between roosts but the distances between roosts are short, and colonies show fidelity to patches of habitat. Non-reproductive females, and probably males, are more likely to roost alone and in slightly cooler roosts.

Figure 12: Approximate distribution of the long-eared myotis (Myotis evotis) and locations of species records in the NWT. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

3.1.4. Long-legged Myotis

The long-legged myotis is a small brown bat (about 6-10 grams) similar in size to a little brown myotis. It has a prominent keel on the calcar, a short, blunt tragus, and short ears that do not extend past the nose when pushed forward (Figure 13). It also has a light layer of fur on the underwing extending from the elbow to the knee.

Figure 13: Long-legged myotis (Myotis volans) (photo credit: Donald Solick).

The foraging behaviour of the long-legged myotis is not well known, but it appears to be an aerial hawking species. It feeds primarily on moths and beetles. It forages in a variety of habitats, including cluttered areas like riparian forest and under the forest canopy, as well as in more open areas.

The long-legged myotis is a western species. It ranges across most of western North America, occurring only as far east as Alberta and North Dakota.

In the NWT, the long-legged myotis has been documented through captures in the South Nahanni watershed and the Liard valley (Figure 14). Mist-netting surveys in the South Slave region have not yielded additional observations; therefore, similar to the long-eared myotis, it is likely that this population is smaller and more restricted in range than the little brown and northern myotis.

Long-legged myotis hibernate during the winter but overwintering sites for this species in the NWT have not been confirmed. Elsewhere, this species has been found hibernating in caves with other *Myotis* species.

Reproduction of long-legged myotis in the NWT was recently confirmed by the capture of a reproductive female at Fort Liard (Figure 15). Elsewhere in their range, reproductive females form relatively large maternity colonies (hundreds of individuals) in rock cracks, snags, and buildings, and may share roosts with little brown myotis. Males and non-reproductive females occasionally roost in buildings but are primarily found roosting in coniferous forest, using natural roosts such as snags, loose tree bark, rock crevices, and cracks in the ground.

Figure 14: Approximate distribution of the long-legged myotis (Myotis volans) and locations of species records in the NWT. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the map are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

Figure 15: Records of reproductive females for long-legged myotis (Myotis volans) in the NWT. Data from the NWT Wildlife Management Information System.[4] Map courtesy B. Fournier, ENR.

3.1.5. Big Brown Bat

The big brown bat is a larger species of bat (about 14-21 grams). It can be distinguished from the *Myotis* species by its large size and from the silver-haired, hoary, and eastern red bats by its brown colour[11] (Figure 16).

Figure 16: Big brown bat (Eptesicus fuscus) (photo credit: Cori Lausen).

Big brown bats are primarily aerial hawkers, feeding mostly on large-bodied insects, including beetles, moths, and caddisflies. They typically forage high in the air, above the treetops rather than below the canopy and over habitats such as standing water, riparian areas, and forests.

The big brown bat is found across North America from Canada to the northern tip of South America. Its confirmed distribution (captures or specimens) includes all of the Canadian provinces and the NWT, and all of the continental United States except Alaska. The big brown bat likely also ranges in the Yukon based on unconfirmed records (acoustic recordings and sightings).

In the NWT, the distribution of big brown bat records is patchy (Figure 17). The big brown bat is expected to be present in the South Slave region around Fort Resolution and Fort Smith, as well as in the Liard valley. Low-frequency echolocation calls, which could be from big brown bats or silver-haired bats, have been recorded at several other locations in the southern NWT.[4] Further work is required to confirm species identification and presence. The northernmost record of big brown bat was recently confirmed in a cave near Tulít'a in 2018, however, this record may be extralimital.

The big brown bat hibernates in the winter, and most known hibernation sites are caves. Big brown bats tend to prefer colder, more exposed areas within the caves compared to *Myotis* species. Big brown bats can also overwinter in rock crevices and occasionally in buildings. In the NWT, big brown bats are known to overwinter in SSR-1 as well as in Walk-in Cave in Wood Buffalo National Park, Alberta.

Reproductive female big brown bats typically form maternity colonies of 5-75 individuals in human-made structures, tree cavities, and rock crevices. Both reproductive and non-reproductive individuals may change roosts frequently throughout the season. Neither reproductive females nor juveniles have been captured in the NWT. However, juvenile big brown bats have been captured immediately south of the NWT in Wood Buffalo National Park, Alberta; it is therefore possible that big brown bats are breeding in the NWT as well.

Figure 17: Approximate distribution of the big brown bat (Eptesicus fuscus) and locations of species records in the NWT. The question mark symbol (?) represents uncertainty about the northern extent of the range. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

3.1.6. Silver-haired Bat

The silver-haired bat is a small species of bat (about 11 grams) with black wings and dark (black or dark brown) fur with scattered silver-tipped hair that gives it a frosted appearance. The ear is short and round with a short, blunt tragus and the calcar lacks a keel (Figure 18).[11,12]

Figure 18: Silver-haired bat (Lasionycteris noctivagans) (photo credit: Cori Lausen).

The silver-haired bat is a relatively slow, agile flier. It typically forages in or near forested areas, often in clearings or over ponds. This species of bat preys on a variety of small insects, including moths, midges, leafhoppers, caddisflies, flies, beetles, and ants. Silver-haired bats are particularly good at foraging on swarms of flying insects, but may exploit whatever insect prey is available.[11,12,21,22,23]

In the summer, silver-haired bats are widely distributed across the Canadian provinces, the United States, and Mexico. In British Columbia and southeast Alaska, at least some silver-haired bats stay through the winter and there are occasional reports of this species hibernating in caves, mines, and trees. However, through most of their range, silver-haired bats migrate south for the winter. Females tend to return earlier in the spring and may migrate farther than males.[11,21,24,25,26]

There are very few silver-haired bat records from the NWT. One silver-haired bat was photographed at Fort Resolution in September 2011, and acoustic recordings of silver-haired bats were made near Fort Smith in July 2011 (Figure 19). The silver-haired bat is expected to occur between Fort Smith and Fort Resolution. Low-frequency echolocation calls that could be from silver-haired bats or big brown bats have been recorded at several other locations in the southern NWT. However, very little is known about this species in the north.[5]

The silver-haired bat primarily uses trees for roosting and can be found under loose bark or in tree crevices or cavities. During summer, silver-haired bats roost alone, in small groups of a few individuals, or in small maternity colonies (e.g. 10-22 individuals). Woodpecker cavities may be especially important for maternity colonies. During migration, silver-haired bats typically roost alone.[11,12,21,27,28]

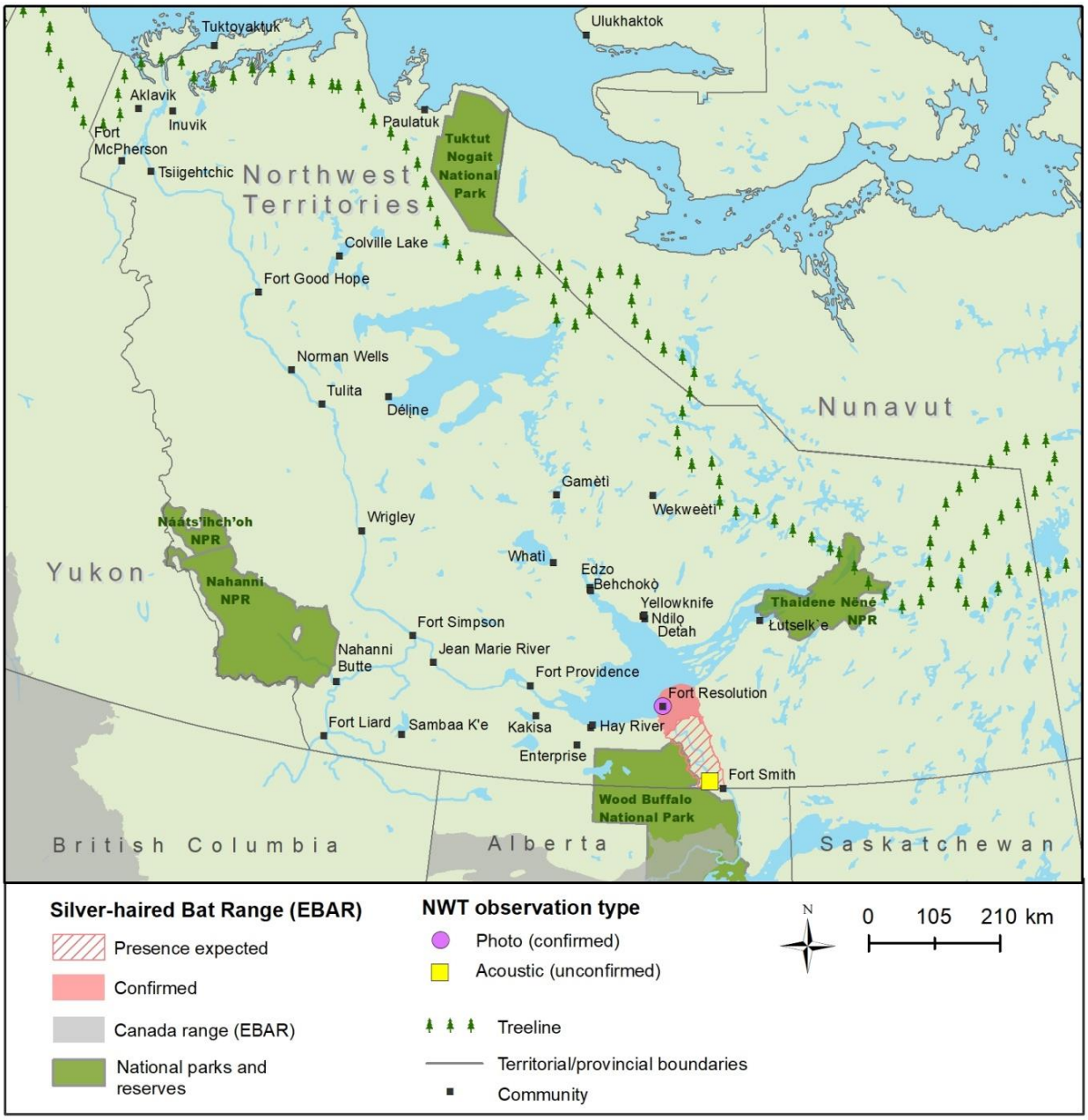

Figure 19: Approximate distribution of the silver-haired bat (Lasionycteris noctivagans) and species records in the NWT. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

3.1.7. Hoary Bat

The hoary bat is the largest bat in Canada (about 28 grams) and easily identifiable. The fur on its back is long and soft, with a mix of dark brown and grey hairs tinged with white, giving it a distinctive frosted appearance. It has yellow fur on the throat, around the ears, and on the underside of the wing. It has dense fur on the upper side of the tail membrane and short, rounded ears (Figure 20).[11,13,21]

Figure 20: Hoary bat (Lasiurus cinereus) (Photo credit: MerlinTuttle.org).

Hoary bats roost in the branches of coniferous and deciduous trees among the needles and leaves. Their roosts are typically along the edges of clearings or fields, near the end of a branch, sheltered by a dense cover of overhanging foliage. They are only occasionally found roosting in tree cavities, and rarely in caves or buildings.[11,13,21,29,30]

Hoary bats are very fast and straight fliers. They typically forage high off the ground (7-15 meters), at or above treetop level, catching insects in the air.[21] Hoary bats typically prey on larger insects such as moths, beetles, dragonflies, and water boatmen. Hoary bats are attracted to insect concentrations at lights outside of buildings.[11,13,21,22,23]

The hoary bat is a solitary species. In summer, hoary bats usually roost alone or in a small family group of less than five individuals, consisting of a female and her young. Unlike most bat species of the NWT, female hoary bats do not congregate in maternity colonies. Because their roosts are more exposed compared to other bat species, female hoary bats forage for shorter times and will stay with their under-developed young for longer periods to keep them warm. Hoary bats may form groups during migration.[11,13,21,29]

The hoary bat is the most broadly distributed North American bat species. It is found across the continent, including in parts of northern Canada and Alaska, as well as in South America. Hoary bat records in the NWT include one sighting and several acoustic recordings from scattered locations, all from between June and August (Figure 21).[13,21,26,31]

Hoary bats migrate long distances for the winter (hundreds of kilometers). Hoary bats overwinter in the southern United States (e.g. California) and Mexico, as well as in coastal regions of North America with non-freezing temperatures. Depending on the climate of their wintering grounds, they may remain active through the winter or hibernate for some or all of it. Female and male hoary bats exhibit different migration patterns. Females tend to return to their summer range earlier in the spring and may migrate farther than males.[13,24,29,32]

With their excellent camouflage, hoary bats are rarely seen, but their calls are frequently recorded on bat detectors and are often distinguishable from other species. Loud chirping calls by hoary bats are also audible to the human ear.[11]

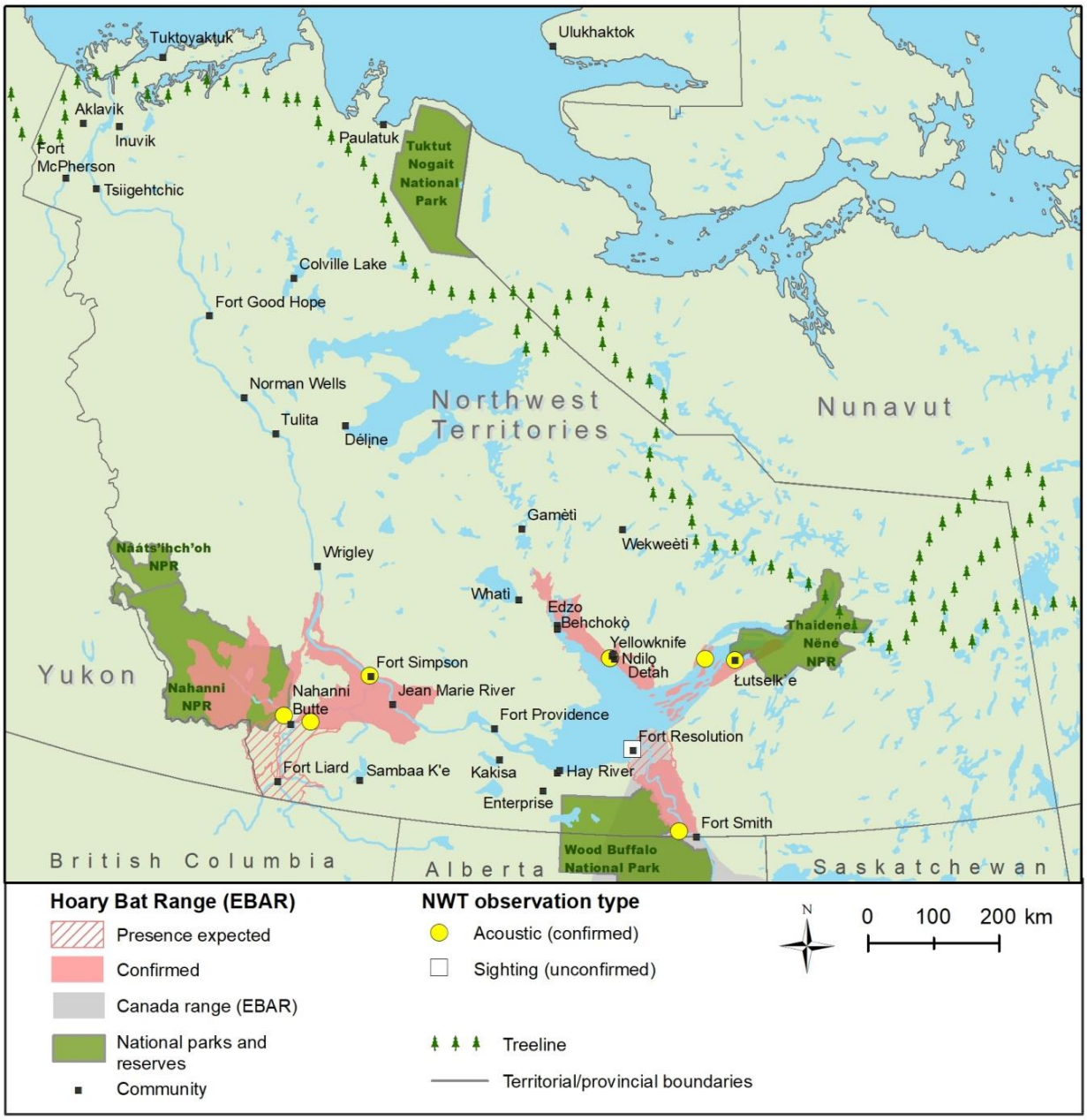

Figure 21: Approximate distribution of the hoary bat (Lasiurus cinereus) and species records in the NWT. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

3.1.8. Eastern Red Bat

The eastern red bat is a medium-sized bat (about 13 grams). Its long, soft fur has a distinctive orange to red colouring that stands out and makes it easy to identify. It has dense fur on the upper side of the tail membrane and short, rounded ears (Figure 22).[14,21]

The eastern red bat roosts in the foliage of trees, clinging to twigs or to the stalks of leaves. They seem to prefer deciduous trees over conifers. They can also be found roosting in shrubs, and sometimes roost quite low down in the branches. A typical roost site may be covered in dense leaves all around but open below, and be located along a forest edge. A roosting red bat can resemble a dead leaf and be difficult to spot.[14,21,33,34]

Like the hoary bat, the eastern red bat is solitary. They roost alone or in small family groups consisting of a mother and her young, and do not form maternity colonies. However, multiple eastern red bats may sometimes be seen migrating or feeding together.[14,21]

Figure 22: Eastern red bat (Lasiurus borealis) (photo credit: Cori Lausen).

The eastern red bat is a fast, moderately maneuverable flier that tends to forage in relatively open areas. Eastern red bats forage on a range of prey captured in the air. They typically prey heavily on moths, but also eat other insects such as beetles, flies, leafhoppers, crickets, and cicadas. In eastern North America they are often seen feeding on swarms of insects around streetlights.[14,21,35,36]

The eastern red bat is generally considered a species of eastern North America, with a range from southern Canada to Mexico. However, in the past 15 years it has been documented repeatedly in the west, including in Alberta and British Columbia. This could be a sign of range expansion, or it could be the result of increased survey effort. The eastern red bat is suspected to occur in the NWT based on a September sighting and a July echolocation call recording in Nahanni National Park Reserve, and August echolocation call recordings on the east arm of Great Slave Lake (Figure 23). An echolocation call recording resembling eastern red bat was also obtained at Pine Lake in Wood Buffalo National Park, Alberta in 2010. Eastern red bats are also expected to be present in the Liard valley. None of these records have yet been confirmed.[37,38,39,40,41,42]

Eastern red bats migrate for the winter, to the southeastern United States and Mexico. In their winter range they can hibernate in tree foliage, in tree cavities, under loose bark, and in leaf litter, and are occasionally encountered in caves. They can also spend time actively foraging if environmental conditions are favourable.[14,21,24,43,44,45]

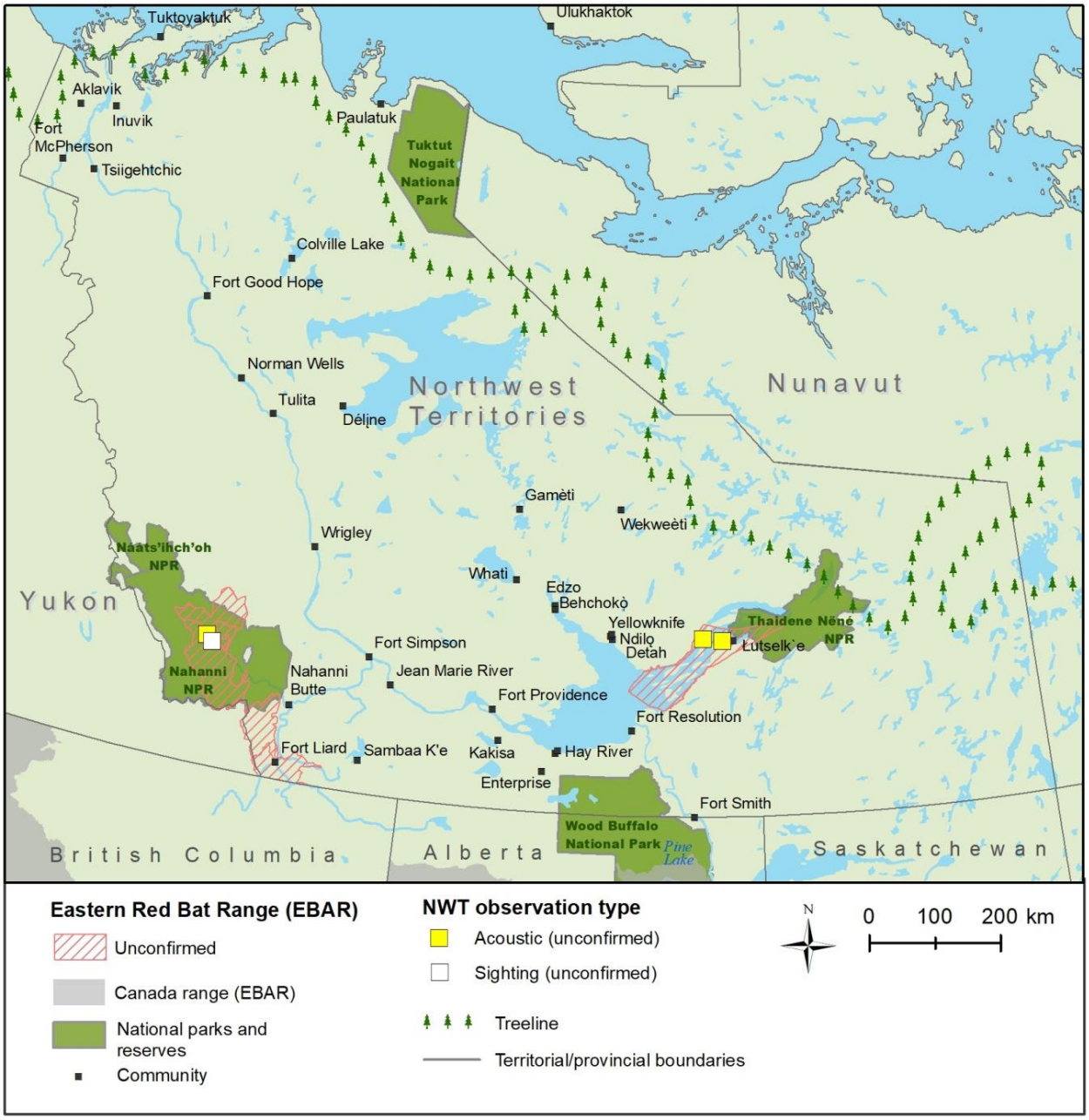

Figure 23: Approximate distribution of the eastern red bat (Lasiurus borealis) and species records in the NWT. Data from the NWT Wildlife Management Information System.[4] The Canada range portions of the maps are from © NatureServe Canada EBAR Map 2019 under Creative Commons Attribution 4.0 International License. Map courtesy B. Fournier, ENR.

4. LIMITING FACTORS, THREATS, AND POSITIVE INFLUENCES

In North America, hibernating bat species are undergoing rapid declines due to WNS. Important threats to bats in the NWT also include human impacts at hibernacula (i.e. activities that change hibernacula conditions, including accessibility, temperature, humidity, etc., or that directly disturb hibernating bats), removal of maternity roosts (e.g. building demolition or incidental removal of roost trees), and exclusion of bats from maternity roosts using inappropriate methods (e.g. when bats are still using the roost, or using exclusion methods that can trap bats inside). Additional threats include loss of roosting and foraging habitat, environmental contaminants, domestic or feral cats preying on bats, and changes to the habitat associated with climate change. Wind turbines represent a possible future threat in the NWT as they can cause large-scale mortality of bats.

4.1. White-Nose Syndrome

White-nose syndrome (WNS) is considered one of the worst wildlife diseases in modern times. It has devastated many bat species and has resulted in the deaths of millions of bats in North America. In eastern Canada, the effects of WNS have been catastrophic and declines have been estimated at more than 90% in hibernating *Myotis* species. As of 2019, WNS is not known to be present in the NWT or in neighbouring jurisdictions, however, surveillance for WNS in the NWT is limited. WNS continues to spread rapidly and WNS could reach the NWT within the next decade, or even sooner.

The impact that WNS has had on bats prompted national and territorial species status assessments and listings. In 2013, an emergency assessment was completed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Shortly after this, in 2014, the little brown myotis and northern myotis were listed nationally as Endangered species in Canada[46]. In 2017, the Species at Risk Committee (SARC) in the NWT assessed little brown myotis and northern myotis as species of Special Concern. They were subsequently listed as species of Special Concern in the NWT in 2018 by the Conference of Management Authorities (CMA). The status of long-eared myotis, long-legged myotis, and big brown bat in the NWT were also assessed in 2018 but the assessments were Data Deficient.

WNS was initially discovered in New York during winter 2006/2007 and has spread rapidly (Figure 24). WNS is caused by the fungus *Pseudogymnoascus destructans (P. destructans)*. The fungus likely arrived in North America from Europe, where it is known to occur on other bat species, but without the same devastating mortality. In North America, the fungus creates an infection of the skin while bats are hibernating. It can appear as white fuzz on the nose and other hairless parts of bats (Figure 25). It can also result in holes and lesions on the wings and tail membranes[47]. WNS causes bats to wake up more frequently during the winter, which depletes the fat reserves they need to survive. Destruction of wing tissue can also cause physiological changes like dehydration and electrolyte imbalance. Bats infected with WNS often die of the disease.

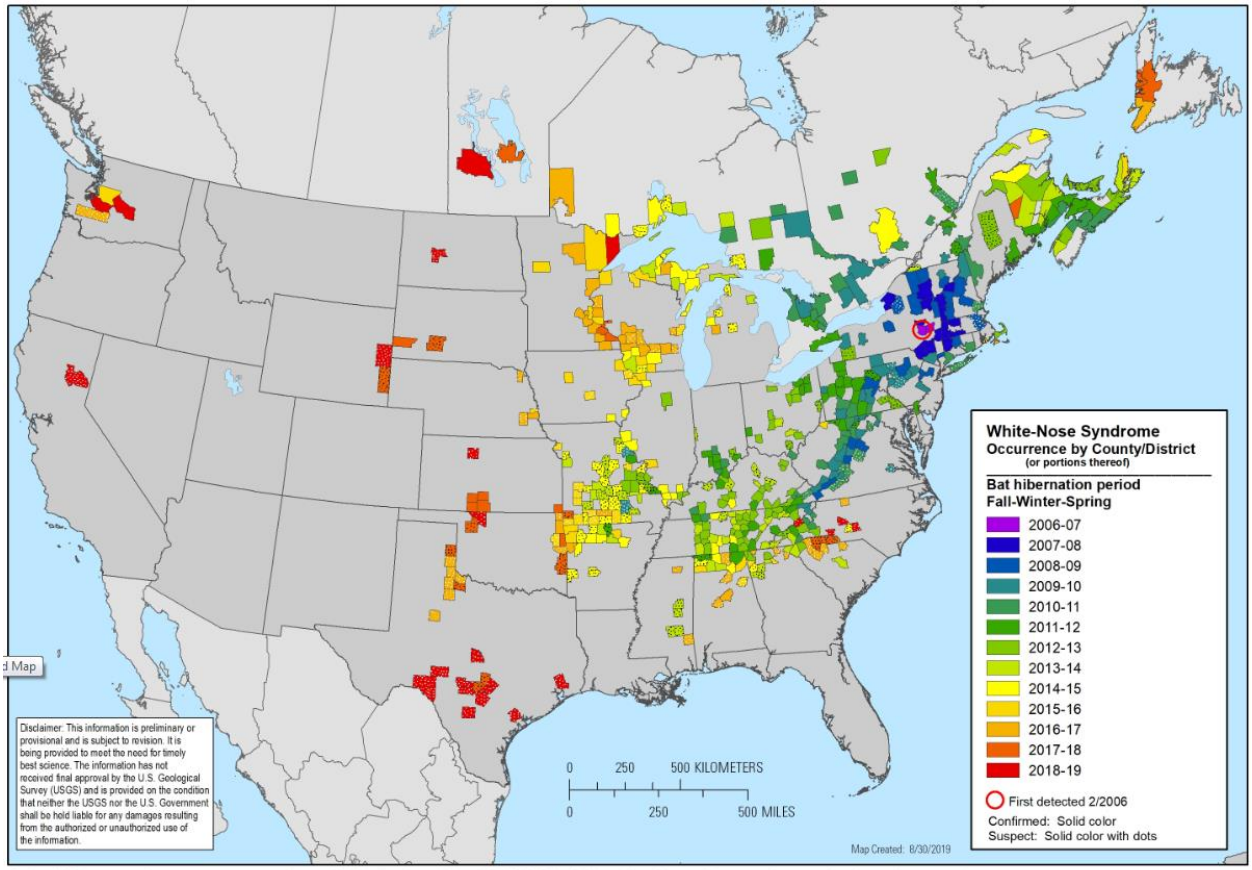

Figure 24: WNS occurrence map – by year (for updates visit: https://www.whitenosesyndrome.org/where-is-wns).

The fungus that causes WNS grows where the environment is relatively cool and moist (optimal growth: 5-15.8°C; growth range: 0-19°C). These requirements are similar to hibernacula conditions preferred by hibernating bats. The SSR-1 hibernaculum has a temperature range of 2.00-2.75^{0}C and 100% relative humidity between November and July.[41,48] These conditions are cooler than optimal growth conditions for *P. destructans*, but they still fall within the range of viable growth temperatures. Much is still unknown about how WNS will affect bats in the north. However, there is growing evidence that winter bat ecology, physiology, and hibernacula conditions at northern latitudes could result in higher survival rates for bats with WNS compared to bats in the south. If bats in northern hibernacula do experience less mortality from WNS, these northern habitats may take on increasing importance on a continental scale as refuges for bats.[49]

Figure 25: White fuzz on the nose of a bat caused by WNS (photo credit: Ryan von Linden).

As noted above, in North America, bats in hibernacula affected by *P. destructans* and WNS have experienced severe population declines or extirpation. WNS predominately affects hibernating *Myotis* species.[50,51] Little brown myotis and northern myotis are highly susceptible to, and are experiencing, devastating population declines as a result of WNS. Population dynamic models of the effects of WNS have predicted a 99% chance of regional extinction for little brown myotis in northeastern North America by 2026, with a similar risk for northern myotis. The impact of WNS on populations of long-eared myotis and long-legged myotis has not yet been documented, primarily because the distribution of the disease did not until recently overlap with the western distribution of these species. However, WNS was recently confirmed in both long-legged myotis (in 2018)[52] and long-eared myotis (in 2019).[53]

Other hibernating bat species are also susceptible to this disease. Big brown bats are affected by WNS, but their survival rates after infection have been shown to be greater than *Myotis* species. The greater survival rates may be due to their larger body size, differing physiology and/or behaviour during hibernation, and/or environmental conditions of hibernation sites. Population trends for big brown bat populations affected by WNS are more variable and uncertain, ranging from population declines (but less severe than *Myotis* species, e.g. 41%), to stable or even increasing populations.[54]

Thus far, there is no evidence of migratory species – including silver-haired bat, hoary bat, and eastern red bat – being impacted by WNS. The fungus *P. destructans* has been detected on silver-haired bat and eastern red bat but diagnostic signs of WNS disease have not been documented.[50,51] Winter activity of eastern red bats and silver-haired bats in and near hibernacula may facilitate infection with *P. destructans* and possible transfer among species, however, being active in the winter may also reduce disease progression.[51] There is no evidence that hoary bats are susceptible to WNS or *P. destructans* infection (Table 2),[29] and they are expected to be less susceptible because of their larger body size and migration to warmer climates during the winter. However, there are many information gaps about the winter behaviour of these migratory bat species, their vulnerability to WNS, and their potential role in transferring fungal spores to other species. Wildlife managers would benefit from learning more about the overwintering behaviour and distribution of these species and assessing their potential vulnerability to WNS.[29]

Table 2: WNS disease status by species.[50]

Species	Global Disease Status[i]	Overwintering Strategy
Little brown myotis	WNS confirmed[j]	Hibernating
Northern myotis	WNS confirmed	Hibernating
Long-eared myotis	WNS confirmed	Hibernating
Long-legged myotis	WNS confirmed	Hibernating
Big brown bat	WNS confirmed	Hibernating
Silver-haired bat	Pd positive[k]	Likely migrating
Hoary bat	No evidence of WNS or Pd	Migrating
Eastern red bat	Pd positive	Migrating

The WNS fungus is able to persist in caves in the absence of bats for years.[55] It can be spread in numerous ways, including from bat to bat, from cave substrate to bat, and from bat to cave substrate, as well as by humans (and other animals) between sites. People visiting caves could accidentally spread the fungus on their boots or equipment. Any human visitation to hibernacula has the potential to introduce WNS if appropriate decontamination protocols are not followed. Researchers in the NWT are required to follow decontamination protocols as a condition of their research permit. Additional efforts may be needed to ensure that others who may be visiting hibernacula, such as recreational cavers, follow them as well. Unintentional movement of bats by long-haul transport vehicles such as trailers, campers, and trucks is also a potential pathway for WNS to be spread over long distances.[56,57,58]

4.2. Human Impacts at Hibernacula

Bats require suitable over-wintering sites that are cool and humid (see section 3.1). Human activities that change hibernacula conditions (including accessibility, temperature, humidity, airflow, and hydrology) can have a negative impact on bats and lead to habitat loss and bat mortality. Harmful activities can include blocking or gating cave entrances, making modifications for tourists (e.g. observation platforms), quarrying, or forestry activities that take place around hibernacula. Additionally, the use of heavy machinery (e.g. timber harvesting equipment) near weak areas of a hibernaculum could cause collapse. Hibernation sites must be managed carefully to

[i] Note that in the NWT there has been no evidence of WNS or Pd.
[j] 'WNS confirmed' indicates that the diagnostic symptoms of white-nose syndrome have been identified on the bat species.
[k] 'Pd positive' indicates that the *Pseudogymnoascus destructans* fungus has been detected on the bat species, but no diagnostic sign of white-nose syndrome has been documented.

avoid impacts. Bats may also use underground mines as hibernation sites. Best management practices should be followed when decommissioning or reactivating mines to prevent negative impacts on bats that may be using the site.[59]

Entering a hibernaculum for research or recreational purposes during winter can cause bats to arouse out of torpor and use up stored fat reserves, resulting in reduced fitness and potential starvation if repeatedly disturbed throughout the season. Industrial activities in or near hibernacula that result in noise, light, or vibrations can also disturb hibernating bats and cause them to arouse from torpor.

Some caves in more southerly locations with high human traffic have regulations in place or gates to limit human access. In the NWT, the precise locations of hibernacula are typically not shared with the public in an effort to reduce human visitation. Motion-sensor cameras were deployed at SSR-1 in 2013 to monitor human visitors and detected no human disturbance at the site. Visits to SSR-1 and SSR-2 for research and monitoring purposes have been limited, ensuring that potential disturbance to hibernating bats is minimized.

4.3. Exclusion and Removal of Maternity Roosts

Reproductive females of most NWT bat species form summer maternity colonies that vary in size and location by species, while males and non-reproductive females typically roost alone or in smaller groups elsewhere. Maternity roosts are used repeatedly over many years.

Exclusion and/or removal of maternity roosts in buildings or trees have the potential to affect a large proportion of bats through direct mortality, reduced fitness, and reduced reproductive success. As a maternity colony may contain most of the breeding females and offspring for the surrounding area, these effects can be significant to local populations. The effects of exclusion (e.g. by sealing the entrances) or removal of maternity roosts depend on factors such as timing, species, and availability of other suitable habitat.

Some homeowners do not want bats living in their buildings and may attempt to remove them or block them out. Excluding bats from the roost at inappropriate times, such as during the spring or summer, or using inappropriate methods to exclude them, can lead to harm or mortality for individual bats and/or for entire maternity colonies. Breeding female bats may abandon an area after their building roost is sealed, or may move to new roosts but have reduced reproductive success. If entrances are sealed when bats are still using the roost, bats can be trapped inside and die. Bats roosting in a building can also be accidentally harmed or killed if building renovations or repairs are done while they are using the roost. Any of these effects can have significant impacts on local populations. The *NWT Guide for Managing Bats in Buildings* provides best practices for managing bats in buildings appropriately in order to avoid or minimize these impacts.[60]

The intentional eradication (extermination) of an entire bat colony in a building has not been recorded in the NWT, but is considered a potential threat. Elsewhere in Canada, hundreds of colony exterminations likely occur each year.

Removal of maternity roosts in trees may occur through timber harvesting, residential development, or any other development activity that requires clearing forested land. Bat tolerance to roost loss may depend on local forest conditions, including the availability of alternate roost trees.

4.4. Loss of Roosting and Foraging Habitat

Bats require roosting and foraging habitat during the summer. Roost choices vary among species but often include tree cavities, behind flaking bark, in rock crevices, and in buildings. *Myotis* species prefer large standing dead or decaying trees located in open areas in old growth forests for tree roosts. The silver-haired bat, hoary bat, and eastern red bat roost in trees or shrubs and can be found under loose bark, in foliage, or in tree crevices or cavities. This dependence on trees makes these species especially vulnerable to deforestation or the removal of snags (standing dead/dying trees).

Habitat loss is an important threat to bats and although bats use forest edges, they tend to avoid large areas of cleared land. Timber harvest has varying degrees of impact on bat habitat depending on the species. In the NWT, commercial timber harvesting has occurred in numerous places and is typically done by small-scale local businesses in localized areas and in small volumes (500-10,000 cubic meters per year). The largest annual harvest since 1980 was in 1996 and totaled 144,461 cubic meters. Harvested species have been predominantly white spruce (*Picea glauca*) and jack pine (*Pinus banksiana*).

Negative impacts can be reduced through selective harvest practices. Selective harvest practices that can assist bat conservation include leaving roost sites (e.g. tree snags) intact and harvesting using methods that increase the amount of forest edge to facilitate travel and foraging. Forestry practices that lead to a decline in the amount of older age forests could have a negative impact, as many bat species are more abundant in the oldest forest stands.

Forest Management Agreements (FMAs) were recently signed in the Fort Providence and Fort Resolution areas and land use permits have been issued for timber harvesting in both areas. With these now in place, timber harvesting is expected to increase in these areas. The land use permits cover five years of timber harvesting, although the FMAs themselves are for 25 years. Timber harvesting in each area will impact approximately 1,000-1,200 hectares per year throughout the lifetime of the FMAs.

4.5. Wind Turbines

Wind turbines are considered an important threat to bats. Wind turbine blades can kill bats by striking them directly in flight, or through trauma caused by the sudden change in air pressure behind turbine blades.[61]

The biological significance of mortality by wind turbines could be important. Between 2002 and 2013, the total estimated mortality of bats due to wind turbines was 47,400 bats annually in Canada.[62] Mortalities are often migratory bats killed in late summer or autumn during migration.[63] However, wind turbines can impact both migratory and non-migratory bats. In one study, long-distance migratory bat species accounted for 73% of all mortalities caused by wind turbines, including: hoary bat (35%), silver-haired bat (23%), and eastern red bat (15%). Non-migratory bats accounted for 22% of all mortalities, including: little brown myotis (12%), big brown bat (9%), northern myotis (1%), and long-legged myotis (less than 1%) in Canada. Hoary bat mortalities were the highest, affecting an estimated 16,345 individuals annually, or approximately 35% of bat mortalities due to wind turbines.[62]

The impact of wind energy development can vary substantially across the ranges of these bat species. Estimates of bat mortality rates at wind energy developments are highly variable (Table 3).[64] Wind farms that are located near areas that bats frequent, such as along migration routes or near maternity roosts, swarming sites, or hibernacula, have a greater likelihood of causing mortality. Mortality rates are anticipated to increase as the number of wind turbines increases.

Table 3: Species-specific predicted annual bat mortality based on bat carcasses from 64 wind facilities across Canada collected between 2002 and 2013.[62]

Species	Predicted Annual Wind Turbine Collision Mortality in Canada
Hoary bat	16,345
Silver-haired bat	11,093
Eastern red bat	6,998
Little brown myotis	5,832
Big brown bat	4,075
Northern myotis	464
Long-legged myotis	2
Unknown bat species	2,498
Other species (do not occur in the NWT)	47
Estimated Annual Total	47,354

There are currently no large-scale wind energy developments in the NWT. However, the *NWT Climate Change Strategy* does include support for increasing the production and transmission of renewable and alternative energy in the context of transitioning to a lower carbon economy. At this time, at least one large wind energy development is being pursued for the Inuvik region, outside the known range of bats.[65] Considerations for future wind farm developments should include best management practices to avoid harm to bats, such as placing wind energy developments away from important bat

habitat (migration routes, maternity roosts, swarming sites, or hibernacula), timing turbine operation outside of migration periods, taking measures during operations to prevent or reduce mortality, and monitoring.[61,64]

4.6. Environmental Contaminants

Mercury contamination is a potential threat to bats in the NWT. Mercury occurs in the environment naturally, however, human activities have the potential to increase the bio-availability of mercury.[3] Long-range atmospheric transport and deposition is the dominant source of mercury in many aquatic habitats. When bats feed on aquatic emergent insects (insects that live in the water as larvae and emerge as adults) they can accumulate mercury in their bodies. Bats appear to be susceptible to mercury accumulation and recent studies have raised concerns about the impact of mercury on bats, including reproductive success, physiological responses (e.g. immune system responses), and survival.[3]

Other contaminants, such as pharmaceuticals, personal care products, polybrominated diphenyl ethers (PBDEs), and pesticides have been found in tissue samples from many bat species in northeastern North America. Pesticides such as neonicotinoids affect bats indirectly by reducing insect abundance (thereby reducing prey availability) and directly through toxic exposure (through consumption of contaminated prey) resulting in motor impairment or death.[66] The effect of pharmaceuticals and personal care products is likely small in the NWT because of the low-density human population. However, contaminants like pesticides and PBDEs can be transported over a long-range and through aquatic ecosystems.

Airborne environmental contaminants have been found in other wildlife in the southern NWT, including very low levels of DDT and Chlordane, PBDEs, and perfluorinated diphenyl ethers (PFDEs), as well as radionuclides from the Fukushima accident.[67] However, the low levels detected are not considered to be biologically relevant.[68]

In the NWT, permits are required for non-domestic pesticide or herbicide use. Permits have been granted for the use of pesticides or herbicides in the Fort Simpson area. Use in the NWT is limited to localized application directly on the ground. Insecticides and rodenticides have been authorized for use inside of buildings and are currently not permitted for use in the environment. Herbicides are occasionally used, for example, along railway corridors and at certain locations along the Enbridge pipeline, fuel tank farm containment berms, and electric substation locations.[69] Agriculture and plant production is currently an extremely small sector in the NWT and large agricultural developments in the NWT are unlikely in the future. However, the NWT has released an agriculture strategy[70] that aims to increase the number of commercial agriculture facilities in the NWT.

4.7. Other Threats

As of 2019, rabies has not been detected in bats in the NWT[71], however, rabies can persist at low levels in some bat populations. Although rabies is unlikely to pose a major

threat to bats in the NWT, it is a preventable human health concern and should be considered in public messaging about bats, research, and monitoring activities.

Domestic and feral cats prey on bats that roost in buildings. Numerous cat-related bat fatalities have been reported in the NWT, and samples have been submitted to ENR in Fort Smith. However, cat-related bat fatalities are not tracked formally and cannot be quantified. Predation by cats is expected to predominantly impact bats using building roosts in or near communities. The impact of this threat on bat populations in the NWT is unknown but presumably small.

Habitat change associated with climate change may affect habitat (for roosting, foraging, and hibernation), prey availability, reproductive success, and vulnerability to WNS. Thermoregulation during extreme heat events may be a concern. Ultimately, however, there may be both positive and negative effects associated with climate change for bats, and impacts on bats are unknown and poorly understood.

4.8. Natural Limiting Factors

Bats are limited by their rate of reproduction, which is slow compared to other small mammals (1-2 pups per year for *Myotis* species, big brown bat, and silver-haired bat, and 2-4 pups per year for hoary and eastern red bat). Reproductive success is influenced by weather and resource abundance. Reproductive rate has been shown to decline with increasing latitude; therefore, the potential for population growth is more limited in the NWT than in the south.

The nocturnal foraging behaviour of bats is also limiting. In regions where summer nights are short, such as the NWT, the time that bats forage is shortened. The shorter overnight foraging time, combined with shorter summers and cooler temperatures, likely limits foraging opportunities and therefore resources available for growth, reproduction, and accumulation of winter fat reserves at the northern edge of the range.

Other natural limiting factors include habitat availability (suitable summer and winter roosts) and natural predators, including raptors (e.g. owls), small carnivores (e.g. weasels), squirrels, and snakes.

5. FACTORS THAT HAVE A POSITIVE INFLUENCE

Bats in the NWT are subject to fewer threats compared to many places elsewhere in North America. There is relatively little habitat loss or degradation within their NWT range compared to southern Canada, no large-scale wind energy development, and WNS has not yet been detected in the NWT. In addition, over the past 5-10 years, bat research and monitoring efforts have increased in the NWT, allowing for an increased understanding of bats. National parks, governments, Indigenous governments and organizations, and renewable resource boards have been involved in creating public education and awareness campaigns about bats in communities, and developing initiatives to mitigate potential threats.

Little brown myotis and northern myotis have been listed as Endangered under the federal *Species at Risk Act* (SARA). The national recovery strategy for these species identifies critical habitat. The listing of these bats under SARA means that individuals of these species, their residences, and their critical habitat are legally protected in the NWT where they are found on federal lands that are under the authority of the Ministers of the Environment or Parks Canada Agency. The NWT as a jurisdiction is expected to provide effective protection on non-federal lands. Under SARA, a protection order may be put in place if individuals, residences, or critical habitat are not effectively protected.

With regard to WNS, a *National Plan to Manage White Nose Syndrome in Canada*[72] was developed and is being implemented by a range of partners across Canada. This document outlines the goals and action items of the Canadian WNS technical working groups that have been established to coordinate and organize Canada's response to WNS. This document also mirrors efforts in the United States. Decontamination protocols are available to avoid the human-caused spread of WNS fungus.

The NWT currently participates in numerous coordinating bodies that are working towards bat conservation, including the Western Bat Working Group, Western Canada Bat Working Group, Northern Bat Working Group, Canadian Inter-agency WNS Committee, and the United States Fish and Wildlife Service's WNS Response Team. These groups help with sharing information about bats and WNS, and coordinating bat conservation and monitoring efforts across jurisdictions.

Some bats (e.g. little brown myotis) are able to exploit human-made structures and use them for roosts in the absence of natural roosting habitat. *Got Bats? NWT Guide for Managing Bats in Buildings* provides best management practices to mitigate human impacts on bats roosting in buildings (e.g. managing bats in buildings appropriately to avoid harming them, building and installing bat boxes to provide alternative summer roosts).There has been increasing interest and involvement in building and installing bat boxes in the NWT. Artificial maternity roosts have been used to naturally relocate a portion of a maternity colony at Lady Evelyn Falls campground near Kakisa without disturbing or harming the population.

Timber harvesting operations in the NWT are not currently permitted to occur during the migratory bird nesting season (May-August), which overlaps with the breeding season for bats (subsection 5.7.2.v. of the *Commercial Timber Harvest Planning and Operations Standard Operating Procedures*).[73]

Other jurisdictions have best management practice guidelines for minimizing the impacts of wind energy development on bats[59], which could be used in the NWT if wind energy developments are proposed.

Monitoring programs and education initiatives to promote understanding of bats in general in the NWT can have a positive impact on bat species. The North American Bat Monitoring Program (NABat) is a collaborative initiative for monitoring bats at local- to range-wide scales.[74] Community bat monitoring can be an effective tool in gathering information about bats, including locations of maternity roosts, detection of incidental mortality, and identification of quality foraging habitat (e.g. Neighbourhood Bat Watch[75]). Increasing awareness of and education about bats in the NWT will likely

continue to increase stewardship, knowledge, and reporting of bat sightings in the future.

In the NWT, a *Cave Management Plan* is being developed for hibernacula in the South Slave region. This plan will facilitate stewardship and protection of these important hibernation sites in a changing environment.

A portion of known bat habitat in the NWT is already protected in national parks and other protected areas. Bat ranges also overlap with areas currently under negotiation in lands, resources, and self-government processes for Indigenous governments and organizations. Some protection of bat habitat could be provided for through regional land use plans. Currently, the Sahtú Land Use Plan provides some legally-binding protection through zoning and conformity requirements in the Sahtú region. Regional land use planning processes in the remaining regions of the NWT that contain bat habitat (Wek'èezhìı, southeastern NWT, and Dehcho) are under development.[76]

Climate plays an important role in determining food availability, timing and duration of hibernation, energy expenditure, torpor use, reproduction rates, and juvenile growth of bats. It is possible that warming temperatures may facilitate shorter hibernation periods and a longer breeding season, and therefore higher reproductive success. There has also been speculation about warming temperatures increasing habitat availability for bats at the northern limit of their range, however, changing climate patterns are complex and negative impacts are anticipated as well (e.g. increased vulnerability to WNS, heat stress). Whether bats will move farther north with climate change or remain restricted by other factors, such as roost availability, is uncertain.

6. KNOWLEDGE GAPS

Although bat research and monitoring in the NWT has greatly increased in the last 5 to 10 years, there are still information gaps, including about biology, diversity, abundance, trends, and distribution of bats in the NWT.

Management would benefit from surveys looking at the extent of occurrence, particularly north of Fort Simpson, the Mackenzie River valley west of Great Slave Lake, the Liard River valley, and in caves or abandoned mines not previously surveyed. Systematic collection or compilation of traditional and community knowledge about bats in the NWT is also considered a gap. The relative importance of natural versus artificial roosts in the NWT is not known.

Currently, WNS is not known to be present in the NWT, however, surveillance is limited. Globally, research efforts are being made to investigate techniques to prevent or reduce the spread and to mitigate or treat the effects of WNS. Researchers are studying how WNS may be affected by overwintering ecology, physiology, and hibernacula conditions in northern regions, and there is still more to be learned on this subject.

Other knowledge gaps include the winter ecology of bats in northern Canada, temperature thresholds for emergence, demography of bats in the north, and potential impacts of land use change and development (e.g. roads, mining, agriculture, and wind farms).

7. MANAGEMENT

7.1. Management Goal and Objectives

The overall goal of this management plan is for each bat species to maintain self-sustaining, resilient populations across their range in the NWT. This will ensure that bats continue to be an important part of our ecosystems.

In order to accomplish this goal, five objectives have been established, combined with recommended approaches to achieve these objectives (Table 4). Progress toward achieving these objectives will be evaluated at least every five years.

This management plan recommends the following objectives for the management of bats in the NWT:

Table 4: ***Management objectives.***

No.	Management Objectives
1	Fill knowledge gaps and enhance understanding of NWT bats, using traditional, community, and scientific knowledge, to inform sound management decisions.
2	Monitor, mitigate, and manage the effects of white-nose syndrome.
3	Prevent or reduce harm to bats associated with human activities.
4	Increase awareness, acceptance, and stewardship of bats and their habitats.
5	Manage bats using an adaptive and collaborative approach, and best available information.

7.2. Approaches to Achieve Objectives

This management plan recommends the following approaches to achieve the management objectives. The recommended approaches are described below and summarized in Table 5.

The approaches are relevant to all bats, but some are noted to be especially important for the designated species at risk. As of 2019, this includes little brown myotis and northern myotis, but the list of bats at risk in the NWT could change in the future.

The relative priority and timeframe of each approach is provided in Table 5.

Objective 1: Fill knowledge gaps and enhance understanding of NWT bats, using traditional, community, and scientific knowledge, to inform sound management decisions.

The focus of objective 1 is to increase our understanding of bats in the NWT to help inform management decisions. This includes collection of traditional, community, and scientific knowledge on bat biology, distribution, abundance, and threats. Understanding our wildlife helps form the basis for assessing their current status, deciding what management is needed, and evaluating the effects that management efforts have in the future. Baseline knowledge is required to detect and understand the changes that may occur in NWT bat populations, for example, as a result of climate change or disease. Participating in collaborative monitoring programs such as the North American Bat Monitoring Program and Neighbourhood Bat Watch can add value to information collected in the NWT, by contributing to national or international efforts. Building a knowledge base on bats (such as where they overwinter and where they raise their young) in the NWT will help inform management interventions.

Approach 1.1: Identify knowledge gaps and encourage research and monitoring on bats, including collecting information on distribution, abundance and trends, health, biology, physiology, genetics, habitat, threats, and cumulative effects.

Approach 1.2 Identify, describe, and map key bat habitats (such as hibernacula and maternity roosts).

Approach 1.3: Monitor population and distribution trends.

Approach 1.4: Encourage people to report observations of bats and keep compiled records.

Approach 1.5: Encourage the collection and recording of traditional and community knowledge about bats.

Approach 1.6: Participate in collaborative research and monitoring for bats and white-nose syndrome in Canada.

Objective 2: Monitor, mitigate, and manage white-nose syndrome.

The focus of objective 2 is to monitor for the presence of WNS in the NWT, prevent human-caused spread, and reduce the impact that WNS may have on bat populations if or when it arrives in the NWT.

Monitoring, surveillance, and reporting observations helps detect WNS as it arrives in new areas[77]. Preventing the human-caused spread of the disease requires that anyone entering hibernacula (e.g. researchers, cavers, tourists) follow proper decontamination protocols to avoid accidentally introducing the fungus that causes WNS.[78] Researchers in the NWT are required to follow these protocols as a condition of their research permit; additional efforts may be needed to ensure that others who may be visiting hibernacula follow them as well. Keeping the precise locations of NWT hibernacula confidential currently helps to manage visitation and minimize the risk of WNS transmission. The risk of bats being accidentally transported long distances by vehicle can be reduced by encouraging people to check their vehicles and equipment for stowaway bats.[58]

Investigation into possible methods to detect, prevent, treat, and mitigate WNS is a very active field of current research. Disease management options that are being explored include: reduction of mid-winter starvation and dehydration in infected bats, using biological or biologically-derived agents to treat infected bats or bats at risk of infection, altering climate in hibernation areas to slow fungal growth or improve bat survival, using UV light to kill the fungus, and using vaccines or probiotics to boost resistance to WNS.[54,79,80,81,82] In addition, small populations of surviving individuals have been documented in some areas initially infected with WNS[83,84]; the mechanisms supporting survival are not yet well known. As we learn more about how to manage WNS and help affected bat populations recover, appropriate methods should be applied in the NWT.

Approach 2.1: Develop and maintain an effective and coordinated surveillance program to monitor for white-nose syndrome, including timely collection, diagnosis, and reporting of test results.

Approach 2.2: Encourage reporting of unusual bat behaviour, such as flying outside during the day, and investigate these observations promptly.

Approach 2.3: Implement precautionary measures to reduce the spread of white-nose syndrome, including preventing accidental human-caused spread.

Approach 2.4: Support national/international efforts and research in disease prevention and mitigation.

Approach 2.5: Implement measures to prevent the spread and mitigate the impacts of white-nose syndrome should they become available and feasible.

Objective 3: Prevent or reduce harm to bats associated with human activities.

The focus of objective 3 is to reduce or prevent habitat loss, direct or indirect mortality, stress, or injury of bats caused by human activities.

Hibernacula are important because many bats from a region are concentrated together in a single site over the winter so activities that disturb the bats while hibernating, or that change the conditions in the cave, can have a negative impact on the population. Bats are known to be very sensitive to disturbance while hibernating. Hibernation sites should be managed carefully to avoid these impacts, and best management practices for bats should be followed when deactivating or reactivating underground mines.

Bats roosting in buildings can be harmed unnecessarily when they are excluded at inappropriate times or using inappropriate methods (e.g. when exclusion practices are used that result in bat mortality), or by performing building renovations or repairs at inappropriate times. Best management practices for managing roosting bats should be used to prevent harm. Education and awareness can be provided to industry and the public on safe, non-lethal methods to keep bats out of human living spaces, dealing with bats found indoors, planning renovations and/or demolition to avoid harming bats, deciding if exclusion is necessary, appropriate timing and methods for exclusion when necessary, and reducing predation by house cats.

Following best management practices for bats during the planning, construction, and operation of wind energy developments would aid in the prevention of harm or mortality caused by wind turbines. Working with partners such as industry, regulatory boards, and land use planning boards can help to identify and minimize other potential negative impacts of human activities such as forestry on bats and their habitat.

Approach 3.1: Complete and implement measures to prevent and mitigate negative human impacts at hibernacula, such as a Cave Management Plan.

Approach 3.2: Prevent destruction of critical habitat for bats identified under the federal *Species at Risk Act*.

Approach 3.3: Develop, promote, and implement best management practices to conserve maternity roosts, including appropriate methods for managing bats in buildings.

Approach 3.4: Promote and implement forestry management practices that maintain trees suitable for roosting.

Approach 3.5: Identify and avoid or mitigate human impacts on key bat habitats through the regulatory process (permitting, screening, and environmental assessment), legislation, land administration and land use planning, conservation areas, stewardship, or other effective mechanisms.

Approach 3.6: Participate in initiatives aimed at addressing threats that may affect bats at a continental scale, such as climate change and contaminants.

Approach 3.7: Ensure that beneficial management practices are used for wind energy developments in the NWT to avoid harm to bats.

Approach 3.8: Work with agricultural producers, gardeners, and others to promote responsible pest control and avoid the use of pesticides and herbicides.

Approach 3.9: Promote and implement best management practices for closing or reactivating underground mines that may be used by bats.

Objective 4: Increase awareness, acceptance, and stewardship of bats and their habitats.

Public education can reduce human impacts on bats. Promoting acceptance and appreciation for bats helps reduce the general fear of bats and encourages people to avoid harming them, for example, when managing bats roosting in buildings. Fostering stewardship behaviour can lead to conservation benefits for these species, such as providing well-designed, well-placed bat boxes that can serve as roosting habitat. It can also help to improve information as people become more likely to notice bats and report their observations.

Approach 4.1: Encourage communities to participate in bat monitoring projects.

Approach 4.2: Develop education initiatives to promote public knowledge, understanding, and acceptance of bats.

Approach 4.3: Promote stewardship activities relating to bats and/or bat habitat, such as strategic use and appropriate placement of bat boxes.

Objective 5: Manage bats using an adaptive and collaborative approach, and best available information.

The focus of objective 5 is to have co-management partners periodically review the latest information on the state of bats in the NWT. Regular check-ins would help ensure that the management plan is actively used and that management actions are adjusted if needed. Co-management is required under land claim and self-government agreements. Collaboration also fosters information-sharing and helps to ensure that all groups who can have a positive impact on bats are engaged.

Approach 5.1: Collaborate with co-management partners, other jurisdictions, and researchers on management and conservation efforts for NWT bats.

Approach 5.2: Encourage flow of information among researchers, co-management partners, regulatory boards, and the public.

Approach 5.3: Conduct periodic co-management reviews of new information, management actions, and progress made toward meeting management objectives.

7.3. Measuring Progress

At least every five years, the Conference of Management Authorities will report on the actions undertaken to implement this management plan and progress made towards meeting its objectives. The first such report will be due in 2026. The management plan may also be updated at that time.

Management will be considered successful if the goal is achieved, that is, if self-sustaining and resilient populations are maintained for each bat species across their NWT ranges.

Overall success can be measured through population trends (population stable, increasing, or not indicative of ongoing decline), species distributions (species continue to be found in their historical range and range recession has not occurred), and species status (have improved, have not become at risk, or have not become further at risk when assessed/re-assessed). These are long-term indicators of success.

Table 5. Recommended approaches for the management of bats in the NWT.

Objective	Management approaches	Threats and/or knowledge gaps addressed	Relative Priority[l]/ Time frame[m]
Objective #1: Fill knowledge gaps and enhance understanding of NWT bats, using traditional, community and scientific knowledge, to inform sound management decisions.	**Approach 1.1:** Identify knowledge gaps and encourage research and monitoring on bats, including collecting information on distribution, abundance and trends, health, biology, physiology, genetics, habitat, threats, and cumulative effects.	All	Necessary/Ongoing
	Approach 1.2: Identify, describe, and map key bat habitats (such as hibernacula and maternity roosts).	Human impacts at hibernacula, exclusion and removal of maternity roosts, loss of roosting and foraging habitat, WNS	Critical/Ongoing
	Approach 1.3: Monitor population and distribution trends.	Fills knowledge gaps	Necessary/Ongoing
	Approach 1.4: Encourage people to report observations of bats and keep compiled records.	Fills knowledge gaps	Beneficial/Ongoing
	Approach 1.5: Encourage the collection and recording of traditional and community knowledge about bats.	Fills knowledge gaps	Beneficial/Ongoing
	Approach 1.6: Participate in collaborative research and monitoring for bats and white-nose syndrome in Canada.	All	Necessary/Ongoing
Objective #2: Monitor, mitigate, and manage white-nose syndrome.	**Approach 2.1:** Develop and maintain an effective and coordinated surveillance program to monitor for white-nose syndrome, including timely collection, diagnosis, and reporting of test results.	WNS	Necessary/Ongoing
	Approach 2.2: Encourage reporting of unusual bat behaviour, such as flying outside during the day, and investigate these observations promptly.	WNS	Necessary/Ongoing

[l] **Relative priority** can be *critical, necessary,* or *beneficial.* Critical approaches are the highest priority for the conservation of bats and should be implemented sooner rather than later. Necessary approaches are important to implement for the conservation of bats, but with less urgency than critical. Beneficial approaches help to achieve management goals but are less important to the conservation of the species compared to critical or necessary.

[m] **Relative timeframe** can be short-term, long-term, or ongoing. Short-term approaches should be completed within five years (2026) and long-term approaches require more than five years to complete. Ongoing approaches are actions carried out repeatedly.

	Approach 2.3: Implement precautionary measures to reduce the spread of WNS, including preventing accidental human-caused spread.	WNS	Critical/Ongoing
	Approach 2.4: Support national/international efforts and research in disease prevention and mitigation.	WNS	Necessary/Ongoing
	Approach 2.5: Implement measures to prevent the spread and mitigate the impacts of white-nose syndrome should they become available and feasible.	WNS	Critical/Ongoing
Objective #3: Prevent or reduce harm to bats associated with human activities.	**Approach 3.1:** Complete and implement measures to prevent and mitigate negative human impacts at hibernacula, such as a Cave Management Plan.	Human impacts at hibernacula	Critical/Ongoing
	Approach 3.2: Prevent destruction of critical habitat for bats identified under the federal *Species at Risk Act*.	Human impacts at hibernacula	Critical/Ongoing
	Approach 3.3: Develop, promote, and implement best management practices to conserve maternity roosts, including appropriate methods for managing bats in buildings.	Exclusion and removal of maternity roosts, loss of roosting and foraging habitat	Necessary/Ongoing
	Approach 3.4: Promote and implement forestry best management practices that maintain trees suitable for roosting.	Loss of roosting and foraging habitat	Necessary/Ongoing
	Approach 3.5: Identify and avoid or mitigate human impacts on key bat habitats through the regulatory process (permitting, screening, and environmental assessment), legislation, land administration and land use planning, conservation areas, stewardship, or other effective mechanisms.	Human impacts at hibernacula, exclusion and removal of maternity roosts, loss of roosting and foraging habitat, other threats	Necessary/Ongoing
	Approach 3.6: Participate in initiatives aimed at addressing threats that may affect bats at a continental scale, such as climate change and contaminants.	All	Beneficial/Ongoing
	Approach 3.7: Ensure that beneficial management practices are used for wind energy development in the NWT to avoid harm to bats.	Wind turbines	Necessary/Ongoing

	Approach 3.8: Work with agricultural producers, gardeners, and others to promote responsible pest control and avoid the use of pesticides and herbicides.	Other threats	Beneficial/Ongoing
	Approach 3.9: Promote and implement best management practices for closing or reactivating underground mines that may be used by bats.	Human impacts at hibernacula	Beneficial/Ongoing
Objective #4: Increase awareness, acceptance, and stewardship of bats and their habitats.	**Approach 4.1:** Encourage communities to participate in bat monitoring projects.	All	Beneficial/Ongoing
	Approach 4.2: Develop education initiatives to promote public knowledge, understanding, and acceptance of bats.	All	Necessary/Ongoing
	Approach 4.3: Promote stewardship activities relating to bats and/or bat habitat, such as strategic use and appropriate placement of bat boxes.	All	Beneficial /Ongoing
Objective #5: Manage bats using an adaptive and collaborative approach, and best available information.	**Approach 5.1:** Collaborate with co-management partners, other jurisdictions, and researchers on management and conservation efforts for NWT bats.	All	Necessary/Ongoing
	Approach 5.2: Encourage flow of information among researchers, co-management partners, regulatory boards, and the public.	All	Necessary/Ongoing
	Approach 5.3: Conduct periodic co-management reviews of new information, management actions, and progress made toward meeting management objectives.	All	Necessary/Ongoing

7.4. Socioeconomic, Cultural, and Environmental Effects of Management

Bats are not harvested in the NWT; therefore, management of bats is not expected to have any significant impacts on cultural practices or the exercise of Aboriginal or treaty rights.

Maintaining key bat habitat may require support from land owners, communities, and individuals. Many home/cabin owners dislike bats roosting in their buildings, therefore, education and outreach will be important with regard to how to manage bats in buildings appropriately without harming them.

Monitoring is an important management strategy. However, care and consideration must be maintained with regard to preventing human-assisted spread of the disease. If bat habitats (e.g. roosts or hibernacula) are surveyed or monitored, or if bats are captured and studied, then steps must be taken to decontaminate gear and prevent fungus transmission.

The recommended approaches in this management plan are not expected to have significant negative impacts on other species. Bat conservation has the potential to benefit ecosystems and people by conserving their role as predators of insects – including mosquitoes and insect pests that affect forests and gardens.

8. NEXT STEPS

Management partners will use this plan to help in assigning priorities and allocating resources in order to manage bats in the NWT. It will be reviewed every five years and may be updated.

This management plan will be followed by a consensus agreement by the Conference of Management Authorities that will lay out the actions the participating Management Authorities intend to undertake to implement it. At least every five years, there will be a report on the actions undertaken to implement the management plan and the progress made towards meeting its objectives. The first such report will be due in 2026. The management plan may also be updated at that time.

Success in the management of NWT bats depends on the commitment and cooperation of various groups involved in directing this plan and cannot be achieved by any one agency alone. NWT residents, management partners, municipalities, and other organizations are invited to join in supporting and implementing this plan for the benefit of bats and NWT society as a whole.

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APPENDIX A – SPECIES STATUS AND ASSESSMENTS

Species	Jurisdiction	Status Rank[n] (Coarse filter – to prioritize)	Status Assessment[o] (Fine filter – to provide advice)	Legal Listing[p] (To protect under species at risk legislation)
Little brown myotis	**NWT**	S1 – At Risk (2015)	Special Concern (2017)	Special Concern (2018)
	Canada	N3 (2012)	Endangered (2013)	Endangered (2014)
	Global	G3 - Vulnerable (2016)	LC - Least Concern (2008)	N/A
Northern myotis	**NWT**	S1 – At Risk (2015)	Special Concern (2017)	Special Concern (2018)
	Canada	N1N2 (2014)	Endangered (2013)	Endangered (2014)
	Global	G1 - Critically Imperiled	LC - Least Concern (2008)	N/A
Long-eared	**NWT**	S1-S2 – May be at Risk (2015)	Data Deficient (2017)	No Status

[n] National and global ranks are from the NatureServe conservation status assessments that determine the extinction risk of species and elimination risk of ecosystems at global scales, as well as their extirpation risk at national scales: http://explorer.natureserve.org/. For NatureServe definitions of rankings, see: http://www.natureserve.org/conservation-tools/conservation-status-assessment. The NWT status ranks and ranking definitions are from Working Group on General Status of NWT Species (2016).

[o] Status assessments are independent biological assessments. A status assessment in the NWT is determined by the NWT Species at Risk Committee (SARC): http://www.nwtspeciesatrisk.ca/SARC. Status in Canada is assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC): http://www.cosewic.gc.ca/ and the species status assessment can be found at: www.sararegistry.gc.ca. Global status is assessed by IUCN Species Survival Commission (SSC) and is found on the IUCN Red List of Threatened Species: http://www.iucnredlist.org/. Status and year in table reflects the most recent assessment.

[p] Legal listing is the legal status of the species on the NWT List of Species at Risk under the territorial *Species at Risk (NWT) Act*: www.nwtspeciesatrisk.ca and on Schedule 1 of the federal *Species at Risk Act*: www.sararegistry.gc.ca. There is no global legal listing.

Species	Jurisdiction	Status Rank[n] (Coarse filter – to prioritize)	Status Assessment[o] (Fine filter – to provide advice)	Legal Listing[p] (To protect under species at risk legislation)
myotis	**Canada**	N5 – Secure (2017)	Not Assessed	No Status
	Global	G5 - Secure (2016)	LC - Least Concern (2016)	N/A
Long-legged myotis	**NWT**	S1-S2 – May be at Risk (2015)	Data Deficient (2017)	No Status
	Canada	N5 (1996)	Not Assessed	No Status
	Global	G4 - Apparently Secure (2016)	LC - Least Concern (2008)	N/A
Big brown bat	**NWT**	S1-S2 – May be at Risk (2015)	Data Deficient (2017)	No Status
	Canada	N5 (1996)	Not Assessed	No Status
	Global	G5 - Secure (2016)	LC - Least Concern (2016)	N/A
Silver-haired bat	**NWT**	Undetermined	Not Assessed	No Status
	Canada	N5 – Secure (1996)	Not Assessed – High priority candidate for assessment	No Status
	Global	G3 - Vulnerable (2016)	LC - Least Concern (2008)	N/A
Hoary bat	**NWT**	Undetermined	Not Assessed	No Status

Species	Jurisdiction	Status Rank[n] (Coarse filter – to prioritize)	Status Assessment[o] (Fine filter – to provide advice)	Legal Listing[p] (To protect under species at risk legislation)
	Canada	N5 (1996)	Not Assessed – High priority candidate for assessment	No Status
	Global	G3 - Vulnerable (2016)	LC - Least Concern (2008)	N/A
Eastern red bat	**NWT**	Presence Expected	Not Assessed	No Status
	Canada	N5 (1996)	Not Assessed – High priority candidate for assessment	No Status
	Global	G3 - Vulnerable (2016)	LC - Least Concern (2016)	N/A

Species Assessments:

Assessment of little brown myotis in the NWT by the Species at Risk Committee (verbatim from SARC 2017[1]).

The Northwest Territories Species at Risk Committee met in Yellowknife, Northwest Territories on November 16, 2016 and assessed the biological status of little brown myotis in the Northwest Territories. The assessment results were not released until April 2017 to facilitate the bundling of assessment results with two other species. The assessment was based on this approved status report. The assessment process and objective biological criteria used by the Species at Risk Committee are available at: www.nwtspeciesatrisk.ca.

Assessment: Special Concern in the Northwest Territories

A species of Special Concern means that the species may become threatened or endangered in the Northwest Territories because of a combination of biological characteristics and identified threats.

Reasons for the assessment:

Little brown myotis fit criterion (b) for Special Concern.

(b) – The species may become threatened if negative factors are neither reversed nor managed effectively.

Main Factors:

- Although the range of this species is fairly large and there are at least a few thousand individuals in the Northwest Territories, there are currently only two known over-wintering sites.
- Although white-nose syndrome is not currently present in the Northwest Territories, it is estimated that at current expansion rates, it could reach our populations from eastern North America in one or two decades. With the recent discovery of white-nose syndrome in the United States' Pacific northwest, it is conceivable that this disease could spread to the Northwest Territories sooner than predicted.
- The main threat is:
    - This species is highly susceptible to devastating population declines as a result of white-nose syndrome. In eastern Canada, populations impacted by white-nose syndrome have declined by 94%.

Additional Factors:

- Human impacts at hibernacula and exclusion and removal of maternity roosts have the potential to affect a large proportion of the species' population at the same time.

Positive influences to little brown myotis and their habitat:

- Some of the records of this species in the Northwest Territories occur within Nahanni National Park Reserve and Wood Buffalo National Park.
- Little brown myotis has been federally listed as endangered under the *Species at*

Risk Act, which provides some protection for individuals and habitat in Canada, including the Northwest Territories.
- A cave management plan is being developed for the known hibernacula in the Northwest Territories.
- Monitoring programs and education initiatives to promote understanding of bats in general in the Northwest Territories can have a positive impact on the species.

Recommendations:

- Additional studies, including traditional knowledge studies, are required for all bat species in the Northwest Territories.
- Complete and implement the Northwest Territories cave management plan, participate in collaborative research and monitoring on bats and white-nose syndrome in Canada, and help facilitate communication and coordination of bat conservation and monitoring efforts across jurisdictions.
- Promote and implement best management practices to mitigate human impacts on bats and their habitat, including roosting sites.

Assessment of little brown myotis in Canada by COSEWIC (verbatim from COSEWIC 2013[46]).

Assessment Summary – November 2013

Common name

Little Brown Myotis

Scientific name

Myotis lucifugus

Status

Endangered

Reason for designation

Approximately 50% of the global range of this small bat is found in Canada. Subpopulations in the eastern part of the range have been devastated by WNS, a fungal disease caused by an introduced pathogen. This disease was first detected in Canada in 2010, and to date has caused a 94% overall decline in known numbers of hibernating Myotis bats in Nova Scotia, New Brunswick, Ontario, and Quebec. The current range of WNS has been expanding at an average rate of 200-250 kilometres per year. At that rate, the entire Canadian population is likely to be affected within 12 to 18 years. There is no apparent containment of the northward or westward spread of the pathogen, and proper growing conditions for it exist throughout the remaining range.

Occurrence

Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

Status history

Designated Endangered in an emergency assessment on February 3, 2012. Status re-examined and confirmed in November 2013.

Assessment of northern myotis in the NWT by the Species at Risk Committee (verbatim from SARC 2017).

The Northwest Territories Species at Risk Committee met in Yellowknife, Northwest Territories on November 16, 2016 and assessed the biological status of northern myotis in the Northwest Territories. The assessment results were not released until April 2017 to facilitate the bundling of assessment results with two other species. The assessment was based on this approved status report. The assessment process and objective biological criteria used by the Species at Risk Committee are available at: www.nwtspeciesatrisk.ca.

Assessment: Special Concern in the Northwest Territories

A species of Special Concern means that the species may become threatened or endangered in the Northwest Territories because of a combination of biological characteristics and identified threats.

Reasons for the assessment:

Northern myotis fit criterion (b) for Special Concern.

(b) – The species may become threatened if negative factors are neither reversed nor managed effectively.

Main Factors:

- The range of this species in the Northwest Territories is fairly large. They are suspected to be wintering in the two known hibernacula in the Northwest Territories.
- Although white-nose syndrome is not currently present in the Northwest Territories, it is estimated that at current expansion rates, it could reach our populations from eastern North America in one to two decades. With the recent discovery of white-nose syndrome in the Unites States' Pacific northwest, it is conceivable that this disease could spread to the Northwest Territories sooner than predicted.
- The main threat is:
    - This species is highly susceptible to devastating population declines as a result of white-nose syndrome. In eastern Canada, populations impacted by white-nose syndrome have declined by 94%.

Additional Factors:

- Human impacts at hibernacula and exclusion and removal of maternity roosts have the potential to affect a large proportion of the species population at the same time.

Positive influences to northern myotis and their habitat:

- Some of the records of this species in the Northwest Territories occur within Nahanni National Park Reserve and Wood Buffalo National Park.
- Northern myotis has been federally listed as endangered under the *Species at Risk Act*, which provides some protection for individuals and habitat in Canada, including the Northwest Territories.
- A cave management plan is being developed for the known hibernacula in the Northwest Territories.
- Monitoring programs and education initiatives to promote understanding of bats in general in the Northwest Territories can have a positive impact on the species.

Recommendations:

- Additional studies, including traditional knowledge studies, are required for all bat species in the Northwest Territories.
- Complete and implement the Northwest Territories cave management plan, participate in collaborate research and monitoring on bats and WNS in Canada, and help facilitate communication and coordination of bat conservation and monitoring efforts across jurisdictions.
- Promote and implement best management practices to mitigate human impacts on bats and their habitat, including roosting sites.

Assessment of northern myotis in Canada by COSEWIC (verbatim from COSEWIC 2013).

Assessment Summary – November 2013

Common name

Northern Myotis

Scientific name

Myotis septentrionalis

Status

Endangered

Reason for designation

Approximately 40% of the global range of this northern bat is in Canada. Subpopulations in the eastern part of the range have been devastated by WNS, a fungal disease caused by an introduced pathogen. This disease was first detected in Canada in 2010 and to date has caused a 94% overall decline in numbers of known

hibernating *Myotis* bats in Nova Scotia, New Brunswick, Ontario, and Quebec hibernacula compared with earlier counts before the disease struck. Models in the northeastern United States for Little Brown Myotis predict a 99% probability of functional extirpation by 2026. Given similar life history characteristics, these results are likely applicable to this species. In addition to its tendency to occur in relatively low abundance levels in hibernacula, there is some indication this species is experiencing greater declines than other species since the onset of WNS. The current range of WNS overlaps with approximately one third of this species' range and is expanding at an average rate of 200 to 250 kilometres per year. At that rate, the entire Canadian population will likely be affected within 12 to18 years. There is no apparent containment of the northward or westward spread of the pathogen, and proper growing conditions for it exist throughout the remaining range.

Occurrence

Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

Status history

Designated Endangered in an emergency assessment on February 3, 2012. Status re-examined and confirmed in November 2013.

Assessment of long-eared myotis in the NWT by the Species at Risk Committee (verbatim from SARC 2017).

The Northwest Territories Species at Risk Committee met in Yellowknife, Northwest Territories on November 16, 2016 and assessed the biological status of long-eared myotis in the Northwest Territories. The assessment results were not released until April 2017 to facilitate the bundling of assessment results with two other species. The assessment was based on this approved status report. The assessment process and objective biological criteria used by the Species at Risk Committee are available at: www.nwtspeciesatrisk.ca.

Assessment: Data Deficient in the Northwest Territories

A Data Deficient species means a species in respect of which the Species at Risk Committee does not have sufficient information to categorize as extinct, extirpated, endangered, threatened, special concern, or not at risk.

Main Factors:

- Very little information is known about this species in the Northwest Territories. There is only one confirmed record of this species occurring in the Northwest Territories.
- The main threat is:
    - The future impact of white-nose syndrome on this species is uncertain; however, given the documented devastating impact on other hibernating

Myotis species, there is concern that white-nose syndrome may have a large impact on this species.

Positive influences to long-eared myotis and their habitat:

- Records for this species in the Northwest Territories are within Nahanni National Park Reserve.
- Monitoring programs and education initiatives to promote understanding of bats in general in the Northwest Territories can have a positive impact on the species.

Recommendations:

- Additional studies, including traditional knowledge studies, are required for all species in the Northwest Territories, with an emphasis on the Liard valley.
- Complete and implement the Northwest Territories cave management plan, participate in collaborative research and monitoring on bats and white-nose syndrome in Canada, and help facilitate communication and coordination of bat conservation and monitoring efforts across jurisdictions.
- Promote and implement best management practices to mitigate human impacts on bats and their habitat, including roosting sites.

Assessment of long-legged myotis in the NWT by the Species at Risk Committee (verbatim from SARC 2017).

The Northwest Territories Species at Risk Committee met in Yellowknife, Northwest Territories on November 16, 2016 and assessed the biological status of long-legged myotis in the Northwest Territories. The assessment results were not released until April 2017 to facilitate the bundling of assessment results with two other species. The assessment was based on this approved status report. The assessment process and objective biological criteria used by the Species at Risk Committee are available at: www.nwtspeciesatrisk.ca.

Assessment: Data Deficient in the Northwest Territories

A Data Deficient species means a species in respect of which the Species at Risk Committee does not have sufficient information to categorize as extinct, extirpated, endangered, threatened, special concern, or not at risk.

Main Factors:

- Very little information is known about this species in the Northwest Territories. There are only three confirmed records of this species occurring in the Northwest Territories.
- The main threat is:
    - The future impact of white-nose syndrome on this species is uncertain; however, given the documented devastating impact on other hibernating *Myotis* species, there is concern that white-nose syndrome may have a large impact on this species.

Positive influences to long-legged myotis and their habitat:

- Record for this species in the Northwest Territories are within Nahanni National Park Reserve.
- Monitoring programs and education initiatives to promote understanding of bats in general in the Northwest Territories can have a positive impact on the species.

Recommendations:

- Additional studies, including traditional knowledge studies, are required for all bat species in the Northwest Territories, with an emphasis on the Liard valley.
- Complete and implement the Northwest Territories cave management plan, participate in collaborative research and monitoring on bats and white-nose syndrome in Canada, and help facilitate communication and coordination of bat conservation and monitoring efforts across jurisdictions.
- Promote and implement best management practices to mitigate human impacts on bats and their habitat, including roosting sites.

Assessment of big brown bat in the NWT by the Species at Risk Committee (verbatim from SARC 2017)

The Northwest Territories Species at Risk Committee met in Yellowknife, Northwest Territories on November 16, 2016 and assessed the biological status of big brown bats in the Northwest Territories. The assessment results were not released until April 2017 to facilitate the bundling of assessment results with two other species. The assessment was based on this approved status report. The assessment process and objective biological criteria used by the Species at Risk Committee are available at: www.nwtspeciesatrisk.ca.

Assessment: Data Deficient in the Northwest Territories.

A Data Deficient species means a species in respect of which the Species at Risk Committee does not have sufficient information to categorize as extinct, extirpated, endangered, threatened, special concern, or not at risk.

Main Factors:

- Little is known about this species in the Northwest Territories. There are few confirmed records of this species occurring in the Northwest Territories, including no confirmed records of reproduction. However, there are indications that the species might be more widely distributed than confirmed records suggest.
- The main threat is:
    - The future impact of white-nose syndrome on this species is uncertain, but there is some concern that white-nose syndrome will have an impact on this species in the Northwest Territories. The big brown bat does not appear to be as susceptible to the negative impacts of white-nose syndrome as little brown myotis and northern myotis. In eastern North America, the effect of white-nose syndrome has resulted in population declines as high as 41%, but other studies suggest less impact.

Positive influences to big brown bats and their habitat:

- Some of the few records of this species in the Northwest Territories occur within Nahanni National Park Reserve and Wood Buffalo National Park.
- A cave management plan is being developed for the known hibernacula in the Northwest Territories.
- Monitoring programs and education initiatives to promote understanding of bats in general in the Northwest Territories can have a positive impact on the species.

Recommendations:

- Additional studies, including traditional knowledge studies, are required for all bat species in the Northwest Territories.
- Complete and implement the Northwest Territories cave management plan, participate in collaborative research and monitoring on bats and white-nose syndrome in Canada, and help facilitate communication and coordination of bat conservation and monitoring efforts across jurisdictions.
- Promote and implement best management practices to mitigate human impacts on bats and their habitat, including roosting sites.

APPENDIX B – PLANNING PARTNERS

The Gwich'in Renewable Resources Board is the main instrument of wildlife management in the Gwich'in Settlement Area. Its powers include approving plans for the management and protection of particular wildlife populations (including endangered species), particular wildlife habitats, and forests (*Gwich'in Comprehensive Land Claim Agreement*, sections 12 and 13). The Gwich'in Renewable Resources Board works collaboratively with renewable resources councils and government in research, monitoring, and management of wildlife and habitat. The Gwich'in Renewable Resources Board consults regularly with the renewable resources councils, and its management authority may be delegated to renewable resources councils.

The Sahtú Renewable Resources Board is the main instrument of wildlife management in the Sahtú Settlement Area. Its powers include approving plans for the management and protection of particular wildlife populations (including endangered species), particular wildlife habitats, and forests (Sahtú Dene and Metis Comprehensive Land Claim Agreement, sections 13 and 14). The Sahtú Renewable Resources Board works collaboratively with renewable resources councils and government in research, monitoring, and management of wildlife and habitat. The Sahtú Renewable Resources Board consults regularly with the renewable resources councils, and management authority may be delegated to renewable resources councils.

The Wek'èezhìı Renewable Resources Board is the wildlife co-management authority responsible for managing wildlife, wildlife habitat, forests, plants, and protected areas in Wek'èezhìı as set out in the Tłı̨chǫ Agreement (Tłı̨chǫ Agreement, sections 12, 13, 14 & 16). Responsibilities include making determinations or recommendations on management proposals for activities which may affect wildlife and wildlife habitat. The Wek'èezhìı Renewable Resources Board works collaboratively with the Tłı̨chǫ communities and Tłı̨chǫ, territorial, and federal governments in research, monitoring, and management of wildlife and habitat.

The Tłı̨chǫ Government has powers to enact laws in relation to the use, management, administration and protection of lands and renewable resources, on Tłı̨chǫ lands. This includes laws relating to the management and exercise of harvesting rights for wildlife, plants, and trees (Tłı̨chǫ Agreement, section 7). The Tłı̨chǫ Government has prepared the Tłı̨chǫ Land Use Plan to assist in managing approximately 39,000 km^2 of Tłı̨chǫ lands. The Plan provides a guide for future development by outlining how Tłı̨chǫ land will be protected and how activities and development on Tłı̨chǫ lands should occur.

The Government of the Northwest Territories (GNWT), represented by the Minister of Environment and Natural Resources (ENR), has ultimate responsibility for the conservation and management of wildlife, wildlife habitat, and forest resources in the NWT, subject to land claims and self-government agreements. It is the Minister of ENR's ultimate responsibility to prepare and complete management plans and recovery strategies under the *Species at Risk (NWT) Act*. Other GNWT departments also have responsibilities including land management, resources, communities, infrastructure, and economic development. ENR engages with other GNWT departments on species at risk

issues through the Inter-departmental Species at Risk Committee, inter-departmental committees of Directors and Deputy Ministers, and Cabinet.

APPENDIX C – GUIDING PRINCIPLES

The following principles guided the development of this management plan:

- Recognize that the biological diversity of the NWT is a legacy to be preserved, and that all residents have a shared responsibility for the protection and conservation of species at risk.
    - Recognize the shared responsibility of the Management Authorities, seek collaborative partnerships, and expect that all responsible parties will contribute.
    - Respect treaty and Aboriginal rights as well as land claim and self-government agreements.
    - Involve interested parties in developing the plan/strategy, including engagement at the community level throughout the process, especially for culturally sensitive species.
- Recognize that some conservation measures may have social, economic, or ecological implications.
- Use adaptive management, which is: a systematic approach for continually improving management policies or practices by deliberately learning from the outcomes of management actions.
- Be guided by and implement the Precautionary Principle, which is: where there are threats of serious or irreversible damage, lack of full certainty shall not be used as a reason for postponing cost-effective conservation measures.
- Make full use of the best available information, including traditional, community, and scientific knowledge.
    - Recognize and respect differences and similarities in approaches to the collection and analysis of different types of knowledge.
    - Recognize and address information gaps.
- Have a clear goal and clear, measurable objectives.
    - Include only management approaches that are realistic and biologically feasible.
    - Recognize that conservation and recovery can take a long time, therefore long-term approaches are needed.