Status of Bats (Chiroptera) in 2013
Banff National Park
Alberta, Canada

Myotis lucifugus photo G. Horne

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1.0 Executive Summary

Detailed specific information about bats of Banff National Park is scarce to nonexistent. There have been no in-depth studies or research on bats of this park. By conducting a detailed literature review six species are probably still found in the park and one more species has some potential to reside in Banff (nine species are found in the Province of Alberta). Confirmation of species presence, knowledge of species distribution, abundance, roosting sites, maternity sites and hibernacula is lacking.

White Nose Syndrome (WNS) a fatal fungal disease accidentally introduced to the United States from Europe has killed more than five million bats in eastern North America. It is spreading from its epi-centre in New York State at a rate of 200 to 400 kms per year. It has been categorized as one of the greatest wildlife catastrophes in the last half century of North America. Expert projections of when the disease might reach western Canada vary from 11 to 22 years to reach the west coast and approximately the winter of 2015-2016 to reach northern Montana.

Banff National Park most certainly has one of three bat species designated in 2012 by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered (little brown myotis *(Myotis lucifugus)*) and possibly a second designated species (northern myotis *(Myotis septentrionalis)*). Legal listing of these species in Schedule 1 of the Species at Risk Act (SARA) has not occurred yet, but is expected. Other Banff myotis genera are currently not designated as endangered but are vulnerable to the disease. Before the potential arrival of WNS, Banff urgently needs to inventory its bat resources. This inventory can be expected to last a minimum of several summer field seasons given the size and complexity of the park. After inventory, monitoring for the presence of WNS will be required. Should WNS arrive in the park, a recovery monitoring plan will be appropriate.

2.0 Basic Bat Biology and Life Cycle

Bats are mammals of the order Chiroptera, meaning hand-wing from Greek. Bats are the only true flying mammal. Flying squirrels, flying lemurs and gliding phalangers glide on furred membranes stretched between extended legs (Banfield 1974). Worldwide there are more than 1,300 species of bats. This diversity is second only to rodents (2,200 species) in the class mammalia. Bats are found worldwide excluding high latitude polar regions, very arid deserts and some oceanic islands. The oldest known bat fossils dated back to approximately 50 million years ago.

They are often called "flying rodents" or "flying rats". In many languages, the word for "bat" is cognate with the word for "mouse": for example, *chauve-souris* ("bald-mouse") in French, *murciélago* ("blind mouse") in Spanish, летучая мышь ("flying mouse") in Russian, *slijepi miš* ("blind mouse") in Bosnian, *nahkhiir* ("leather mouse") in Estonian, *vlermuis* (winged mouse) in Afrikaans, from the Dutch word *vleermuis*. An

older English name for bats is flittermice, which matches their name in other Germanic languages (for example German *Fledermaus* and Swedish *fladdermus*) http://en.wikipedia.org/wiki/Bat .

The species diversity of bats in the United States and Canada represents less than 5 percent of the world species. All bat species in North America are of the sub-order Microchiroptera (microbats/echo locating bats). There are 47 species in the United States in 4 families and 19 genera. In Canada there are 20 species of one family and 9 genera (Harvey 2011), all are insectivores. See Appendix 1 for a complete list of Canadian bat species.

2.1 Biology

Bats are hair covered mammals giving birth to live young and nurse these young from mammary glands. All of Canada's bats belong to the family Vespertilionidae, from the Latin word *vespertilio* ("bat"), from *vesper*, meaning "evening". These bats are active nocturnally, however some activity can be observed in the evening before sunset. As well, winter activity during daylight has been considered abnormal yet recent research (Lausen & Barclay 2002) indicates this activity by bats in the prairies may be more common than previously thought. All feed exclusively of insects, primarily flying insects.

Echolocation, or biosonar, is used by all bats found in Canada (microchiropterans). Bats emit pulses of high frequency (greater than 20 kHz and inaudible to humans) sound up to 200 times per minute (Harvey et al. 2011). The calls used by hunting bats are of three types: search phase (looking for prey), approach phase (prey has been detected) and terminal or feeding-buzz phase (up to capture). Echolocation is also used by bats to navigate around obstacles. Some bats theoretically can receive echoes from objects 85m away (Fenton 2001).

Echo locating bats contract the muscles in the middle ear just before (about 6 ms) each call (pulse) then relax the muscles in time to listen for the echo to return. This prevents a bat from deafening itself. Pulses and echoes from other bats should not interfere with echolocation because each individual is comparing each original pulse with its echo. Since the echo locating bat is listening for echoes of its own voice, it should not be disturbed by other sounds (Fenton 2001). At times when hundreds or thousands of bats are funnelling through a constriction, like exiting a roost, it is presumed they must use memory instead to guide their flight path.

2.2 Bat Life Cycle

Bats swarm or gather together in late August to early September for the purpose of mating. The sperm is carried by the female for delayed impregnation in late winter or early spring. Non-migrating bats normally use caves and abandoned mines as

hibernacula. Big Brown Bats are known to use buildings, air vents and other lightly heated structures as alternates to natural features. All hibernacula sites need to have stable environments of temperature, humidity and shelter from strong drafts. Hibernating bat body temperatures drop to near that of the ambient air temperature and likewise respirations and heart rates lower greatly in a state of torpor.

Bats may awake several times during the winter to drink water either from pools in the hibernaculum, from condensation on their bodies or leave to go to outside water sources. If bats are disturbed excessively by humans, these events can consume their stored energy reserves to a degree that they may not survive until spring.

Bats will emerge in spring with the presence of their food source, flying insects. Females of the same species may group together in maternity colonies in locations used previously. Other species are solitary and raise their young while roosting on trees. Some bat species adapt readily to man made structures for maternities by using attics and other building spots where high temperatures are sustained. Natural maternity locations can be under tree bark, in hollow trees or rock cracks where there is warming by the sun. Caves in Alberta are too cold to be used as nursery or maternity sites. The average gestation is 50 to 60 days. Most bat species give birth to a single pup one third to one quarter the mother's weight.

Migratory bat species found in Alberta give birth and raise their young in Canada and migrate to the southern United States and Mexico for the winter.

The only food source for the pup is lactation. This form of feeding lasts six weeks. Then the pup must feed on insects on its own. Hawking, aerial feeding on insects is the most common method of adult bat feeding. Insects are caught directly in the mouth and or the wing and tail membranes are used to catch/deflect insects to the mouth. The other form of feeding is called gleaming, bats either hover or crawl to hunt insects on vegetation, the ground or tree trunks.

3.0 Bats Species in Alberta

Nine species of bats have been identified in Alberta:

- Big Brown Bat *(Eptesicus fuscus)*
- Eastern Red Bat *(Lasiurus borealis)*
- Hoary Bat *(Lasiurus cinereus)*
- Little Brown Myotis *(Myotis lucifugus)*
- Long-eared Myotis *(Myotis evotis)*
- Long-legged Myotis *(Myotis volans)*
- Northern Myotis *(Myotis septentrionalis)*
- Silver-haired Bat *(Lasionycteris noctivagans)*
- Western Small-footed Bat *(Myotis ciliolabrum)*

Only two species are encountered frequently by people: the big brown bat and little brown myotis. The remaining species reside as solitary individuals where people seldom see them, or else they are easily confused with the two common species (Alberta Sustainable Resources 2013 **http://www.srd.alberta.ca/FishWildlife/WildSpecies/Mammals/Bats/Default.aspx)**.

Alberta Mammals, An Atlas and Guide by H.C. Smith (1993) presents information about the current nine species. It has detailed, well drawn, bat skull diagrams and range maps. Handbook of Canadian Mammals Volume 2 - Bats by C.G. Van Zyll de Jong, (1985) covers Alberta's nine species in authoritative detail. Author A.W.F. Banfield of The Mammals of Canada (1974) includes the eight of the nine currently recognized Alberta bat species. The northern myotis *(Myotis septentrionalis*) is the single species not listed by Banfield. The earlier work of J.D. Soper in The Mammals of Alberta (1964) lists 8 species. It, as well, excludes the northern myotisat *(Myotis septentrionalis*). The western small-footed bat *(Myotis ciliolabrum)* was described under the name Say masked bat *(Myotis subulatus subulatus)*. Previously the little brown myotis was called the little brown bat. As well, the other myotis species used the common name "bat".

A summary using information copied from the Alberta Sustainable Resources web site is found in Appendix 2. For each Alberta bat species there are details of: size, appearance, distribution, habitat, food, breeding behaviour, growth processes, conservation status and management issues.

4.0 Federal and Provincial Status of Bats that occur in Banff National Park

4.1 Alberta Status

In the Province of Alberta wildlife species are classified to General Status Categories. The definitions of those categories that most pertain to bats are;

At Risk - Any species known to be at risk after formal detailed status assessment and legal designation as *Endangered* or *Threatened* in Alberta.

May Be At Risk - Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.

Sensitive - Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

Secure - A species that is not *At Risk*, *May Be At Risk* or *Sensitive*.

Undetermined - Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.

Not Assessed - Any species that has not been examined during this exercise.

Updated from Vinhof (2006)

Species	**Alberta Provincial Status Listing**	**Overwinter Strategy**	**Summer Roost Type**	**Summer Roosting Strategy**
Big Brown Bat (*Eptesicus fuscus*)	Secure	Hibernates	Buildings, Tree Cavities, Rock Crevices	Colonial
Eastern Red Bat (*Lasiurus borealis)*	Accidental/ Vagrant	Migrates	Foliage	Solitary
Hoary Bat (*Lasiurus cinereus*)	Sensitive	Migrates	Foliage	Solitary
Silver-haired Bat (*Lasionycteris noctivagans*)	Secure	Migrates	Tree Cavities	Colonial
Western Small-footed Myotis (*Myotis ciliolabrum*)	Sensitive – special concern	Hibernates	Rock Crevices	Solitary or Colonial
Western Long-eared Myotis (*Myotis evotis*)	Secure	Hibernates	Buildings, Tree Cavities, Rock Crevices	Solitary or Colonial
Little Brown Myotis (*Myotis lucifugus*)	Secure	Hibernates	Buildings, Tree Cavities, Rock Crevices	Colonial
Northern Long-eared Myotis (*Myotis septentrionalis*)	May be at risk	Hibernates	Tree Cavities	Colonial
Long-legged Myotis (*Myotis volans*)	Undetermined	Hibernates	Tree Cavities, Rock Crevices	Colonial

4.2 Federal Status

4.2.1 Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

On 3 February 2012, an emergency assessment subcommittee of COSEWIC assessed the status of tri-colored bat (*Perimyotis subflavus*), little brown myotis (*Myotis lucifugus*), and northern myotis (*Myotis septentrionalis*) in Canada (see Appendix 3 for full COSEWIC report of the two species known or possibly found in BNP). All three species were assessed as Endangered. The subcommittee concluded that the unprecedented mortality in Canada's native bat species from *Geomyces destructans*, the pathogen responsible for White-nose Syndrome, poses a serious and imminent threat to the survival of each of these species. Populations of all three species have recently declined precipitously due to the rapid spread of White Nose Syndrome. A recommendation has been made to the Minister of the Environment that an Emergency Order be issued placing these wildlife species on Schedule 1 of the Species at Risk Act.

The emergency assessment was based on the best available knowledge for the three bat species and the disease agent in Canada and in the United States. Although information on bats and the fungal disease is somewhat limited, the evidence of population collapse and rapid spread of the disease is clear. This is only the fourth emergency assessment carried out by COSEWIC in about ten years.

The following definitions are used by COSEWIC;

Extinct (X) - A wildlife species that no longer exists.

Extirpated (XT) - A wildlife species that no longer exists in the wild in Canada, but exists elsewhere.

Endangered (E) - A wildlife species facing imminent extirpation or extinction.

Threatened (T) - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

Special Concern (SC) - A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

Data Deficient (DD) - A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

Data Sensitive Species (DSS): A wildlife species for which COSEWIC has determined that the publication of specific information related to where it occurs may negatively affect its survival or recovery.

Not At Risk (NAR) - A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.

4.2.2 Species at Risk Act (SARA)

In 2003, the Species at Risk Act (SARA) was proclaimed. The purpose of SARA is to protect wildlife species at risk in Canada. Within the Act, COSEWIC was established as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. This is the first step towards protecting wildlife species at risk. Subsequent steps include COSEWIC reporting its results to the Canadian government and the public, and the Minister of the Environment's official response to the assessment results. Wildlife species that have been designated by COSEWIC may then qualify for legal protection and recovery under SARA.

It is up to government to legally protect wildlife species designated by COSEWIC. COSEWIC's assessments do not take into account political, social or economic factors. The potential impacts of legal listing are for Government to analyze, and the Act applies only to wildlife species on the SARA legal list.

Schedule 1: is the official list of species that are classified as extirpated, endangered, threatened, and of special concern.

Schedule 2: species listed in Schedule 2 are species that had been designated as endangered or threatened, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.

Schedule 3: species listed in Schedule 3 are species that had been designated as special concern, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.

Special concern species: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

Species at risk: an extirpated, endangered, threatened species, or a species of special concern.

4.2.2.1 Species Listing Process Under SARA

SARA separates the scientific assessment process from the listing decision. This approach ensures that scientists can provide fully independent recommendations, and that

decisions affecting Canadians are made by elected officials who can be held accountable for those decisions. COSEWIC uses the best biological information on a species deemed to be in some danger of disappearing from Canada to assess the risk status of that species. It reviews research information on population and habitat status, trends, and threats; uses community and Aboriginal traditional knowledge; and applies assessment criteria based on international standards.

COSEWIC assesses the species as extinct, extirpated, endangered, threatened, special concern, data deficient, or not at risk. COSEWIC sends its assessment and supporting evidence (i.e. rationale and status reports) to the Minister of the Environment and the Canadian Endangered Species Conservation Council once per year. The COSEWIC assessment and the reasons for it are also posted on the SARA Public Registry.

The Minister of the Environment has 90 days in which to publish response statements on the public registry. These statements indicate how the Minister intends to respond to each COSEWIC assessment and, to the extent possible, provide timelines for action. Certain species may require extended consultation.

The Minister of the Environment forwards COSEWIC assessments to the Governor in Council (GIC). The GIC within nine months after receiving the assessment may, on the recommendation of the Minister, by order:

a. accept the assessment and add the species to the List;
b. decide not to add the species to the List; or
c. refer the matter back to COSEWIC for further information or consideration.

If the GIC does not make a decision within nine months of receiving the COSEWIC assessment, the Minister shall by order amend the List according to COSEWIC's assessment. Once a species is added to Schedule 1, it benefits from all the legal protection afforded, and the mandatory recovery planning required, under SARA.

5.0 Threats to Bats

5.1 Predators

5.1.1 Native Predators

Native predators of bats in Canada can include raccoons, skunks, owls and hawks. There are a couple of more unusual predation reports from Alberta as well. Black-billed Magpies *(Pica pica)* were observed in the Edmonton area preying upon a roosting bat, pursuing and capturing a flying bat and a pair of immature magpies consuming a bat, the capture was not observed, Hochachka & Scharf (1986). At Lac des Arcs, Exshaw, Alberta an American Kestrel *(Falco sparverius)* was observed pursuing a bat which it eventually caught in mid-air. Immediately a Ring-billed Gull *(Larus delwarensis)* closed

in, when the kestrel dropped the bat the gull hit it while it fell and then picked up the bat from the lake surface. The first gull, with its bat, was then chased by six more gulls out of sight, Holroyd & Beaubien (1983). Hoary and big brown bats have been known to attack and kill smaller bat species. Although smaller bats are not considered a significant portion of the diet for those two species, opportunistically they may consume other bats (Fenton 2001).

5.1.2 Non-native Predators

Non-native predators will include feral and domestic cats and dogs. Domestic cats can be very successful bat hunters, often not eating their catch but just bringing it home to show off to its owner.

5.2 Parasites

Bats are hosts to many parasites, both endoparasites (within a bat's body) and ectoparasites (those living outside a bat's body). The list of both types is long, incomplete and documentation of such, expanding. Typical endoparasites include blood parasites (plasmodia, trypanosomes), tapeworms and roundworms. Ectoparasites of bats are mites, ticks, fleas and bedbugs. Bats seem to suffer no particular ill effects from the various parasites that live on them or in them (Fenton 2001).

5.3 Rabies

Rabies is a disease caused by the virus Rhabdovirus. At least four species of bats found in Alberta have positively tested for rabies. By proportional provincial occurrence (from 1979 to 1983), little brown myotis – 4.7%, big brown bat – 55.8%, silver-haired bat – 27.9%, and hoary bat – 11.6% (Pybus 1986).

In North America 5 to 10% of all bats submitted for rabies testing are found to be infected. This is a very biased sample since most collected bats are those that are not "normal" but more often than not; aggressive, weak or dead. When bats were captured during foraging flight in the wild only 0.1 to 0.5% were infected (Nargorsen & Brigham 1993).

The signs of a rabid bat can be divided into two stages, "furious" when they go berserk or act out of character and "dumb" when they become immobilized and die (Fenton 2001). Fenton made a useful summary of the dangers of rabid bats;

> "Although it is tempting to think that the animal with furious rabies is more dangerous than the one with dumb rabies, first impressions may be wrong. Almost everyone recognizes the danger posed by a bat that makes an unprovoked attack. Someone bitten under these circumstances is likely to seek immediate medical advice.
>
> A bat with dumb rabies, however, such as the one lying helplessly on the ground, often arouses our humane instincts. The person going to help the stricken animal

> may be bitten, but pay little attention to the bite. Ignoring the bite seems sensible because bat bites are usually relatively small and the bite was provoked. This was the situation surrounding the first human death reported from bat rabies in the US (in1958). Animals with furious rabies may not be more dangerous to people than those with dumb rabies."

The most common way for rabies to spread is by biting. The virus can be concentrated in the saliva. There are three other transmission routes: 1) eating infected tissue 2) bites of ectoparasites and 3) aerosol – inhaling airborne virus (Fenton 2001).

Bats are not asymptomatic carriers of the active rabies virus. This means when a bat has the active virus it will be probably be immobilized within two days and dead within four or five days. But, bats like other mammals can harbour dormant rabies virus for three to nine months before contracting the virus and dieing (Fenton 2001).

5.4 Being Young and Inexperienced

Young bats, like juveniles of most species, have a steep learning curve. They have been found killed on bared wire and caught up in "sticky" plants like burdocks (Fenton 2001). They are the most likely to choose unsafe roosting locations. For young bats, the first winter's hibernation survival is the most tenuous because their newly learnt, but unrefined, feeding skills put them at risk for the start of hibernation with low body fat (Fenton 2001).

5.5 Humans

Prior to the emergence of White Nose Syndrome, an introduced fungus from Europe, direct human impacts were having the most significant impact on bat populations in Canada. Those direct impacts include intentional killing of bats, disturbance of bats at critical times (maternity colonies, breeding and hibernation) and habitat destruction. Indirect impacts include pesticide application on insect species used as bat food and other toxic chemical side effects.

Even open rain barrels or stock watering tanks can be fatal to bats. Bats swoop over to drink or feed on insects, get caught in the water and are unable to crawl up the vertical smooth sides or take off while floating, then die from exhaustion and or drowning.

5.5.1 Wind Turbines

Wind turbines are a more recent immerging source of significant bat mortality. Migratory bat species are killed more often than resident and non-migratory species. Late summer and autumn is the time when most bats die. Most bat deaths are not caused by actual impact with turbine blades but appear to be caused by barotrauma, severe lung damage due to sudden drop in air pressure from the rotating blades. The speed at the blade tips may exceed 320 kms per hour (Harvey et al 2011).

Environmental conditions such as extreme weather events and even algal blooms can have impacts on bats. In August 1985, 500 bats were counted (of 1000 bats estimated) were found dead and floating on Steele Lake (150 kms north of Edmonton) as well as 24 mallards *(Anas platyrhynchos)* and American Wigeons *(Anas Americana)*. The dead bats (6 *Myotis* spp. and one hoary bat *(Lasiurus cincereus)* along with two mallards were collected for examination at the Provincial Veterinary Lab. Death appeared to be very acute caused by the toxic alkaloid of the blue-green alga *Anabaena flos-aquae*. It is speculated that bats skimming over the lake to drink ingested small amounts of the toxic (Pybus, Hobson & Onderka 1986).

5.5.2 Climate change

Climate change prediction models forecast that western North America will become warmer and drier resulting in less water available for ecosystems. When annual environmental conditions mimic these predictions, the reproductive success of female insectivorous bats declines. It is shown that levels of precipitation and flow rates of small streams near maternity colonies is fundamentally tied to successful reproduction in female bats, particularly during the lactation phase. Across years that experienced greater than average mean temperatures with less than average precipitation and stream flow, bat populations responded by slight to profound reductions in reproductive output depending on the severity of drought conditions (Adams 2010).

5.5.3 White-Nose Syndrome (WNS)

The United States Fish and Wildlife Service released in May 2011 A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats (Anon. 2011). This plan summarizes the disease:

> White-nose syndrome [WNS] was named for the visible presence of a white fungus around the muzzles, ears, and wing membranes of affected bats. Scientists recently identified a previously unknown species of cold-loving fungus*(Geomyces destructans)* as a consistent pathogen causing skin infection in bats at affected sites. This fungus thrives in low temperatures (5-14º C; 40-55º F) and high levels of humidity (>90 %), conditions characteristic of many bat hibernacula. Pathologic findings thus far indicate that such fungal infections can be detected as early as October, and it is hypothesized that bats affected by WNS arouse from hibernation more frequently, and/or for longer periods than normal, and are prematurely expending the fat reserves they rely on for winter survival. Chronic disturbance of hibernating bats has been known to cause high rates of winter mortality through fat loss, and aberrant behaviors associated with WNS may cause bats to consume critical fat reserves prematurely during winter. Aberrant behaviors observed at sites affected by WNS include shifts of large numbers of bats in hibernacula to locations near the entrances or unusually cold areas; large numbers of bats dispersing during the day from hibernacula, even during mid-winter; a general unresponsiveness to human disturbance; and, on occasion, large numbers of fatalities, either inside the hibernacula, near the entrance,

> or in the immediate vicinity of the entrance. Additionally, recent hypotheses suggest that the characteristic wing pathology associated with WNS may cause death by disruption of important wing-dependent physiological functions, such as water balance, thermoregulation and mechanical function of the wing leading to dehydration, increased thirst-mediated arousals, increased heat loss, and inhibition of flight. Although evidence indicates that skin infection by *G. destructans* is the plausible primary cause of mortality associated with WNS, the exact processes by which skin infection leads to death remain undetermined, and it is unclear the extent to which other conditions may contribute to susceptibility of species or individuals to fungal infection and/or mortality.

The British Columbia Bat Action Team produced a Bat Conservation Fact Sheet 2, Spring 2010 that summarizes the basic facts:

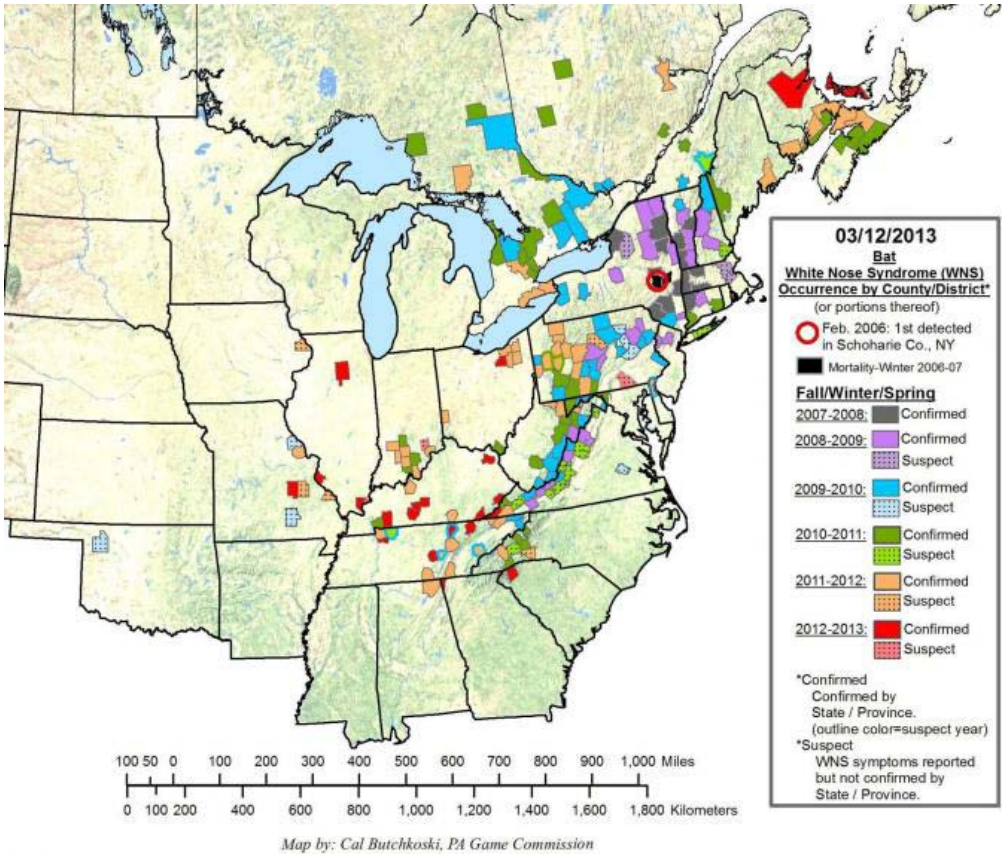
> White-nose Syndrome (WNS) is a fungal disease that has been associated with mass die-off of hibernating bats in North America. The name refers to a white fungus that grows on the muzzles and bodies of bats found in mass die-offs since 2006. All North American bat species that hibernate are thought to be at risk. The newly discovered fungus associated with WNS is called *Geomyces destructans*. This morphologically distinct fungus is now known from countries across Europe, although bats do not appear to be dying there.
>
> The fungus grows best in cold temperatures associated with bat hibernation. As the fungus grows, bats wake up from hibernation to groom their fur to fight off the fungus. Waking up and reentering hibernation uses up a lot of energy. Bats use up their winter fat reserves too quickly and die of starvation before spring. Transmission is not well under-stood; the disease spreads bat to bat but humans can also play a role. For example, cavers, other recreationists such as geocachers, people frequenting mines, and bat biologists, may spread the disease through spores on boots, clothing, or equipment.

Currently nine hibernating species of bats have been affected by White-nose Syndrome or documented with the WNS-fungus. Those nine include big brown bat *(*Eptesicus fuscus), eastern small-footed myotis *(Myotis leibii),* little brown myotis *(Myotis lucifugus),* northern myotis *(Myotis septentrionalis),* Indiana myotis *(Myotis sodalist),* tri-colored bat *(Perimyotis subflavus),* gray myotis *(Myotis grisescens),* cave myotis *(Myotis velifer)* and southeastern myotis *(Myotis austroriparius).* All bat species that hibernate in caves and mines could be affected by White-nose Syndrome in the future.

5.5.3.1 Known Geographic Range of White-Nose Syndrome in North America

As of March 12, 2013 the disease is confirmed in 21 states, suspected in two more and confirmed in five Canadian provinces, Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario. The map shown has changed three times since starting to write this report in January 2013. It was first detected in February 2006 in four caves in the Schoharie County area, New York. Photography from the previous winter (2005)

revealed the earliest apparent documented evidence of the disease (Anon. 2011)



The fungal pathogen (*Geomyces destructans*) has been detected in 6 bat species, with the species in Canada being the big brown bat, little brown myotis, northern myotis and tri-colored bat. The later three species are COSEWIC designated as endangered in February 2012. Mortality in infected bat hibernacula ranges from 75% to 99% and an estimated 5.5 to 7 million bats have died in North America from the disease since its emergence.

5.5.3.2 White-Nose Syndrome and the Canadian Wildlife Directors Committee

In 2011, under the guidance of the Canadian Wildlife Directors Committee (CWDC) and with leadership from the Canadian Cooperative Wildlife Health Centre (CCWHC), Canada's Inter-agency White-nose Syndrome Committee prepared a "National Plan to Manage White-nose Syndrome in Bats in Canada", modeled after a similar US plan. The Canadian plan received support in early 2012 from the CWDC as the framework for managing the WNS threat to Canadian bat populations. The linked needs of development of a detailed implementation plan and definition of the role of the CWDC in the WNS effort resulted in a half-day WNS workshop for the CWDC during its October 2012 meeting. This workshop benefited from participation by more than 20 government wildlife managers, wildlife health specialists, conservation organization representatives

and academics interested in the disease and bat conservation who subsequently collaborated on development of a draft implementation plan.

The workshop consisted of three invited presentations, setting the stage for a round-table discussion by the CWDC concerning its anticipated role. A strong foundation for the CWDC discussion was laid with a review by Scott McBurney (CCWHC, Atlantic Region) of the history and current geographical distribution of WNS in Canada, the etiology and pathology of the disease, and ongoing research and bat monitoring activities. An example of a US state response to WNS was presented by Scott Darling (Vermont Fish and Wildlife Department), describing the limited information about the disease, bats and bat populations at the start of the outbreak, successful involvement of the public in disease reporting and bat colony identification, the rapid growth in information about the disease and bats, but confirming the need for continued research and monitoring efforts, coordinated at a national level. The final presentation, from Jeremy Coleman (United States Fish and Wildlife Service (USFWS)), described the challenges around national coordination in the US, the planning processes involved and the plans that were developed. The value of national coordination was emphasized by both Coleman and Darling, as was the value of strengthened collaboration and coordination between Canada and the US.

CWDC Considerations

The discussion following the presentations elucidated considerations such as these (not in any particular order of priority):

- Little is known of bat ecology, populations and hibernacula in Canada
- Information on the ecological services provided by bats is limited, and would be valuable to confirm the magnitude of the ecological impact of WNS and the loss of bats
- CWDC is uniquely positioned to direct and monitor the management of this emerging disease (WNS) and bat conservation
- Coordination at a national level is required
- Partnerships are needed, and national coordination will be key to making the connections and for maintenance of the partnerships
- WNS program needs to be underpinned by government-led planning processes and plans, with initial government funding as a precursor to identifying and gathering other funding for conservation of bats
- WNS actions are under the umbrella of the National Wildlife Disease Strategy (NWDS)
- CCWHC can play a role in national coordination, but new resources or core programs will be needed to enable this new role
- The Committee on the Status of Endangered Wildlife in Canada's (COSEWIC) emergency assessment of the status of the three bat species as endangered has resulted in a recommendation to the Minister of Environment that an emergency order be enacted to list the impacted bat species under the Species at Risk Act (SARA)

- If listed under SARA, the WNS effort is likely to move into a recovery planning phase
- Developing a national recovery plan for species under provincial and territorial management authority is likely to result in a framework that engages all public and private partners
- Work at the continental level could be modeled after international processes for collaboration on management of migratory birds
- Common messaging about the disease, bat conservation and the ecological significance of bats that resonates with all potential funders and the public is required
- Coordinated monitoring programs, coupled with government policy and legislation for WNS containment will be needed
- Coordinated monitoring is a prerequisite to enable funding from sources from outside government (the mining industry, as a key producer of bat hibernation habitat, and the wind power industry, because of interest in migration patterns and timing, were cited as examples of possible non-traditional funding sources)
- Research is critical to future management of the disease and bats
- Although the relationship between Canada and the US is strong at the working level, points of contact between the countries at the senior level should be formalized and continental executive/steering committee procedures confirmed

See the first part of Appendix 4, a bulletin titled: A Workshop of the Canadian Wildlife Directors Committee October 16, 2012 Ottawa, Ontario

As a result of that October 2012 workshop a draft document, Canada's White Nose Syndrome Management Plan – Priority Actions for Implementation in 2013, was created January 22, 2013. A new national organizational structure is proposed with five working groups to be created to implement WNS responses. A coordinator would be hired to oversee three primary technical groups and two support groups. This 14 page draft, including three organizational charts, is included as the second part of Appendix 4.

5.5.3.3 White Nose Syndrome Decontamination Protocols

There has been an evolution of the most effective yet practical decontamination procedures to use to minimize the accidental conveyance of the fungal spores from a cave or mine to another unaffected site. The National White-Nose Syndrome Decontamination Protocol - Version 06.25.2012 [June 25, 2012 version] is the most recent protocol posted. This is the standard all U.S.A. land management agencies require as the minimum treatment. Many older versions are still accidentally found during internet searches. Check for updates.

http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5378842.pdf

http://whitenosesyndrome.org/topics/decontamination

http://www.fws.gov/midwest/endangered/mammals/BatDisinfectionProtocol.html

http://cavingnews.com/20130209-white-nose-syndrome-decontamination-protocol-research-released

http://www.caves.org/pub/journal/PDF/v75/cave-75-01-01.pdf

6.0 Bats in Banff National Park

6.1 Previous Research

6.1.1 Banff

The only recent research regarding bats conducted within the boundaries of Banff National Park was the wildlife inventory of the ecological or biophysical land classification (Holroyd & Van Tighem 1983). Previously, the 1941 expedition by The American Museum of Natural History made mammal collections in the Canadian Rocky Mountains including Banff (Crowe 1943).

6.1.2 Kananaskis Country

In neighboring Kananaskis Country, southeast of Banff, there has been considerable bat research conducted by Dr. Robert Barclay of the University of Calgary, http://www.bio.ucalgary.ca/contact/faculty/barclay.html . The following list summarizes the general location, topic, capture equipment and citation (all included references);

1985 K- Country and foothills within 100 kms SW of Calgary, foraging activity of *Myotis lucifugus* over calm and turbulent water, mist nets (Von Frenckell, B. and R.M.R. Barclay 1987)

1985-1988 K- Country, population structure of *Myotis lucifugus* and *evotis* in relation to foraging behavior and energy demand, mist nets & harp traps (Barclay, R.M.R. 1991)

1987 K- Country and foothills within 100 kms SW of Calgary, influence of physical clutter and noise on the activity of *Myotis lucifugus* & *Eptesicus fuscus* over water, no capture (Mackey, R.L., and R.M.R. Barclay 1989)

1987-1988 K- Country, response of tympanate moths to the echolocation calls of a substrate gleaning bat, *Myotis evotis,* mist nets & harp traps (Faure, P.A., J.H. Fullard and R.M.R. Barclay 1990)

1987-1989 K- Country and Writing on Stone, digestive efficiency of *Myotis lucifugus, M. evotis,* and *M. volans*, mist nets (Barclay, R.M.R., Dolan, M.A., and Dyck, A. 1991)

1988-1989 K- Country, sensory basis of prey detection by the lone-eared myotis *Myotis evotis*, and the consequences for prey selection, harp traps (Faure, P.A. and R.M.R. Barclay 1992)

Early 1990's K- Country, foraging and echolocation behavior of the long-eared bat *Myotis evotis* mist nets & harp traps (Faure, P.A. and R.M.R. Barclay 1994)

2001-2002 K- Country, Sheep R., South Saskatchewan R., Red Deer R., and Milk R., morphological differences of *Myotis evotis* between populations in mountain and prairie environments, mist nets & harp traps (Solick, D.I. and R. M. R. Barclay 2006)

2002 K- Country, Sheep R. foothills, thermoregulation and roosting behavior of reproductive and non-reproductive female *Myotis evotis*, mist nets & harp traps (Solick, D.I. and R. M. R. Barclay 2006)

2002 K- Country and Sheep River, geographic variation in the use of torpor and roosting behaviour of female *Myotis evotis*, mist nets & harp traps (Solick, D.I. and R.M.R. Barclay 2007)

6.1.3 Kootenay National Park

In a study funded by Parks Canada, the behavior, echolocation calls, and distribution of bats in Kootenay, Glacier, and Mount Revelstoke National Parks in British Columbia, Canada was completed (Fenton, M.B., H.G. Merriam and G.L. Holroyd 1983). The species involved include *Myotis lucifugus, M. evotis, M. volans, M. septentrionalis, M. californicus , Lasionycteris noctivagans, Eptesicus fuscus , Lasiurus cinereus,* and *L. borealis.* The distribution of these species within the three parks was assessed by capturing bats in traps and mist nets and by monitoring of their echolocation calls. Most of the species exploited concentrations of insects around spotlights, providing convenient foci of activity for assessing distribution. Although most species of *Myotis* were commonly encountered away from the lights, *Lasiurus cinereus* in Kootenay National Park was only regularly encountered feeding on insects at lights. These data were collected during fieldwork conducted in the parks in 1981 (27 July to 8 August) and 1982 (15 to 27 July).

For Kootenay National Park the following species were either detected by echolocation calls and or with nets/traps: *Myotis lucifugus* (11 caught, calls locally fairly abundant), *Myotis californicus* (2 caught, calls uncommon), *Myotis volans* (1 caught, call detected), *Myotis septentrionalis* (0 caught, calls uncommon), *Myotis evotis* (0 caught, calls uncommon), *Eptesicus fuscus* (3 caught, calls uncommon) and *Lasiurus cinereus* (0 caught, calls locally fairly abundant). The presence of *Myotis californicus* at Palmer Creek on the eastern boundary of Kootenay National Park constituted a new distribution record.

The study spent time listening to and observing bats attracted to lights. "The echolocation calls of bats active around lights made it clear that they were actively hunting, and it was often possible to watch the bats as they attempted to catch flying insects. We commonly observed more than one species of bat feeding around the lights at one time. In Kootenay this typically included *M. lucifugus, L. cinereus, E. fuscus,* and *M. evotis* or *M. septentrionalis*; in the other parks *M. lucifugus, M. volans,* and *M. septentrionalis* or *M. evotis*. We never saw any evidence of agonistic interactions between the bats, conspecifics or others, feeding around lights."

The authors propose, "It is likely that the rapid feeding strategy of the smaller *Myotis* spp. makes them less dependent on concentrations of insects around lights than the larger, slower feeding *Lasiurus cinereus*. It is possible that were it not for the prolonged concentration of prey at lights, *Lasiurus cinereus* would be unable to occupy any of Kootenay National Park."

The authors summarized their findings as: "Kootenay , Glacier, and Mount Revelstoke National Parks have relatively rich bat faunas, but probably low population levels of bats. In all three parks permanent lights offer bats important concentrations of food which may be critical to the occurrence of *Lasiurus cinereus* in Kootenay. The bat faunas of the three parks are generally similar. The *L. cinereus* and *L. noctivagans* are generally restricted to lower elevations, while *Myotis* spp., notably *Myotis volans* which we captured near the summit of Mount Revelstoke, are more widespread along an altitudinal gradient. *Lasiurus cinereus* forages high over open habitats from fields to rivers and in forest clearings. The *L. noctivagans* are more restricted, foraging along the Illecillewaet River and its banks. Both of these species tend to fly high and fast. The *Myotis* spp. often forage in and around the trees, whether in open areas, along the margins of clearings, streams and ponds, or along trails."

6.2 Bat species occurring in Banff National Park

Since the number of literature citations that reference bats is Banff is limited, the information they contain is fully presented in this report, oldest to most recent. The terms of this report asked for the prevalence or relative abundance of the bat species present. Due to the lack of a broad and rigorous bat study specific to Banff, conclusions regarding abundance would be conjectural. Table below summarizes the known or expected bat species of Banff National Park.

Reference \ Species	little brown myotis *(Myotis lucifugus)*	long-eared myotis *(Myotis evotis)*	long-legged myotis *(myotis volans)*	northern myotis *(Myotis septentrionalis)*	silver-haired bat *(Lasionycteris noctivagans)*	big brown bat *(Eptesicus fuscus)*	hoary bat *(Lasiurus cinereus)*
Crowe, P.E. 1943	X					X	
Rand, A.L. 1948	X					X	
Soper, J.D. 1964	X	X			X	X	X
Banfield, A.W.F. 1958	X	X			X	X	X
Banfield, A.W.F. 1974	X	X	X		X	X	X
Holroyd, G.L. et al. 1983	X				X	X	X
Van Zyll de Jong, C.G. 1985	X	X	X	X	X	X	X
Nagorsen, D.W. et al. 1993	?	?	?	?	?	?	?
Smith, H.C. 1993	X	X	X		X	X	X
Banff NP web site 2013	X	X	X		X	X	X

6.2.1 Notes on Some Mammals of the Canadian Rockies

by P.E. Crowe, 1943. Bulletin of American Museum of Natural History, Volume 80 Article 11, pp 391-410.

Three species of bats, little brown myotis *(Myotis lucifugus)* as two sub-species, silver-haired bat *(Lasionycteris noctivagans)*, and big brown bat *(Eptesicus fuscus)* as two sub-species, were reported. One big brown bat sub-species (*(Eptesicus fuscus fuscus)* (Beauvois)) was collected from Banff, "This specimen, caught by a resident of Banff in his house, is fully as dark as typical eastern representatives of this race and is so identified pending the examination of further specimens from this locality. Many others were seen flying over the streets of the town in the company of a smaller bat, probably Myotis, but no other specimens were collected. Outside the town bats were not in evidence."

The little brown myotis *(Myotis lucifugus)* is the assumed species observed "flying over the streets".

6.2.2 Mammals of the Eastern Rockies and Western Plains of Canada

by A.L. Rand, 1948 National Museum of Canada Bulletin No. 108, Biological Series No. 35. Department of Mines and Resources, Mines and Geology Branch, pp 55-65.

Seven species of bats are presented. They included include little brown bat *(Myotis lucifugus)*, long-eared bat *(Myotis evotis)*, long-legged bat *(Myotis volans)*, Say masked bat *(myotis subulatus)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, eastern red bat *(Lasiurus borealis)* and hoary bat *(Lasiurus cinereus).*

The little brown bat *(Myotis lucifugus)* is referenced from the Assiniboine and Jasper areas (from back to Crowe 1943) and "probably occurs in the Banff area." As well, the long-legged bat *(Myotis volans)* is mentioned seen flying in Jasper (from Hollister 1911) and the silver-haired bat *(Lasionycteris noctivagans)* "Probably occurs throughout in forested areas; specimens from Jasper area and Red Deer in National Museum." The big brown bat *(Eptesicus fuscus)* is "recorded from Waterton Lakes to Wood Buffalo Park."

6.2.3 The Mammals of Banff National Park, Alberta

by A.W.F Banfield, 1958. National Museum of Canada, Bulletin No. 159, Biological Series No. 57. Department of Northern Affairs and Natural Resources, 53 pp.

Five species of bat found in the park are listed. These include little brown myotis *(Myotis lucifugus)*, long-eared myotis *(Myotis evotis)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, and hoary bat *(Lasiurus cinereus)*.

Little brown myotis *(Myotis lucifugus)*

> Four specimens were collected from Banff [assuming townsite area], one from Mount Eisenhower [Castle Mountain] and four Storm Mountain.
>
> "These bats are common in the Bow Valley; there are several colonies in the attics of Banff houses and in the tourist lodges along the highways."
>
> Previous specimens collected/recorded from Crowe (1943) and Miller and Allen (1928) are mentioned. Banfield compares sub-species variation, *Myotis lucifugus alascensis Miller* verses *Myotis lucifugus pernox.* He wrote *"*With a larger number of specimens at my disposal, I have been able to compare them with other series from Alberta and British Columbia. Although one or two Banff specimens are rather light in colour, most of them seem to resemble the dark western *alascensis.* The park population seems to be best considered as belonging to that subspecies, although there is some eastern influence from prairie populations."

Long-eared myotis *(Myotis evotis)*

> The common name big-eared bat is used but refers to *Myotis evotis*. Banfield wrote "There are 2 specimens of this bat in the Banff Museum, collected at Banff on September 3, 1909, and in 1900 by Norman Sanson. This species has also been recorded nearby at Vermilion Crossing, Kootenay National Park, B.C., by Munro and Cowan (1944). Comparison of the Banff specimens with a series from the Kootenay station indicates that the Banff population is referable to the above subspecies. Colonies will probably be found in some buildings in the Bow Valley."

Silver-haired bat *(Lasionycteris noctivagans)*

> Banfield wrote “There are 2 specimens of the silver-haired bat in the Banff Museum, collected by Sanson at Banff in 1900. A specimen in the National Museum of Canada was collected at the Goat Creek Cabin by Warden Walter Child on August 21, 1939. It was preserved by C.H.D. Clarke, who also reported that a specimen was taken in 1930 at the Red Deer Ranger Station east of the park.”

Big brown bat *(Eptesicus fuscus)*

> Banfield wrote “Big brown bats are frequently observed flying over Banff townsite on summer evenings. Two were shot in flight in the Bow Valley [Johnson's Canyon]. Crowe [1943] lists one specimen from Banff under the subspecies name *fuscus,* remarking that it was fully as dark as eastern representatives of this race. Engels (1936), reviewing the distribution of western forms of this species, states: "some *pallidus* are rich brown some almost white." My specimens are much paler than a series of eastern *fuscus* from Ontario. It seems advisable to refer big brown bats from the park to the western *pallidus,* which is reported from the prairies as well. The Banff Museum contains a mummified specimen from Banff.”

Hoary bat *(Lasiurus cinereus)*

> Banfield wrote “The Banff Museum contains 3 specimens collected at Banff by Sanson. Two are labeled August 20, 1909, the third is labeled 1900. These bats generally migrate southward during the third week in August. Clarke (1940) reported an injured hoary bat found by a forestry gang at Stony Creek on August 21, 1939.”

6.2.4 The Mammals of Alberta

by J.D. Soper, 1964. Government of Alberta, The Department of Industry and Development, The Queen’s Printer, pp 88-101.

Eight species of bats are included. Two species have two subspecies each described. Small range maps are shown for all species and subspecies. Five of those eight species have range maps that cover Banff National Park: little brown myotis *(Myotis lucifugus)*, long-eared myotis *(Myotis evotis)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, and hoary bat *(Lasiurus cinereus).*

6.2.5 The Mammals of Canada

by A.W.F Banfield, 1974. National Museums of Canada, University of Toronto Press, pp 40-68.

Six species of bats are shown on the individual range maps of this book that indicate those species could be expected to be found in Banff National Park and or the immediate surrounding area. These include little brown myotis *(Myotis lucifugus)*, long-eared myotis *(Myotis evotis)*, long-legged myotis *(myotis volans)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, and hoary bat *(Lasiurus cinereus)*. Sub-species variations are recognized with the little brown myotis and big brown bat. Regarding the little brown myotis, Banff is situated at or near the range boundaries of three sub-species. *Myotis lucifugus alascensis* Miller, 1913 is found west of the Rocky Mountains of Alberta. *Myotis lucifugus lucifugus* (LeConte), 1831 is found in Canada north and east of the Rocky Mountains. *Myotis lucifugus pernox* Hollister, 1911 is a large form of uncertain status, known only from the vicinity of Jasper, Alberta.

As for the big brown bat, Banfield (1974) clearly indicates the range of *Eptesicus fuscus pallidus* Young, 1908 includes Banff as part of the western Prairies to south-eastern British Columbia. However, as Crowe (1943) identifies *Eptesicus fuscus fuscus* (Palisot de Beauvois), 1796 as one specimen collected in Banff, it is mentioned again. Banfield (1974) indicates the range of *Eptesicus fuscus fuscus* as eastern Canada west to eastern Saskatchewan.

6.2.6 The Ecological (Biophysical) Land Classification of Banff and Jasper National Parks, Volume III – Wildlife Inventory

by G.L. Holroyd and K.J. Van Tighem, 1983. Canadian Wildlife Service, Edmonton, Alberta, pp 279-285.

Seven bat species are listed in this document, five of which have been referenced to Banff National Park. The other two species are only reported from Jasper, long-legged bat *(Myotis Volans)* and Keen's bat *(Myotis Keenii)* (this species has since been taxonomically split into two species: Keen's long-eared myotis *(Myotis Keenii)*, a Pacific species, and the northern myotis (Myotis septentrionalis), a species that ranges from the Rocky Mountains to eastern Canada (Nagorsen & Brigham 1993)).

Little brown myotis *(Myotis lucifugus)*

> Holroyd and Van Tighem wrote "In Banff and Jasper National Parks, the little brown bat is generally uncommon. It occurs in the lower valleys of the Front Ranges and is locally fairly common in the lower and middle Bow valley, the townsite of both parks … In Banff National Park, little brown bats were detected in the Muleshoe area, Pilot Pond area, around Forty Mile Creek near Banff townsite and in the Vermillion Lakes area in mid-August 1980 and at Lake Minnewanka and the golf course in May 1980. During this project, seven dead bats were removed from an attic in Banff townsite, ten females were caught at the Baker Creek bungalows and seven lactating females were netted at their nursery colony in the Johnston Creek Staff House." They went on to cite Banfield (1958) and Soper (1970) and stated the "numbers of bats in the Bow Valley may have changed since Banfield's assessment."

Continuing with this species they wrote, “Searches for day roosts, nursery colonies and hibernation sites were unsuccessful. Feeding habitats include quiet lakes and ponds, open lodgepole pine, spruce or Douglas-fir forest and forest clearings. Little brown bats also feed around street lights of the townsites. Buildings with accessible attics remain the most probable location for nursery colonies and perhaps day roosts but questioning of local residents revealed only single individuals. The scarcity of caves and the presence of ice in many probably accounts for the scarcity of bats in Banff and Jasper.”

Long-eared myotis *(Myotis evotis)*

The authors consider this a very rare visitor in Banff and they did not record any during their biophysical project. They cited Banfield (1958) which in turn had referred to specimens in the Banff Park Museum from 1900 and 1909.

Silver-haired bat *(Lasionycteris noctivagans)*

The authors classified this bat species as rare in Banff National Park. They wrote “A rabid specimen was collected in Banff in August 1973 (Schowalter, pers comm.). The National Museum of Canada holds one specimen of this species from the Spray River in Banff. None were trapped or detected ultrasonically during our surveys. Nursery sites for this species have been found in crow’s nests and in lumber piles as well as under tree bark. Potential nursery sites may occur in avalanche rubble and log piles along rivers.”

Big brown bat *(Eptesicus fuscus)*

The authors considered the big brown bat generally uncommon in both Banff and Jasper parks. They did state “the big brown bat is the most common bat in both Banff townsite and Jasper townsite and is fairly common in the montane ecoregion. During their biophysical study only one bat was identified at the Vermillion Lakes in August 1980. They again cited Banfield (1958) for historical species data. As well, they mentioned “Records of the Banff wardens indicated that this species was found in the Rimrock Inn.” Major renovations took place at the Rim Rock Inn in the late 1980’s (Worobets 2013 pers. comm.), therefore suitable habitat may no longer exist.

Under management considerations they wrote “Although the big brown bat is clearly associated with the townsite area, no nurseries have been located and only one roost has been identified. Old buildings with accessible attics are being replaced by well-insulated and generally inaccessible attics. Thus, artificial nurseries, roosts and hibernation sites are disappearing. Natural sites used by these bats may need protection if the species is to remain in the mountain national parks.”

Hoary bat *(Lasiurus cinereus)*

> The authors considered this species as rare in Banff. They list two records from May 1980 in Banff National Park, the Banff golf course and the Forty Mile Creek Picnic Area.

6.2.7 Handbook of Canadian Mammals Volume 2 - Bats

by C.G. Van Zyll de Jong, 1985. Publication of the national Museum of Natural Sciences, National Museum of Canada. 212 pp.

Six bat species have range maps that include Banff National Park: little brown myotis *(Myotis lucifugus)*, long-eared myotis *(Myotis evotis)*, long-legged myotis *(myotis volans)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, and hoary bat *(Lasiurus cinereus)*. The range map of the northern myotis *(Myotis septentrionalis)* may just include the headwaters of the North Saskatchewan River in the northern part of BNP. As well, a peripheral localities are noted for the species includes Mount Revelstoke National Park (MRNP), 1 km west of Woolsey Creek and Cadomin Cave, east of Jasper National Park.

Another species, the California myotis *(Myotis californicus)*, has both a range map and a noted peripheral locality just to the west of BNP in the Columbia Trench, Wilmer National Wildlife Area near Wilmer, British Columbia. The species has a range from Guatemala to the Alaskan panhandle in habitats from humid coastal forest to semi-desert and an elevation spread of sea level to at least 1800m. Although there is no evidence of this species ever being recorded in BNP, should it be found, it will be a pleasant but not a totally unexpected discovery. Refer back to the second paragraph of section 6.1.3.

6.2.8 Alberta Mammals An Atlas and Guide

by H.C. Smith, 1993. The Provincial Museum of Alberta, Edmonton, Alberta, pp 34-53.

This book list the nine species of bats currently recognized as native to the Province of Alberta. Each species has a very brief description of geographical distribution and a full page range map with dots indicating …… Six bat species have range maps that include Banff National Park: little brown myotis *(Myotis lucifugus)*, long-eared myotis *(Myotis evotis)*, long-legged myotis *(myotis volans)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, and hoary bat *(Lasiurus cinereus)*. Three of those six species have range maps with dots Banff: little brown myotis *(Myotis lucifugus)*, silver-haired bat *(Lasionycteris noctivagans)* and big brown bat *(Eptesicus fuscus)*.

6.2.9 Bats of British Columbia

by D.W. Nagorsen and R.M. Brigham. 1993. Royal British Columbia Museum Handbook. Vol.1. The Mammals of British Columbia. UBC Press, Vancouver. 164 pp.

This excellent reference book does not present range maps showing defined or suspected territory boundaries but indicates locality records as black dots on a provincial scale map (10 x 8 cm). No indication is made for any species records outside the provincial boundaries. However, there is further mention of the northern myotis *(Myotis septentrionalis)* in MRNP on the Giant Cedars Trail (Fenton et al 1983) and at the Revelstoke Dam. These details are noted in this report to further support 6.2.7 and notion that the range of *Myotis septentrionalis* may include BNP.

Likewise, following up on the clues of the California myotis *(Myotis californicus)* found in 6.2.7, a museum specimen was collected from Rogers Pass, Glacier National Park, in January (no year given). Although the Wilmer, B.C. locality (see 6.2.7) is not mentioned by name, two black dots of species records do appear to match the area.

6.2.10 Banff National Park of Canada Official Website

The official Banff National Park web site, at the location http://www.pc.gc.ca/pn-np/ab/banff/natcul/Animaux-Animals/mammifieres-mammals.aspx#bats lists six species, little brown myotis *(Myotis lucifugus)*, long-eared myotis *(Myotis evotis)*, long-legged myotis *(myotis volans)*, silver-haired bat *(Lasionycteris noctivagans)*, big brown bat *(Eptesicus fuscus)*, and hoary bat *(Lasiurus cinereus).* No links are provided to further detail of those species.

6.2.11 Bats and Evidence of Bats near Banff National Park

Rat's Nest Cave, located near Canmore, Alberta, has bone, guano and bat observations. C.J. Yonge (2001 and 1989) makes reference to bats in his book, Under Grotto Mountain Rat's Nest Cave and his map (1989) of the cave. Rat's Nest Cave is a complex cave 4.03 km long and 245m depth. It has a single entrance with a bat friendly gate built by Continental Lime Limited (now Graymont Western Canada Inc.) the lease holder of the entrance area.

6.2.12 Bat Specimens from Banff Held in Museum Collections

A.W.F Banfield (1958) refers to the Banff Museum curating specimens of both long-eared myotis *(Myotis evotis) and* silver-haired bat *(Lasionycteris noctivagans)* circa 1900. The Banff Museum, a National Historic Site, was closed for the winter season when this

report was being written. A follow up when the museum is open in the summer is recommended.

The Royal Alberta Museum (RAM) located in Edmonton was queried. Bill Weimann of RAM checked their collection and only found two male little brown myotis *(Myotis lucifugus)* collected in 1988 from Jasper, nothing from Banff.

6.2.13 Media Requests About Bats

Request for assistance from the public and special user groups were made in the hope that residents and or frequent users of Banff National Park may have very important information regarding bats. Half page backgrounders were sent to the Alberta Speleological Society and the Bow Valley Naturalists asking their help by publishing the park's request for information. As well, Greg Horne & Robert Barclay were interviewed by Cathy Ellis of the Rocky Mountain Outlook newspaper on the same topic.

7.0 Hibernacula and Roosts in Banff National Park

7.1 Hibernacula

There are no known hibernacula in Banff National Park. There are four known bat hibernacula in the Province of Alberta: Wapiabi (Chungo) Cave, southwest of Nordegg, Cadomin Cave, south of Hinton, Procrastination Pot (or NDP Cave), east of Jasper and Walkin Cave south of Fort Smith. The nearest hibernacula west of Banff in British Columbia are a couple abandoned mines near Cranbrook sheltering Townsend's big-eared bat *(Plecotus townsendii).* Recent research by Lausen 2006 has determined, using radiotelemetry, that big brown bats *(Eptesicus fiscus)* use narrow deep rock crevices or erosion holes located in steep valley walls in Dinosaur Provincial Park. The potential possibilities of sub-human size cracks and crevices suitable for over-wintering bat use in the Canadian Rocky Mountains verges on uncountable.

7.1.1 Caves

The definition of a cave as stated in the General Regulations of the Canada National Parks Act reads "*any subterranean cavern or area, either natural or man-made"*

A national survey of Park Canada's cave and karst resources (Horne 2009) used two expanded definitions of a cave. Definition "A" from that survey best fits caves of Banff, "A natural underground opening in bedrock or talus, large enough for humans to enter, to an extent that artificial light is required for safe travel and or observe small detail. A total

dark zone is not a mandatory criterion, but if it exists then the location is by default a cave. It can be partly or completely water filled (seasonal or year round)"

The frequency of frost pockets (a joint or bedding plan surface exposure that has been enlarged by weathering, especially freeze-thaw action. Frost-pockets take on the appearance of cave entrances, but rarely go back far enough to lose daylight (Rollins 2004)) in the Rocky Mountains may give the landscape the appearance of more caves than there actually are. Frost pockets may be suitable as summer diurnal or nocturnal roosts but never as hibernacula.

The guidebook, Caves of the Canadian Rockies and Columbia Mountains (Rollins 2004) lists 11 caves for Banff National Park that would fit either definition. Banff National Park inventory records (Worobets 2013) plus personal knowledge by the author add three more to the list of known and named caves for a total of 14.

Given the size of Banff National Park, its rugged terrain, its relatively low human use away from highways and the few number of people seriously interested in caves, the potential for there being many more, yet to be discovered, caves is huge. The fact that none of those known caves are hibernacula for bats is simply random chance based upon historic and current human use patterns in the park. The potential for Banff National Park to presently have one or more important hibernacula is very reasonable.

Because bats can access very restricted places, even the known caves in Banff cannot be completely dismissed as not having hibernaculum use in portions of the caves inaccessible to humans. Recent developments in electronic bat acoustic monitoring equipment now allow passive recording of bat activity entering and exiting of caves, mines or buildings, http://www.titley-scientific.com/us/index.php/anabat-roost-logger .

7.1.1.1 Known Named Caves of Banff National Park

Cave and Basin (near Banff townsite)
Goat Cave (near Banff townsite)
Sheep Cave (near Banff townsite)
Pichet Cave (Mount Peechee)
Hole-in-the-Wall (Sawback Range)
Rose and Cavern (upper) (Healy Creek)
Rose and Cavern (lower) (Healy Creek)
Vroom Closet (Vermillion Range)
Block Lakes Cave (Sawback Range)
Jaw Bone Cave (Mount Wilson)
Goat's Nest Cave (Cirrus Mountain)
Castleguard Cave (Castleguard Mountain)
Frost Pot (Castleguard Mountain)
Dippy's Loop (Castleguard Mountain)

One fairly unique Banff habitat that might be used by bats is the geo-thermally warmed zone around its hot springs. Both caves and crevices, plus sub-human size cracks and holes may provide seasonal roosting and nursery bat habitat. The Pacific coast bat species *Myotis keenii* uses such habitat. "Until recently, the only known maternity colony of Keen's Long-eared Myotis was on Hot Spring Island in Haida Gwaii. This colony is the only one studied in detail. Most of the natural history data for this species comes from this population. The maternity colony contains about 40 female Keen's Long-eared Myotis, which roost under rocks heated by a natural hot spring. Temperatures at the roost entrance in summer range from 22°C to 27°C, whereas the ambient temperature varies from 11°C to 18°C because of these warm temperatures, the colony is quite humid throughout the year. The roost is situated below the high tide line and it is often submerged for several hours at high tide. During these periods of high tides the roost is abandoned." (http://www.scbat.org/bats-species-of-the-south-coast/keen-myotis/)

7.1.2 Mines

All abandoned mines are potential bat summer roosting and or hibernacula sites. Like caves, mines must have the correct combination of climatic conditions and other yet to be fully understood factors to be used consistently by bats. Abandoned mines across Canada and many parts of the world provide hugely significant accidental or bonus bat habitat. The historic decommissioning of terminated underground mines by blasting their entrances closed has resulted in the potential loss countless additional bat habitat. Now that the value of this artificial habitat is known, more sophisticated mine decommissioning options should be considered. There is a huge wealth of knowledge available to assist land managers with designing and constructing bat friendly mine gates to allow easy passage of bats and keep the public safe from abandoned mine hazards. The starting place for research on this topic should be Bat Conservation International, www.batcon.org .

In Banff National Park and very near Banff in Kootenay and Yoho National Parks there abandoned mines with open entrances. The status of these features in terms of bat occupation is largely unknown with certainty.

As a minimum, the following old mine locations in Banff include (Worobets 2013);

Copper Mountain, mines and cabins
Protection Mountain, mines
Niblock Gate, mine
Paradise Ridge, mines

In Kootenay National Park mines are found at (Worobets 2013);

Mount Whymper, 2 to 3 kms from Banff west boundary
Talc Lake, ½ km from Banff west boundary

In Yoho National Park mines are found at (Worobets 2013);

Mount Field, about 12 kms from the Banff west boundary
Mount Stephen, about 12 kms from the Banff west boundary

7.2 Summer Bat Roosting Sites

There are basically two types of roosts bats in Alberta use in the summer: those that roost in colonies in buildings and those that live in trees, caves, mines or rock crevices. The bats favoring the buildings often want the elevated temperatures because of the need for nursery conditions for females to quickly raise their pups. Many other locations tend to be ambient air temperature or cooler, in those sites bats are in daily torpor (body temperature matching air temperature and reduced metabolic rate) while resting during daylight.

7.2.1 Buildings

They gather in colonies that range from a few bats to a few hundred bats in one building. Colonies can be found in houses, barns, garages, hospitals, hi-raise apartments, shopping malls, and just about any type of building. Within the building, they prefer small dark spaces that are poorly ventilated and heat up during the day. The optimum temperature in these roosts is 39° to 42°C. Bats can only enter a building by going through a hole that already exists, such as a crack or a vent. They cannot chew holes into or inside a building. Roosting sites usually are within a few hundred metres of a source of water. The water provides moisture for drinking, which the bats obtain by swooping low over the surface. Dehydration may force bats to fly during the day to drink water. It also supplies an aquatic habitat to support high concentrations of insects.

Within buildings, bats commonly live:

In eaves and attics

In walls and roofs

Behind soffits and facing boards

Around chimneys

They may take up temporary roosts:

Behind shutters and sliding doors

Under shingles and sidings or even in the open on walls

Under or between thick cedar shakes

Inside closed patio umbrellas or hanging hip waders!

http://srd.alberta.ca/fishwildlife/WildSpecies/Mammals/Bats/Default.aspx

7.2.1.1 Potential Bat Habitat in Specific Banff Structures

Old structures are worth investigating for bats in Banff. These are not listed in any order of significance or probability of sheltering bats. This list was compiled with the assistance of Chris Worobets, a Banff born resident and a current long time Resource Conservation employee of Banff National Park.

- Banff Springs Hotel, attic spaces of the main building
- Several older churches
- Parks Canada administration building
- Banff Park Museum
- About a dozen or so of older residential houses 80 to 100 years old, some of these are houses owned by the Whyte Museum
- Chateau Lake Louise
- Deer Lodge
- Brewster garages between Deer Lodge and Chateau Lake Louise
- Warner's barn and staff accommodations
- Cave & Basin buildings
- Upper Hot Springs building
- Num-Ti-Jah Lodge
- Saskatchewan Crossing Warden Station house and barn
- Banff train station
- Warehouse across tracks from Banff train station
- Cascade Power Plant
- Forty Mile dam site building
- Below Minawanka dam, abandoned generator building
- Lower Bankhead interpretation building
- East Gate buildings
- Stony Creek Warden cabin, older cabin
- Windy Warden cabin
- Indianhead Warden cabin
- Ya Ha Tinda Ranch buildings

7.2.2 Bridges

Bridges can be marginal to extremely important bat roosting sites. Lausen (2011) reports that a concrete bridge in Waterton Lakes National Park is a significant roost for little brown myotis. The Congress Avenue Bridge in downtown Austin Texas supports the spring and summer roosting of 750,000 and up to 1.5 million Mexican free-tailed bats. Their nightly mass immergence for feeding has developed into a well promoted tourist attraction drawing 100,000 people annually to watch them (http://en.wikipedia.org/wiki/Mexican_free-tailed_bat). Bats use expansion cracks between concrete and steel sections as well as various nooks and cubby holes safe from predators as diurnal or nocturnal roosts. Any bridge, new or old could be a candidate, and any type of material. Concrete box culverts can also provide important roosting habitat. Older large bridges in Banff National Park worth inspecting might be Banff Avenue Bow

River, golf course Spray River and Forty Mile Creek's Norquay or Banff west entrance bridges.

As the owner and maintenance authority of most of the bridges and box culverts in Banff National Park, Parks Canada should develop a mandatory inspection/monitoring protocol for every bridge scheduled for major maintenance of its expansion joints, deck and underside structure. The discovery of roosting bats may simply mean scheduling of work to the non-roosting season (late October to early April), or ensuring that maintenance or upgrades do not compromise previously occupied roost spaces. As a wildlife net benefit, a known bat roosting bridge could have artificial extra roosting spaces added (bat houses). Bridges scheduled for removal or replacement, warrant extra inspection and monitoring to determine their status as a bat roosting structure. Bat Conservation International has produced a very well done publication titled Bats in American Bridges (Keeley & Tuttle 1999). The Federal Highways Administration and the Texas Department of Transportation were the lead agencies in initiating this project as well as nine other state departments of transportation. Topics including ideal structures, evaluation, improving/creating roosts and mitigation, see Appendix 6 for the report.

7.2.3 Trees and Rocks

Less is known about bats that live among trees and rocks. Individual bats often go back to the very same tree summer after summer. Tree bats roost among the leaves or needles, under the bark, or in cracks and holes in tree trunks, often in old woodpecker nests or frost fractures. Bats in rock cliffs may use the same cave or crevice year after year http://srd.alberta.ca/fishwildlife/WildSpecies/Mammals/Bats/Default.aspx .

8.0 Resource Management Issues

8.1 Risks of Disease Transmission by People to Bats

The only significant disease humans can transmit to bats in Canada is the movement of the spores of fungus *Geomyces destructans* which causes White Nose Syndrome (see section 5.5.3). The theoretical disease transmission path is for spores from a contaminated cave, mine or bat capture equipment being moved by attachment to clothing/footwear/equipment and deposited in the location by shedding on to cave or mine surfaces. The other potential route is for spores to directly infect bats caught or handled with equipment used in bat research.

Although the disease was somehow aided by humans to cross the Atlantic Ocean from Europe, the exact method and route is unknown. Theories abound with the most probable being spore transport on clothing or footwear. The other mode may have been infected bats roosting in a shipping container that survived the journey to North America. The accidental movement of North American WNS infected bats by truck or rail from the eastern side of the continent to the western side could always be an unfortunate possibility.

Considerable research has been devoted to developing and refining decontamination protocols, see the White Nose Syndrome section (5.5.3.3) of this report.

8.2 Risks of Disturbance by People of Bats

With no known hibernacula or summer roosts, the current possibility of bat disturbance is low. Should media exposure to Banff National Park's interest to learn more about bats reveal new information about such sites, then protective measures may be required.

Diplomatic enquiries to pest control companies operating in the park should be made regarding past bat control work. One goal would be to determine if they had encountered large groups of bats, if so, then where, when and what measures were taken. Then park staff can follow up to determine if bats are still present. The second goal of contact with pest control companies is to clearly establish the communication and action protocols these companies must take when customers request their services for bat control or if they encounter bats incidentally during other control work.

Banff National Park staff will need to be prepared to provide advice and possibly assistance to solve or mitigate bat control desired by residents and businesses. Schedule 1 SARA designation will leave no option not to do so. Even without Schedule 1, the park must take protective measures for bats targeted for control or removal.

Currently the four known hibernacula in Alberta (2 on provincial lands & 2 in National Parks) are closed to recreational use as a preventative measure to reduce the potential for cavers accidentally introducing WNS before it reaches the province by bat to bat transmission. Should any caves or mines of Banff be discovered to be hibernacula should be likewise be closed to recreation until the full consequences of WNS has played itself out in North America and or a consensus has been reached regarding re-opening hibernacula caves.

8.3 Risks to Humans from Bats

8.3.1 Rabies

Any bat species found in Canada could potentially by infected with rabies. See section 5.3 for details about the disease. Parks Canada staff expected to handle live and dead wildlife should be given the rabies vaccine and submit periodic blood samples to check on minimum anti-body presence. Leather gloves should be used to handle all live bats and those one is not sure about. Disposable gloves can be used for collecting corpses for sampling or testing procedures. Anyone bitten by a bat should seek medical attention and in all probability will receive the regular preventive drug doses for rabies.

The public should be cautioned not to directly handle any dead bats, use a stick to push bats into a box or bag. The public should be encouraged to report bats or bat corpses to Resource Conservation so a proper investigation can take place.

8.3.2 Histoplasmosis

This is a fungal disease of the human lungs. It is caused by inhaling the spores of an endemic soil dwelling fungus (mycosis) that grows specially well on the droppings of chickens, pigeons and bats. Our lungs are dark, humid and warm, the perfect place for fungus to grow. As I've told my co-workers, I had mushrooms growing in my lungs. I've had the disease after caving in Mexico. It was the result of climbing up and down several times on a huge slope of bat guano.

Although previously thought to mainly occur from the southern USA through to South America (plus Africa, southern Europe and southeast Asia), histoplasmosis has recently been confirmed in Alberta. In 2011 a woman from Ponoka, Alberta contracted the disease after cleaning up bat droppings in her house, http://news.nationalpost.com/2011/11/24/bat-poop-likely-cause-for-outbreak-of-a-rare-disease-in-alberta/

Earlier in 2011, the Province of Alberta started requiring doctors and labs to notify health officials of any confirmed cases of histoplasmosis so they can track its spread. The use of a respirator that can filter particles as small as two microns in diameter is the best precaution for persons entering a bat roost with significant amounts of bat droppings or guano piles (Nargorsen & Brigham 1993).

9.0 Monitoring Approaches & Techniques

9.1 Potential Monitoring for Species Presence/Absence and Relative Abundance

For a bat survey in Banff National Park, mistnets, harp traps, and ultrasonic bat detectors should be employed to determine presence/not detected and relative abundance of bats, as these methods tend to complement one another. The species that tend to be under-estimated or missed by one method are often sampled by the other method. For example, the presence of certain species may be difficult to determine given their low vulnerability to trapping, indistinct morphology, low intensity echolocation, and/or limited species identification ability based on the current resolution of ultrasonic detectors (Vonhof 2006). Determination of the absolute abundance of bats is difficult and not considered appropriate. However, bats counts can be made in roosts and hibernacula and or during emergence flights.

Regardless of monitoring technique, there are general considerations will influence the design and effectiveness of programs designed to sample bats at any intensity level, including:

- In most studies, investigators are limited in the number of sites that can be visited over the 3-4 months of the year that bats are active in Alberta;

- Effectively, only a small number of closely situated capture or detection stations can be attended to by a team of two to three people in one night;
- It may be necessary to repeat sampling several times, and yet not all nights will be suitable for sampling due to the constraints of weather;
- Bat activity tends to vary with ambient air temperature, humidity, lunar phase, and insect availability, all of which change throughout the season;
- The catchability and detectability of bat species differs, complicating the comparison of data among different species and areas.

These various factors require that adequate sample sizes, and repeated sampling of the same study areas (ideally under the same conditions), are necessary to produce an accurate inventory. Therefore, the sampling effort that can be achieved for bats within a project will be more sensitive to variables such as the size of the project area, the number of study areas within it, and the number of nights spent per study area than it may be for other animals. The inherent variability requires that biologists planning to survey bats be especially vigilant in their attempts to control these factors whenever possible (Vonhof 2006).

Attempts should be made to maximize sampling effort, taking into consideration the goal of the study or survey. For presence/not detected studies, it is recommended that each study area be visited more than once. Limitations of current sampling methods, and the spatial and temporal heterogeneity exhibited by bats, may give an inaccurate representation of species present at a site during any given night. Furthermore, the failure to find evidence for the presence of a species should be viewed with caution as it may reflect the rarity of a species or a sampling artifact, rather than the true absence of that species. The confidence in such results will increase with repeated sampling at the same location. To account for seasonal variation in distribution or abundance, for studies involving larger-scale geographic areas, it is recommended that at least two circuits of the project area be made during the sampling season (i.e. sample at each station, then return and sample all stations again, later in the season) (Vonhof 2006).

Specific factors that will influence a bat survey include time of year, time of night and environmental conditions such as precipitation, wind and temperature. Bat surveys normally should be conducted between early May and the end of August. Variations in activity and presence by sex, species, age groups warrant spaced sampling with the overall “window” of opportunity. Bat activity can often peak just after dusk and just before dawn with another potential peak during the middle of the dark period. During nights of heavy precipitation or temperatures below 5 degrees Celsius in areas of higher elevation, there is little point in conducting a survey (Vonhof 2006).

9.2 Capture

Capturing bats is the primary means of establishing species presence and distribution in a project area, and is the mainstay of all bat studies. Having bats in hand allows positive species identification, age and sex determination, the collection of mass and other

mensural data, and an assessment of reproductive condition. In addition, capturing bats is the necessary precursor to a variety of other techniques, including radio-telemetry and collecting samples for genetic analyses. However, not all bat species are easily captured, because of their behaviour, morphology, and/or flight patterns, and therefore most capture techniques are biased towards the more easily captured species (see below). Furthermore, all capture techniques involve a significant disturbance to the animals during handling, and every effort must be made to minimize this disturbance. (Vonhof 2006).

Mistnets and harp traps are the two most common methods of capturing bats. Mistnets are made from black monofilament nylon in widths from 6 to 36m, heights of 2 to 3m with a mesh size 36mm. Nets require constant monitoring by field staff to quickly detect and remove bats before they chew their way out. Weather factors like rain and wind increase a net's detectability for bats. The mistnet is set up across suitable bat flyways at various heights depending upon species and habitat.

Harp traps consist of a frame with vertically strung monofilament line 2.5 cm apart, a second frame offset so the lines are spaced between those of the first frame and below the frames is a collection bag for the bats. These traps are much less labor intensive and can be left unattended for an hour. The sample area, two square meters, is much smaller than mistnets. Harp traps are heavy and more expensive than mistnets.

All capture staff should have up to date rabies vaccinations. The capture crew leader should be a biologist with experience in capture, identification of potential local species and bat measurements. Acoustic monitoring experience by at least one field staff is necessary. Interpretation of bat sonograms for species identification requires a high degree of experience.

9.3 Radio Telemetry

The use of radio telemetry can be useful to locate roosting sites. A transmitter is attached to the back of a bat (hair clipped area) by the use of a non-toxic surgical glue. The protocol is that the maximum added mass of such devices should not exceed 5% of the animal's body mass not including a full stomach of insects. Using that mass ratio rule, six of Banff's seven potential species are suitably large enough to carry a 0.35 gram transmitter. The long-eared myotis with a mean mass of 6.7 grams (range 4.2-10.7 gr) would be considered too light on average.

The 0.35 gram radio transmitters have a maximum detection range of 1 to 3 kms and a battery lifespan of 8 to 10 days. A larger transmitter of 0.7 gram has a battery life of 3 to 4 weeks and a greater detection distance. For either size, the time limiting factor may be a bat's ability to shed or disable a transmitter by grooming and or chewing (on the antenna). The typical maximum time span for the adhesive is two weeks.

9.4 Acoustic Monitoring

There are commercially available electronic bat detectors that detect, collect and analyse the ultrasonic echolocation calls of bats. Depending upon the technology used in the equipment, the degree to which one is able to determine identification to species will vary. Within the myotis family, some species calls are easily confused and only capture can confirm their identity.

Acoustic monitoring is divided into three strategies; passive, active and mobile. For passive monitoring the detector is set up and records bat activity unattended for periods of hours to months. It can sample pre-set times and data can be stored in memory cards or even downloaded through a cell phone network. During active monitoring the detector is operated in hand to give real time detection results. Depending upon the equipment used, calls can be displayed on a computer screen as sonograms allowing for immediate interpretation and possible species identification. A third method is mobile monitoring where a roof top microphone is vehicle mounted (or it could be bicycle mounted) and a road transect is sampled. Again, with the best combination of equipment, it is possible to record the route taken, the location of calls detected and travelling speed.

The important qualifier with acoustic monitoring is that this method is to determine relative levels of bat activity in different habitats (Vonhof 2006). Follow-up techniques are required determine abundance and confirm species.

Lava Beds National Monument in northern California uses both passive and mobile acoustic monitoring as part of their landscape-scale data collection. The development of data management and monitoring protocols is critical and allows for interchanging personnel to implement monitoring methods over multiple years (Thomas 2011).

9.5 Examples of Bat Surveys Completed in National Parks of Alberta

9.5.1 Waterton Lakes National Park

During two periods (July 4-7 & August 16-18) in 2011 totaling seven days, a bat survey of Waterton Lakes National Park was conducted by Cori Lausen (Bichdale Ecological Ltd.) using mistnets and acoustic detectors. Previous to the study, five bat species were known and after the 2011 field work two more species were confirmed by capture. Three additional species were identified acoustically but without capture these cannot be verified. Two maternity colonies were located and a significant roost under a bridge was found. Eight mistnet capture stations were established and 181 bats captured. Passive acoustic monitoring stations were made at 20 sites in the park.

The contractor, C. Lausen, recommended that due to the westward spread of White Nose syndrome, the future research efforts be directed to

- finalize bat species diversity list

- determine locations and population estimates for maternity colonies pre White Nose Syndrome to determine baseline data and potential WNS detection
- determine which species overwinter

Due to wind turbine power generation in the Waterton area attention should be directed to

- Confirm tree roosting (migratory) bat species are resident in summer
- Determine whether tree roosting species raise young in the park
- Delineate migration routes and timing in the park

9.5.2 Elk Island National Park

Geoff Holroyd and Gordon Burns of the Canadian Wildlife Service along with the Warden Service of Elk Island National Park conducted three evening bat surveys 27 to 29 of July 1983 (Holroyd 1983). This was part of the small mammal survey using capture and echo location detection. The capture methods included visual searches for roosting bats, mist netting and a harp trap. Three bat species were caught and calls of four species detected.

Bat activity in Elk Island was judged as low compared to the mountain parks or southern Ontario. Distribution, however, was more even than in the mountain parks. This was thought to be because Elk Island habitat is superficially less varied and may have fewer "hot spots" for foraging than in the mountain parks. Even street lights in Elk Island were less of a focus of feeding activity for bats than in the mountain parks.

The study concluded "much can be learned about bats in a relatively short time." It mentioned the interpretive interest and value of the topic of bats and the live use of an echo location detector during an evening interpretive event.

Elk Island was included as part of a much larger bat survey study area of central and northwestern Alberta, from late June to late August 2000, by Vonhof, M.J. and D. Hobson (2001). The report is available on-line at http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/documents/SAR4BatsOfCentralAndNorthWestAB.pdf . The details specific to Elk Island National are not clearly presented in the report. However, the most important aspect of this report in relation to bats in Banff are its management implications and future directions:

- Bat surveys should be expanded to other regions of the province where our knowledge of species' presence and range limits is lacking. Very few regions have been adequately sampled and numerous gaps in our knowledge exist.

- A central database or data storage system should be established to store all data collected on bats in the province.
- Surveys for hibernacula in Alberta should be a strong priority. At least six of the nine species of bats in Alberta hibernate.
- More information is required about migratory bat species (hoary and silver haired).
- Studies on the roosting habitat requirements of forest dwelling bats in Alberta are urgently required.
- All studies of bats in Alberta should collect ectoparasites from captured bats. Ectoparasites are a conspicuous feature of bats everywhere, and are an important component of biodiversity in Alberta along with their bat hosts.

9.6 Bat Research in Other Western/Northern National Parks

Recently, bat inventory and other research have taken place in Nahanni (Lausen 2006), Kluane (Lausen et al. 2008) and Gwaii Haanas National Parks.

10.0 Knowledge Gaps and Recommended Next Steps

The current level of knowledge about bats in Banff National Park is weak. A definitive species list does not exist. The distribution and abundance of species within the eco-regions of the park is unknown. The location and status of day roosts, maternity colonies and hibernacula is unknown. All these knowledge gaps are significant impediments to effective management of the resource.

The end result of the introduction and spread of White Nose Syndrome to North America also is unknown, but the consequences of this disease to bat populations in the northern part of the continent will be grave. When or if the disease reaches western Canada and Banff the impact on myotis bat species will be devastating. Since identified in 2006, the current average rate of spread for WNS is 200-400 km per year. Using that model, WNS could reach the west coast of North America in 11-22 years (Forbes 2012). Baseline simulation of the epizootic dispersal based on minimum and maximum temperatures in hibernacula and lipid reserves in the little brown myotis using 1000 simulations (in USA study area) predicts a different story (Hallam and Federico 2011). WNS might be in northern Montana in the winter of 2015-2016 using a route from Oklahoma (western most infection as of 2011-2012) then north via the Rocky Mountains.

In consultation with a bat survey expert, design a monitoring plan to address to the basic knowledge gaps before the potential arrival of White Nose Syndrome, see Appendix 5. This means acting immediately by conducting the first season's survey in 2013. Given the size, complex habitats and geography of the park, expect that bat surveys and research will need to take place over several seasons in order to have an adequate understanding of bat presence, distribution and habitat utilization in Banff National Park. Then, if White Nose Syndrome does in fact arrive in the park, expect to monitor its effects to its peak and continue the monitoring of bat populations for signs of recovery or stabilization.

In addition to contracting a bat survey expert, consideration should be given to purchasing acoustic bat detector equipment that can be deployed by park staff to conduct a combination of passive, active and mobile monitoring as reconnaissance fieldwork ahead of an expert dedicating valuable field time. The recorded results should still be interpreted by an expert, at least until park staff has gained enough experience to make preliminary assessments themselves. As some of this equipment is expensive, the mountain parks may want to consider a pool of equipment that could be shared amongst those parks. A complete setup for vehicle mobile monitoring will cost approximately $2800. This vehicle set up is the equipment most suitable for several parks to share. Acoustic equipment for a passive listening post cost about $1200 for basic recording and if high quality calls are desired then add the cost of a solar charging unit. All parks would want to have listening posts out in the field collecting data at the same time, so sharing of these is less practical. An acoustic techniques course will be held in Calgary May 21 to 24, the cost is $995 per person, see http://www.batsrus.ca/training.html . This will probably be the last course held in western Canada for several years.

As possible within the constraints of budget and time, incorporate the management implications and future direction recommendations of Vonhof and Hobson (2001) listed in section 10.1.

Public (residents and visitors) awareness of bats in general needs to be raised and of the looming threat that White Nose Syndrome poses. Banff National park can contribute to this awareness by providing more information on its website and particularly after even one season of bat surveys, much more will be known and can be shared. Park interpretive programs can feature bats and the park can support the scheduling of bat experts to give guest speaker talks. Conservation, naturalist and speleological societies can likewise host guest speakers and raise the profile of bats to its members. Keep channels of communication wide open with organized speleological groups and individual cavers because their interest and expertise of caves and the search for undiscovered ones may reveal more hibernacula.

Staff awareness, both Parks Canada and the many businesses operating in the park, is worth the time to improve. In their regular job duties, workers have the potential to

discover bats and the roosts. Given a better understanding of bats, these workers are more likely to report their findings to resource conservation staff.

10.1 Suggested Research Priorities for Bats in Alberta

Environment Sustainable Resource Development of the Province of Alberta lists on their web site three levels of bat research priorities: high, medium and low.

http://srd.alberta.ca/FishWildlife/WildlifeManagement/AlbertaBatActionTeam/ABATProgramsPublications.aspx

The priorities most relevant to Banff are;

High Priority

Conduct geographic surveys for species presence and reproductive activity throughout the province. Priorities: northeastern, northwestern, central regions

Identify winter hibernacula for bats in the province, and establish a regular monitoring program for known bat hibernacula. To achieve this goal, begin gleaning information from indirect sources to help identify previously unknown hibernacula. Example: caving groups.

Passive acoustic monitoring programs in strategic areas around the province may also be beneficial in locating winter hibernation area.

Medium Priority

Identify summer roosting habitat requirements, especially for tree-roosting species in the Boreal and Parkland zones.

Focus on understanding the degree of dependency on forests and specific roosting needs within forests.

Low Priority

Assess genetic population structure with regard to management needs.

Conduct surveys of exposed diurnal roosts for extent, species/sex/age composition, and duration.

Collect ectoparasites.

10.2 Membership and Participation in Bat Management Working Groups

There are three levels of bat management working groups (geographically relevant to BNP) that compliment themselves, The Alberta Bat Action Team (ABAT), the Western Canada Bat Network (WCBN) and the Western Bat Working Group (WBWG). It is recommended that Banff National Park formally join and participate in ABAT as a minimum, ideally BNP would monitor the efforts and research developments of the other two groups.

The Western Bat Working Group, the Western Canada Bat Network and the Alberta Bat Action Team represent a hierarchy of working groups, each facilitating communication about bat conservation, research and management on different geographic scales.

10.2.1 Alberta Bat Action Team (ABAT)

The Alberta Bat Action Team (ABAT) is a working group of enthusiastic people with a common goal of improving bat conservation and management within Alberta. ABAT is forging ahead with innovative programs aimed at conservation and management of bat species that reside in or migrate through the province.

http://srd.alberta.ca/FishWildlife/WildlifeManagement/AlbertaBatActionTeam/Default.aspx

ABAT has strong membership representation from: consulting companies, government, industry, universities and the public. All members have previous experience with bats and a passion for improving our understanding and management of the nine species that occur in the province.

10.2.2 ABAT and the Western Canada Bat Network

ABAT is a founding member of the Western Canada Bat Network (WCBN – formerly called the Western Canadian Bat Working Group) a group of bat professionals, students and enthusiasts from across Western Canada organized under the Western Bat Working Group (see link to website under Related Information below).
This newsletter first started in Fall 2002. It is produced two times per year and is housed by the Alberta Sustainable Resource Development on the Alberta Bat Action Team website. All past issues can be accessed at the following link:
http://srd.alberta.ca/FishWildlife/WildlifeManagement/AlbertaBatActionTeam/ABATProgramsPublications.aspx

The WCBN can be contact by e-mail at western.canada.bat.network@gmail.com .

10.2.3 Western Bat Working Group (WBWG)

The Western Bat Working Group (WBWG) is a partner in the Coalition of North American Bat Working Groups. The WBWG is comprised of agencies, organizations and

individuals interested in bat research, management, and conservation from 13 western States, the Provinces of British Columbia and Alberta, and Northern Mexico. Membership in the WBWG is open to anyone who is interested in participating in bat conservation. There are no membership fees or dues. There are currently more than 450 members. Funding for bat conservation work accomplished by the WBWG is generated by State and Federal land management agencies, non-governmental organizations, and by individual members. http://www.wbwg.org/index.html

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Appendix 1. Bat Species Found in Canada

Antrozous pallidus Pallid Bat

Corynorhinus townsendii Townsend's Big-eared Bat

Eptesicus fuscus Big Brown Bat

Euderma maculatum Spotted Bat

Lasionycteris noctivagans Silver-haired Bat

Lasiurus blossevillii Western Red Bat

Lasiurus borealis Red Bat, Eastern Red Bat

Lasiurus cinereus Hoary Bat

Myotis californicus Californian Myotis

Myotis ciliolabrum Western Small-footed Myotis

Myotis evotis Long-eared Myotis, Western Long-eared Myotis

Myotis keenii Keen's Myotis, Keen's Long-eared Myotis

Myotis leibii Small-footed Bat

Myotis lucifugus Little Brown Myotis

Myotis septentrionalis Northern Myotis, Northern Long-eared Myotis

Myotis thysanodes Fringed Myotis

Myotis volans Long-legged Myotis

Myotis yumanensis Yuma Myotis

Nycticeius humeralis Evening Bat

Nyctinomops macrotis Big Free-tailed Bat

Perimyotis subflavus Tri-colored Bat, Eastern Pipistrelle

Appendix 2. Description of Bats Found in Alberta

The information contained in this appendix is from the Alberta Environment Sustainable Resource Development web site
http://srd.alberta.ca/FishWildlife/WildSpecies/Mammals/Bats/Default.aspx

Big Brown Bat *(Eptesicus fuscus)*

Size

Adult big brown bats weigh 15 to 25 grams (0.5 to 0.8 ounces). Wingspan can measure 30 centimeters (12 inches).

Appearance

As its name describes, the big brown bat is brown, the upper side being darker than the underside. The flight membranes are black and unfurred.

Distribution

The big brown bat is probably the most common bat in southern Alberta, particularly in the vicinity of Lethbridge and Medicine Hat. The number of individuals gradually declines in the northern regions with only a few reports from the Peace River region and Wood Buffalo National Park.

Natural History

Habitat

- Big brown bats roost in colonies, often in schools, houses, and barns. In the southern part of the province, red brick buildings more than 40 years old are preferred.
- Big brown bats are relatively sedentary. They use an aggregation of roosting sites within a small local area and usually forage within three or four kilometres (two to two-and-a-half miles) of their day roost.
- Big brown bats are able to tolerate cold better than most bat species. A few individuals have been found in environmental temperatures of -15°C (5°F); however, usually they hibernate before such extremes are reached.
- Although few details are known about the hibernation of big brown bats in Alberta, it appears that buildings are the preferred sites. (They are the only species of bat known to hibernate in buildings in Alberta).
- As the number of big brown bats found in Edmonton is greater in the winter than in the summer, it is thought that the bats may move into the city to hibernate, often in old warehouses where temperatures remain just above freezing.
- These bats seldom move more than 120 kilometres (75 miles) between nursery and hibernation sites. Some individuals may use the same site as a nursery roost and a hibernaculum (place to hibernate); however, this is unusual.

- Hibernacula are characterized by low humidity, variable temperature and often, considerable air movement. If the temperature in the hibernaculum drops below -4°C (24.8°F), big brown bats will arouse themselves from torpor and seek a warmer site. This behaviour may explain many of the reports of bats seen during the winter in Alberta.
- Males and females in the United States appear to hibernate separately in caves and buildings, respectively. It is not known whether this pattern is true for big brown bats in Alberta.

Food

Flight patterns and feeding activity are consistent among members of the local population and often are associated with concentrations of night-flying insects. For example, bats roosting two kilometres (1.2 miles) south of Stony Plain, Alberta, fly into town each night to feed on insects gathered around street lights.

Reproduction and Growth

Breeding Behaviour

- A colony in Alberta may consist of 10 to 80 individuals; southern colonies are slightly larger than those in the north.
- Summer colonies consist predominantly of adult females; juveniles are present in June, July and August.
- There is strong site fidelity, with females consistently returning to the same nursery roosts each year, arriving in early May.
- Parturition (birth) is not synchronized and may be any time from May through June.
- Litter size in Alberta is usually one young per female.
- The pregnancy rate is approximately 92 percent in adult females but many yearling females do not produce young until their third summer.
- The sex ratio at birth is approximately 1:1 and the rate of mortality appears similar in males and females.

Growth Process

- Juveniles are tended only by the adult females. Birth weights range from 2.5 to 3 grams (0.09 to 0.10 ounces).
- The young can fly and forage for themselves after four weeks while adult size is attained by ten weeks.
- Juvenile males may mature and breed in their first fall, but as indicated earlier, in northern populations females rarely produce young until their third summer.

Life expectancy is one to two years; however, some individuals live up to 20 years.

Conservation and Management

Status

The big brown bat is classified as Secure in the current *General Status of Alberta Wild Species* report. Secure is a species that is not *At Risk*, *May Be At Risk* or *Sensitive*.

Eastern Red Bat *(Lasiurus borealis)*

Size

The eastern red bat is a moderate size, weighing 7 to 12 grams (0.3 to 0.4 ounces). Wingspan can measure up to 30 centimetres (12 inches).

Appearance

One of the brightest-coloured bats, the eastern red bat has fur ranging from bright orange to light rusty brown. Adult males are usually redder, while females are "frosted" with white.

Distribution

It is found most commonly in the southern and eastern United States and in eastern Canada as far west as Saskatchewan. Until recently, the eastern red bat was considered an infrequent visitor to Alberta. However, this species has been heard on bat detectors and captured during bat inventory projects in Alberta more frequently in recent years. The species appears far more common and widespread than was thought as little as ten years ago.

In eastern regions of the province, red bats have been found as far north as Ft McMurray and as far south as Drumheller. Regular observations of adult males and non-breeding females each summer in northeast Alberta suggest it may be a frequent visitor.

Other red bats are heard on bat detectors in late summer along the Red Deer River at the Saskatchewan border as well as near Calgary. In addition, several red bat carcasses have been found under wind turbines in southwestern Alberta near Pincher Creek.

It may be that this species is shifting its distribution westward, as supported by the recent detection of red bats in northeastern British Columbia. The new information suggests that a reproductive population may exist in the province, but without any observations of juveniles or reproductive females, the data are not conclusive.

These bats are migratory and red bats collected in Alberta have been adult males and females.

Natural History

Habitat

- Eastern red bats are solitary bats that roost in the foliage of thick forest cover.
- During the day the bats hang by one foot from the base of a leaf, giving the appearance of a dead leaf. This behaviour may provide some protection from predation by blue jays, hawks and owls. Blue jays are the primary predator on young eastern red bats.
- Eastern red bats are well-adapted to living in an environment of fluctuating temperatures. The tail membranes are thickly furred and can be used as a blanket to cover the bat during hibernation.
- So much heat energy is conserved through various behavioural and physiological adaptations that red bats may be unable to survive in the stable environment present in caves. This may be the reason they hibernate in trees, and under leaf litter.

Reproduction and Growth

Breeding Behaviour

- In eastern locations, one to four young per female are born under a leaf in late May or early June.
- No juveniles have been found in Alberta and the reproductive behaviour of this bat in western Canada is unknown.

Conservation and Management

Status

The eastern red bat is classified as Secure in the current *General Status of Alberta Wild Species* report. Secure is a species that is not *At Risk*, *May Be At Risk* or *Sensitive*.

Issues

- Mortality at current and potential wind energy projects.
- General lack of population information.

Hoary Bat *(Lasiurus cinereus)*

Size

The hoary bat is the largest bat found in Alberta. Adults may weigh up to 35 grams (1.2 ounces). Wingspan can measure 40 centimetres (16 inches).

Appearance

Long, narrow wings provide a strong, powerful, and rapid flight. The body and inter femoral flight membranes are covered with thick dark brown or black hair. Many of the individual hairs are tipped with white, giving a "frosted" or "hoary" appearance. The frosted coat may provide camouflage by making the bat look like lichen or a withered leaf on tree bark.

Distribution

- Hoary bats are distributed widely throughout North, South, and Central America and are one of the most widespread of mammals.
- They are the only wild land mammal to naturally colonize the Hawaiian Islands.
- They undertake long migrations in the spring and fall, as they raise their young throughout Canada and the northern United States but winter in the southern United States and Mexico.
- Males apparently spend the summer in the western United States. Females migrate farther than males.

Natural History

Habitat

- Hoary bats are solitary individuals, roosting in areas of forest cover.
- During the day, they are concealed among the leaves or on the bark three to four metres (10 to 12 feet) above the ground. One female in Wisconsin returned to the same spot on a spruce branch at least three years in a row.
- Hoary bats appear to prefer evergreen trees, and could live throughout the boreal forest zone of Alberta.

Food

- Hoary bats leave the trees after dark to feed on nocturnal flying insects, often high above the canopy.

Reproduction and Growth

Breeding Behaviour

- Most of the hoary bats found in Alberta are females or females with young.
- Each female bears two young in late June.
- The juveniles stay in the tree while the female forages for food.

Conservation and Management

Status

The hoary bat is classified as Sensitive in the current *General Status of Alberta Wild Species* report. Sensitive is any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

Issues

- Mortality at current and potential wind energy projects.

Little Brown Myotis *(Myotis lucifugus)*

Size

On average, adult little brown myotis weigh approximately 8.5 grams (0.3 ounces). Wingspan can measure up to 20 centimetres (8 inches). Females are usually larger then males.

Appearance

Not surprisingly, the little brown myotis (often called the 'little brown bat') has brown fur, darker on the back than the undersides. The wings generally lack fur.

Distribution

- The little brown bat is the most common bat in Alberta. The provincial population is estimated at 1 to 1.5 million individuals.
- The adult females are relatively conspicuous as they roost together in colonies in occupied or unoccupied buildings throughout the province.

Natural History

Habitat

- Colonies of this species are common in central Alberta and may be found in:

  Barns, churches, garages, houses, office towers, schools and shopping malls

- In more remote areas of the province, colonies are found in large hollow trees.
- Summer cottages close to bodies of water (for example Wabamun Lake, Pigeon Lake, Gull Lake, Beauvais Lake) often are colonized by little brown bats.
- The largest colonies may be in buildings in good repair.
- During the summer, colonies consist almost exclusively of pregnant or lactating females and their young (thus the term "nursery" or maternal colonies).
- Colonies can consist of three to 1100 bats but typically have from 50 to 300 individuals.
- Little is known about where or how male little brown bats spend their time. A few have been found roosting individually in concealed roosts throughout the summer and are, consequently, difficult to locate.
- Similarly, juvenile females in Alberta are seldom found during their second summer but apparently join the other adult females after this time.
- Throughout August and September, many individual bats are seen flying at night or resting on walls and in alcoves during the day. At this time it is easy to find bats on buildings along the main street of many communities such as Edmonton, Innisfail, Lac la Biche or Slave Lake. Red brick buildings seem to be preferred.
- The use of exposed roosts by bats may be more common in the northern part of their range and may be an adaptation to cooler temperatures. Direct sunlight may be important in providing heat energy during cool days.

When Active

- Adult females appear at summer roosts in early May.
- In the summer roosts, bats are often torpid or inactive during the day, especially during cool weather.
- Activity begins shortly before nightfall as the bats prepare to emerge for the evening feeding period. Not all individuals leave the roost each time.

- The bats return to the roost during the late evening, but leave again for another feeding period near dawn.
- They all return to the roost before sunrise and remain inside during the day.
- Where most little brown myotis hibernate in Alberta is not known. Hibernacula usually are cool, dark, humid places in which the air does not move and, thus, the environment is very stable.
- In the eastern United States, little brown myotis hibernate in caves and abandoned mines. In Alberta, a few bats have been found in caves at Cadomin, Jasper, and Nordegg.
- No doubt other caves in the mountains or foothills also serve as hibernacula, but many bats may migrate to the northern United States or southern British Columbia. A few little brown myotis have been found hibernating in caves in Wood Buffalo National Park.
- Males predominate in the winter roosts and the location of most females during the winter is unknown.

Reproduction and Growth

Breeding Behaviour

- In the fall, bats of all ages and both sexes rendezvous at caves in the mountains. This is the only period when large numbers of males have been found.
- This swarming activity is probably important in bringing large numbers of bats together for breeding. During this period, there is a rapid turnover of individuals at each cave which maximizes the exchange of diverse genetic material within the population.
- The females exhibit high site fidelity and return to the same nursery roost year after year. Females relocated to other roosts during the summer rapidly returned to the original roost.
- Nursery colonies are characterized by hot, dark conditions. They are poorly ventilated but often have more than one entrance. The high temperature promotes the rapid growth of young bats.
- Sperm are stored by the hibernating females and fertilization occurs in spring.
- Up to 98 percent of the females are pregnant each year; after a gestation period of 50 to 60 days, each female gives birth to a single young in late June or early July.

Growth Process

- The young are born blind, hairless, and unable to fly. They are completely reliant upon the female for care and maintenance during the first three weeks of life.
- The females are capable of identifying their own young and this is no doubt aided by the continuous squeaking of the juveniles whenever the female is absent.
- By three weeks of age the young bats generally are able to fly and begin to feed themselves.

Conservation and Management

Status

The little brown myotis is classified as Secure in the current *General Status of Alberta Wild Species* report. Secure is a species that is not *At Risk*, *May Be At Risk* or *Sensitive*.

Similar Species

- Long-legged myotis - is morphologically similar to the little brown bat and often misidentified.
- Northern myotis - looks very much like little brown bats, but have longer ears.

Record life span

The oldest little brown myotis observed in Alberta was banded as an adult in Cadomin Cave in October 1975, and was re-sighted as recently as January 2013, making it at least 39 years of age at that time!

Long-eared Myotis *(Myotis evotis)*

Size

Medium sized, with a total body length ranging from 8.3 to 11 centimetres (3 ¼ to 4 ¼ inches). Wingspan is about 28 centimetres (11 inches).

Appearance

The long-eared myotis (sometimes called the 'long-eared bat') as the name implies, is characterized by long black ears which extend well beyond the tip of the nose when gently laid forward.

Distribution

- Is a western species restricted largely to mountainous regions, although a few colonies have been found in the prairies (for example, at Hesketh, Alberta).

Natural History

Habitat

- Preferred habitat appears to be coniferous cover high in the mountains of British Columbia and Alberta.
- These bats probably roost in trees in the summer but individuals collected for scientific study in Alberta usually are collected at caves in the fall.
- Some of these bats swarm at Cadomin Cave in August.

Food

- Diet includes beetles, flies and moths.

Reproduction and Growth

Breeding Behaviour

- Nursery colonies consist of 12 to 30 individuals.
- Each female bears a single young each year. The winter habits of the species are unknown.

Conservation and Management

Status

The long-eared myotis is classified as Secure in the current *General Status of Alberta Wild Species* report. Secure is a species that is not *At Risk*, *May Be At Risk* or *Sensitive*.

Long-legged Myotis *(Myotis volans)*

Size

Adult total body length can range from 8.7 to 10 centimetres (about 3 to 4 inches). Wingspan can range from 25 to 27 centimetres (9 ¾ to 11 inches).

Appearance

Distinguishing features on the long-legged myotis (sometimes called the long-legged bat) include: Thick hair extending on the underside of the wing to a line from the elbow to the knee and the presence of a keeled calcar (a small bone extending laterally from the ankle)

Distribution

- Is common throughout western North America.

Natural History

Habitat

- In the United States, they roost in buildings, rock crevices, and trees.
- Many nursery colonies are in trees and may consist of hundreds of individuals. It is not known where the majority of these bats hibernate.
- Long-legged bats have been collected repeatedly at Cadomin Cave near Cadomin, Alberta. They use the cave as a swarming site in August and September and a few individuals also hibernate there. Long-legged bats may be quite tolerant of cold.

Conservation and Management

Status

The long-legged myotis is classified as Undetermined in the current *General Status of Alberta Wild Species* report. Undetermined is any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.

Issues

- There is a lack of data concerning this species. Little is known about the habits of long-legged myotis in Alberta.

Similar Species

- Little brown myotis

Northern Myotis *(Myotis septentrionalis)*

Size

Adult body length ranges from 8 to 10 centimetres (3 ¼ to 4 inches). Wingspan ranges from 23 to 26 centimetres (9 to 10 inches).

Appearance

Has long ears which extend up to four millimetres (0.16 inches) beyond the end of the nose when laid forward.

Distribution

- The northern myotis (sometimes called the 'northern bat' or the 'northern long-eared bat') is distributed widely throughout Canada but is seldom seen.
- In western Canada, range is restricted to the boreal forest areas.
- Specimens have been collected in Alberta from: Cadomin, Edmonton, Edson, High Level, Peace River, Spruce Grove and Wood Buffalo National Park

Natural History

Habitat

- During the summer these bats roost in a variety of shelters, including trees, caves, and occasionally buildings.
- Tall mature trees, alive or dead, are preferred and the bats often use cavities created by birds or crawl under loose bark on the trunk of the tree.

- Throughout the summer, the bats often change roosts and thus there is a need for many potential roost trees in an area where northern bats occur.
- Like the small-footed bat, this species is quite tolerant of cold and in winter prefers to roost singly in narrow crevices near the entrance of mines and caves.

Food

- Northern myotis are a gleaning species and prefer to snatch insects directly off the surface of leaves or tree branches. Thus, they tend to be active within the forest canopy layer.

Reproduction and Growth

Breeding Behaviour

- This bat appears to congregate in small nursery colonies (up to 30 individuals); however, some females and their young roost alone.
- Each female gives birth to one young each year.

Conservation and Management

Status

The northern myotis is classified as Secure in the current *General Status of Alberta Wild Species* report. Secure is a species that is not *At Risk*, *May Be At Risk* or *Sensitive*.

Also see the *Status of the northern bat in Alberta* report at:

http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/DetailedStatus/Mammals/documents/Status-NLongEaredBatMyotis-inAlberta-May2009.pdf

Issues

- Little is known about its population and current forest practices threaten habitat.

Similar Species

- Little brown myotis

Silver-haired Bat *(Lasionycteris noctivagans)*

Size

Silver-haired bats are notable for their size — they have a wingspan up to 30 centimetres (12 inches).

Appearance

Distinguishing characteristics for this species include:

Colour — black wing membranes and dark, silver-tipped hair

Flight pattern — slow and leisurely, often close to the ground

Distribution

Though widely distributed in North America, the silver-haired bat is most abundant in the northern Rockies.

Males and females appear to use separate ranges during the summer but apparently winter together in the southern United States.

They are strong fliers and some migrate seasonally from Arizona to northern Alberta.

Natural History

Habitat

The silver-haired bat is a non-colonial woodland bat, and is rarely found in buildings.

Silver-haired bats use tree roosts during the summer. They may be found as individuals or in small groups under bark, in abandoned bird's nests, in hollow trees, or hanging upside down among the leaves throughout the forests in central Alberta.

During the winter, they do not stay in Alberta but rather hibernate under the bark of trees, in rock crevices, and, occasionally, in buildings in the southwest United States.

During migration, the bats are most conspicuous as they often use temporary daily roosts in such locations as:
open sheds and garages

on piles of lumber, railroad ties, or fence posts

The specific location of the summer and winter roosts is unknown.

When Active

They appear to be present in southern Alberta only during the spring and fall migrations (April to July, August to October, respectively).

Males do not appear to migrate and, thus, records in Alberta include only adult females during the spring, and females and juveniles during the fall.

Reproduction and Growth

Breeding Behaviour

Litter size is two young per female.

Conservation and Management

Status

The silver-haired bat is classified as Sensitive in the current *General Status of Alberta Wild Species* report. Sensitive is any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

Issues

This species experiences mortality at current and potential wind energy projects.

Owing to their solitary nature and avoidance of humans, little is known about silver-haired bats in Alberta. As a result, there is a lack of population information for this species.

Western Small-footed Bat *(Myotis ciliolabrum)*

Size

Total body length ranges from 7.6 to 8.9 centimetres (3 to 3 ¼ inches). Wingspan is 21 to 25 centimetres (8 ¼ to 9 ¼ inches).

Appearance

The western small-footed bat (sometimes called the 'western small-footed myotis') is easily confused with other Myotis species and can be identified reliably only after extensive experience.

Distribution

- Is relatively common throughout the western United States and the arid regions of Alberta, British Columbia, and Saskatchewan.
- Specimens of this species have been collected sporadically in southern Alberta, particularly from Dinosaur Provincial Park.
- Collections made in Dinosaur Park suggest some western small-footed bats bear young in the park and may hibernate there.
- This species may be widespread in the badlands and arid river valleys in the Milk River area.

- Some western small-footed bats are known to hibernate in south-central Montana.

Natural History

Habitat

- The western small-footed bat is a hardy species. In the western United States, it is the last species to enter hibernacula but the first to leave.
- Individuals hibernate in narrow crevices near the mouth of caves. Here the temperature often dips below freezing yet the small bats appear to be well adapted to the cold and dryness.

Reproduction and Growth

Breeding Behaviour

- Nursery colonies have been found in caves and crevices in rock faces and clay banks.

Conservation and Management

Status

The western small-footed bat is classified as Sensitive in the current *General Status of Alberta Wild Species* report. Sensitive is any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

Also see the *Status of the western small-footed bat in Alberta* report at:

http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/DetailedStatus/Mammals/documents/Status-WesternSmallFootedBat-inAlberta-Mar2008.pdf

In a subsequent detailed status assessment, Alberta's Endangered Species Conservation Committee identified the western small-footed bat as a Species of Special Concern—a species that without human intervention may soon become threatened with extinction. See information on the Endangered Species Conservation Committee and Species of Special Concern at:

http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/Default.aspx

The western small-footed bat is a focal species of the MULTISAR (multiple species at risk) program, a program of integrated species management over broad landscapes in southern Alberta. See:

http://www.multisar.ca/

Issues

- In Alberta, the western small-footed bat exists in clumped, disjointed populations about which little is known.

Appendix 3. COSEWIC Assessments

Little Brown Myotis *Myotis lucifugus*

Attached separately and available at:
http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/ca_petite_chauvesouris_little_brown_myotis_0212_e.pdf

Northern Myotis *Myotis septentrionalis*

Attached separately and available at:
http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/ca_chauvesouris_nordique_northern_myotis_0212_e.pdf

Appendix 4. A Workshop of the Canadian Wildlife Directors Committee & Canada's White Nose Syndrome Management Plan – Priority Actions for Implementation in 2013

BULLETIN

A Workshop of the Canadian

Wildlife Directors Committee

October 16, 2012 Ottawa, Ontario

DRAFT PLAN

Canada's White Nose Syndrome

Management Plan

Priority Actions for Implementation in 2013

WHITE-NOSE SYNDROME IN CANADA

A Workshop of the Canadian Wildlife Directors Committee

October 16, 2012 Ottawa, Ontario

Courtesy of Scott Darling, Vermont Fish and Wildlife Department

Courtesy of Brock Fenton, University of Western Ontario

White-nose Syndrome (WNS), a fungal disease affecting bats in Canada and the US was first reported in a cave in New York State in 2006, and as of August 2012 had spread to 21 states and 4 provinces on the eastern side of the continent. The fungal pathogen (*Geomyces destructans*) is known to infect 7 bat species, with the species in Canada being the little brown bat, northern long-eared bat and tri-colored bat. Mortality in infected bat hibernacula ranges from 75% to 99% and an estimated 7 million bats have died in North America from the disease since its emergence.

In 2011, under the guidance of the Canadian Wildlife Directors Committee (CWDC) and with leadership from the Canadian Cooperative Wildlife Health Centre (CCWHC), Canada's Inter-agency White-nose Syndrome Committee prepared a "National Plan to Manage White-nose Syndrome in Bats in Canada", modeled after a similar US plan. The Canadian plan received support in early 2012 from the CWDC as the framework for managing the WNS threat to Canadian bat populations. The linked needs of development of a detailed implementation plan and definition of the role of the CWDC in the WNS effort resulted in a half-day WNS workshop for the CWDC during its October 2012 meeting. This workshop benefited from participation by more than 20 government wildlife managers, wildlife health specialists, conservation organization representatives and academics interested in the disease and bat conservation who subsequently collaborated on development of a draft implementation plan.

The workshop consisted of three invited presentations, setting the stage for a round-table discussion by the CWDC concerning its anticipated role. A strong foundation for the CWDC discussion was laid with a review by Scott McBurney (CCWHC, Atlantic Region) of the history and current geographical distribution of WNS in Canada, the etiology and pathology of the disease, and ongoing research and bat monitoring activities. An example of a US state response to WNS was presented by Scott Darling (Vermont Fish and Wildlife Department), describing the limited information about the disease, bats and bat populations at the start of the outbreak, successful involvement of the public in disease reporting and bat colony identification, the rapid growth in information about the disease and bats, but confirming the need for continued research and monitoring efforts, coordinated at a national level. The final presentation, from Jeremy Coleman (United States

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Fish and Wildlife Service (USFWS)), described the challenges around national coordination in the US, the planning processes involved and the plans that were developed. The value of national coordination was emphasized by both Coleman and Darling, as was the value of strengthened collaboration and coordination between Canada and the US.

CWDC Considerations

The discussion following the presentations elucidated considerations such as these (not in any particular order of priority):

- Little is known of bat ecology, populations and hibernacula in Canada
- Information on the ecological services provided by bats is limited, and would be valuable to confirm the magnitude of the ecological impact of WNS and the loss of bats
- CWDC is uniquely positioned to direct and monitor the management of this emerging disease (WNS) and bat conservation
- Coordination at a national level is required
- Partnerships are needed, and national coordination will be key to making the connections and for maintenance of the partnerships
- WNS program needs to be underpinned by government-led planning processes and plans, with initial government funding as a precursor to identifying and gathering other funding for conservation of bats
- WNS actions are under the umbrella of the National Wildlife Disease Strategy (NWDS)
- CCWHC can play a role in national coordination, but new resources or core programs will be needed to enable this new role

Courtesy of Scott Darling, Vermont Fish and Wildlife Department

Courtesy of Brock Fenton, University of Western Ontario

Courtesy of Doug Archibald, Nova Scotia Department of Natural Resources

- The Committee on the Status of Endangered Wildlife in Canada's (COSEWIC) emergency assessment of the status of the three bat species as endangered has resulted in a recommendation to the Minister of Environment that an emergency order be enacted to list the impacted bat species under the Species at Risk Act (SARA)
- If listed under SARA, the WNS effort is likely to move into a recovery planning phase
- Developing a national recovery plan for species under provincial and territorial management authority is likely to result in a framework that engages all public and private partners
- Work at the continental level could be modeled after international processes for collaboration on management of migratory birds
- Common messaging about the disease, bat conservation and the ecological significance of bats that resonates with all potential funders and the public is required
- Coordinated monitoring programs, coupled with government policy and legislation for WNS containment will be needed
- Coordinated monitoring is a prerequisite to enable funding from sources from outside government (the mining industry, as a key producer of bat hibernation habitat, and the wind power industry, because of interest in migration patterns and timing, were cited as examples of possible non-traditional funding sources)
- Research is critical to future management of the disease and bats
- Although the relationship between Canada and the US is strong at the working level, points of contact between the countries at the senior level should be formalized and continental executive/steering committee procedures confirmed

Immediate Actions for the CWDC

- Support the rapid development of a national recovery strategy, built on the "National Plan to Manage White-nose Syndrome in Bats in Canada" and the implementation/action plan in preparation; Environment Canada committed to lead in this area, but anticipates significant jurisdictional support
- Identify and secure additional funding for CCWHC to aid in research
- Develop a common communication message (Nova Scotia agreed to lead this effort)
- Establish a CWDC subcommittee (Québec (Co-chair), New Brunswick (Co-chair), Ontario, British Columbia, Environment Canada) to investigate possible national coordination models and innovative funding sources
- Track progress as a part of CWDC teleconferences and meetings

CANADIAN WILDLIFE DIRECTORS COMMITTEE
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Canada's White Nose Syndrome Management Plan

Action Plans of October 2012

Priority Actions for Implementation in 2013

(Draft 22 January 2013)

Background: At the Canadian White Nose Syndrome response planning workshop on 16-18 October 2012 in Ottawa, seven Action Plans for implementation of Canada's WNS Management Plan were developed. These action plans paralleled, in scope and format, those developed in the United States, were comprehensive, broad in scope and included multiple levels of priority and urgency. In order to move ahead with implementation of actions in Canada in response to WNS, the following plan is proposed. In this plan, immediate priorities have been taken from the comprehensive Action Plans and proposed for implementation in 2013. In addition, a structure for the coordination and integration of response actions is proposed.

This plan is consistent with Canada's National Wildlife Disease Strategy and specifically addresses the goals of Prevention, Surveillance, Response, Management and Communication.

The first draft of his document was discussed and accepted with some proposed modifications by the participants in the October 2012 Ottawa workshop on WNS management action plans by teleconference on 15 January 2013. This 2nd version has been prepared for the Inter-agency WNS Committee, a committee intended to include all people in Canada actively engaged in any aspect of WNS management, research and communication and the Canadian Wildlife Directors Committee (CWDC). The CWDC is asked to provide review, comment, endorsement and further guidance on implementation. This document also will be shared with American counterparts for information, advice and to maintain the tightest possible coordination between Canadian and American response efforts.

Structurally, it is proposed that five response implementation working groups be created from among members of the Inter-agency WNS Committee. The Working Groups will be coordinated through the Inter-agency Committee and this Committee also will maintain liaison with the seven US Action Plan groups through appointed representatives who will report back to the Committee. The Inter-agency WNS Committee also will be the forum to discuss research priorities, fund-raising and related matters.

This proposal does not seek to impose any direction on the studies of independent research scientists, but rather to maximize benefits from such work and contribute to it, where feasible.

1. New Structure for WNS Response Management in Canada

It is proposed that Canada's response to WNS be managed with modest re-organization of the current management structure.

- **A National Coordinator for Canada's Response to WNS**

It is proposed that a full time position be created for a coordinator of Canada's response to WNS. Responsibility for coordination would rest with the Executive Director of the CCWHC and the new position would support that coordination responsibility. This position is described more fully below.

- **Inter-agency WNS Committee**

This committee began as an *ad-hoc* group of agency and university personnel engaged with WNS in various ways and anxious to collaborate and coordinate efforts to maximum effect. Teleconferences were held a few times each year. This group ultimately established the sub-groups and processes that resulted in *A National Plan to Manage White Nose Syndrome in Bats in Canada*, then in the workshop leading to the seven detailed action plans for implementation of the management plan. It also established a close working relationship with the WNS management program in the US.

It is proposed that this inclusive Committee should remain the central WNS management committee in Canada[1] and that the CCWHC continue to serve as its secretariat and chair. The USFWS WNS Coordinator will continue to be a member of this Committee.

- **New Working Groups to Implement WNS Responses**

It is proposed that priority WNS response actions from the Canadian Action Plans be implemented through a structure of three primary technical working groups which are then supported by two others. These technical Working Groups are described below and shown on the attached proposed organizational chart. Organizationally, they would be viewed as subcommittees of the Inter-agency WNS Committee and would report to, and be guided by the Inter-agency WNS Committee.

  - Primary Implementation Working Groups:
    - Bat population monitoring
    - Surveillance and diagnostics
    - WNS Mitigation
  - Supportive Working Groups
    - Data management
    - Communication and outreach

[1] See appendix for current list of Committee members

- **Discontinuation of Management Plan and Action Plan writing groups**

It is proposed that the sub-groups of the Inter-agency WNS Committee which were formed to write the management plan and then the action plans be dissolved and that the Inter-agency Committee establish a new series of implementation Working Groups in which the participants in the former writing groups will be key participants and which have logical connections with the former Action Plan writing groups.

The rationale for this proposed change is that 1) We must select and act on a subset of the many actions present in the Canadian Action Plans; 2) There is considerable overlap among the actions proposed in several of the Action Plans and these can be brought together as single activities; 3) The number of people working on WNS in Canada is small and it seems unwise to try to maintain multiple writing groups, committees, subcommittees and working groups, each with overlapping but slightly different functions and mandates; 4) We can take advantage of our small numbers by handling some important coordinating activities directly through the Inter-agency WNS Committee rather than forming subcommittees for this: e.g. liaison with the seven US Action Plan committees and the USFWS central Steering Committee; research prioritization recommendations; fund-raising.

2. Priority Actions for 2013

The following actions are proposed for implementation as early in 2013 as possible.

1. Establish Canadian WNS Response Coordination:

- Define coordination roles and functions
- Hire a coordinator
- Implement key coordination functions

2. Monitor bat populations

- Establish a *Bat Population Monitoring Technical Working Group*
- Make inventory of bat monitoring activities in Canada in 2013
    - What is being done and by whom
- Create a national population monitoring plan for winter 2013-2014 and beyond
    - Participate in, and use outcome from, USFWS Monitoring workshops
    - Make an inventory of known hibernacula, maternity sites.
- Implement the monitoring plan

3. Carry out Surveillance for WNS and for *G. destructans*.

- Establish a *Surveillance and Diagnostics Technical Working Group*
- Make an inventory of disease and pathogen surveillance in Canada in 2013
    - What is being done and by whom
- Develop a national surveillance plan for winter 2013-2014 and beyond
    - Methods and case definitions
    - Locations and priorities
    - Biobank of specimens
- Implement surveillance plan in 2014

4. Mitigate WNS – immediate actions for 2013 and beyond

- Establish a *WNS Mitigation Technical Working Group*
- Make inventory of mitigation efforts in Canada in 2013
    - What is being done and by whom
- Habitat protection for affected bat species
    - Write best practices for protection of hibernacula
    - Write best practices for protection of maternity colonies
    - Propose additional mitigation actions
- Reduce risk of human transport of *G. destructans.*
    - Best practice guidelines for low-impact habitat entry and disturbance, and for decontamination of equipment
        - Relevant to research, management, recreation
- Develop a mitigation plan for 2014 and beyond

5. **Propose Research Priorities in Canada and advocate for their financial support**

- This will be a task for the Inter-agency WNS Committee itself.
- Drawing on the Action Plans for Epidemiology and Ecology, Disease Management and Conservation and Recovery, the most urgent knowledge gaps for management of WNS in Canada will be identified by the Committee and representations will be made for research funding to potential sources.
- Potential opportunities for fund-raising campaigns will be identified and pursued
- As an agenda item for the Inter-agency WNS Committee, it falls to the CCWHC to assure timely discussion and follow-up on decisions and actions from the Committee.

These five key sets of actions and their three working groups would be supported by two additional working groups:

- ***Working Group on Communications and Outreach***
  - Led by National WNS Coordinator
  - Negotiate protection for hibernacula and maternity colony sites
  - Systematic communication with stakeholder groups
    - Best practice guidelines for decontamination, habitat entry, etc
    - Web site material
    - Bat conservation guidelines for public and government

- ***Technical Working Group on Data Management***
  - Assess the data management needs and establish the required data management tools for
    - Population monitoring
    - Disease Surveillance
    - *G. destructans* Surveillance
    - Mitigation efforts

3. Coordination of Canada's Response to WNS

WNS Coordinator

It is proposed that coordination of Canada's responses to WNS be managed by the Headquarters Office of the Canadian Cooperative Wildlife Health Centre, on behalf of the Inter-agency WNS Committee. This coordination thus would be, ultimately, the responsibility of the Executive Director of the CCWHC.

To make such coordination possible, support for a full-time WNS coordinator will have to be found. The WNS Coordinator will support the coordination responsibility of the CCWHC. The responsibilities of the WNS Coordinator position include, but are not limited to, the following:

- Report to the Executive Director of the CCWHC and support the WNS coordinating role of the CCWHC
- Serve as secretariat to the Interagency WNS Committee and its Working Group subcommittees
    - Organize teleconferences and other meetings
    - Record discussions and decisions at meetings and provide written records of each meeting
    - Follow up on all actions and decisions to assist with and assure their implementation

- Take a leadership role in the Working Group on Communication and Outreach
    - Establish and maintain active communications with stakeholder groups
        - May include in-person discussions and meetings
    - Manage content on the Interagency WNS Committee web site
    - Ensure inventories of stakeholders and contact points are made and kept current

- Work closely with the WNS Mitigation Working Group to assemble correct information for communication to stakeholder and other audiences.
    - Ensure that format and content are appropriate to each audience
- Monitor and facilitate communication and collaboration among the Canadian Working Groups of the Interagency WNS Committee.
- Monitor and assure communication and liaison between US Action Plan groups and the Interagency WNS Committee and its Working Groups.
- Each year, assemble all required information for and prepare drafts of a report on Canada's response to WNS

4. Proposed Working Group Mandates and Composition

A. *Bat Population Monitoring Technical Working Group*

This Working Group is a technical scientific working group consisting of people actively engaged in population monitoring and/or those directly responsible for this activity.

Working Group activities in 2013 will include:

- First task will be to identify all bat population monitoring activities underway in Canada and
    - Adjust membership as needed to directly or indirectly incorporate all activities within the group
    - Determine methods currently being used, their equivalence and comparability.
- Identify all available data on bat populations, hibernacula and maternity colony sites
- Work with Technical Working Group on Data Management to achieve a data management system that meets the needs of bat population monitoring.
    - Establish agreement among data owners on how such data can be made available for use in WNS response actions, levels of data security, restrictions on access to data and best means of storing and accessing these data now and prospectively as monitoring proceeds in the future.
- Agree on the methods to be used in Canada for population monitoring and advocate that all bat population monitoring in Canada is carried out by these methods.
    - Represent Canada at USFWS workshops on monitoring methods and disseminate the outcome of these to other bat monitoring groups in Canada
    - Ensure methods used in Canada are analytically compatible with US methods so data can be combined as needed for continental management analysis.
- Identify opportunities in population monitoring activities for obtaining samples for WNS and *G.d.* surveillance and research, and communicate these to the Surveillance working group.
- **Make a population monitoring plan for winter 2013-14 and beyond (3-5 year plan)**
    - Implement and manage the monitoring plan
- WNS Coordinator to serve as secretariat to the Population Monitoring Technical Working Group

B. *Surveillance and Diagnostic Technical Working Group*

This technical scientific working group will consist of people actively engaged in surveillance and diagnosis of WNS (disease) and in surveillance and identification of *Geomyces destructans* and related fungi on bats and in environments.

Working Group activities in 2013 will include:

- The first task will be to make an inventory of disease and pathogen surveillance in Canada in 2013 so all people and programs working on these issues are identified.
- Establish diagnostic and other categories needed for surveillance and define each ("case definitions")
    - For diagnosis of WNS in bats
    - For categorizing bats, habitats and environments according to test results for the presence of *G. destructans*.
- Recommend best methods for laboratory tests (e.g. PCR for *G. destructans*) and recommend changes as science advances

- Create a comprehensive inventory of all laboratories in Canada that test for WNS and *G. destructans* (for diagnosis or research).
- Organize a national system for storing and maintaining an inventory of samples obtained during surveillance activities (biobank)
    - Seek opportunities for sample acquisition from the Population Monitoring working group.
- Identify and agree on data management needs for surveillance for WNS and for *G.d*.
    - Work with the data management working group to establish a data management system that meets needs of surveillance, including inventory of biological samples
- **Make a WNS and G.d. surveillance plan for winter 2013-14 and beyond (3-5 year plan)**
    - Implement and manage the surveillance plan

- WNS Coordinator to serve as secretariat to the Surveillance Working Group

C. *WNS Mitigation Technical Working Group*

This Working Group will be responsible primarily for writing or approving best practice guidelines for mitigation activities that can be undertaken now, and to propose additional mitigation activities in the future as these arise from new science or clever invention. The dissemination of best practice information will be the responsibility of the Working Group on Communication and Outreach.

This Working Group will be composed of agency personnel responsible for mitigation and NGO and university scientists involved in activities for which the best practices will apply.

Working Group activities in 2013 will include:

- Make an inventory of current mitigation efforts in Canada and people involved in them
    - What is being done by whom
- Write/approve best practice guidelines for
    - Protection of hibernacula and maternity colonies
    - Decontamination of equipment potentially exposed to G.d.
        - Relevant to research, management, recreation
    - Entry into bat habitat to minimize disturbance and likelihood of contamination with G.d.

- Identify new or additional feasible mitigation efforts and make recommendations on their implementation on a on-going basis.
- **Write a WNS Mitigation Plan for 2014 and beyond which sets priorities and achievable targets for mitigation efforts across Canada.**
- Work closely with the Communications and Outreach Working Group to achieve appropriately targeted dissemination of best practice information
- WNS Coordinator to serve as secretariat to the Mitigation Technical Working Group

D. *Working Group on Communication and Outreach*

This Working Group will consist of primarily people with communications responsibilities on WNS for government agencies, and university and NGO personnel with similar responsibilities. It may wish to add other s from industry, NGO, government. This working group is not responsible for the technical content of material but for its effective targeting, dissemination and advocacy. It will work in association with technical working groups and its primary purpose is to implement the plans made by the technical working groups.

Working Group activities in 2013 will include:

- Inventory of WNS stakeholder groups and primary contact points for each
    - Recreational caving groups
    - Conservation NGOs
    - Relevant resource industries
    - Relevant recreational equipment industries
    - Relevant government authorities (bats, caves, OHS)
    - Pest-control businesses and associations
    - Other?
- Communication with stakeholders to invite participation and establish positive partnerships with Inter-agency WNS Committee
- Development and implementation of communication strategies for major communication initiatives
    - Best practices for decontamination of equipment
    - Best practices for intrusions into bat habitat (least impact)
- Dissemination of information on general bat conservation opportunities and practices
- Establish and maintain an Inter-agency WNS Committee Website
- WNS Coordinator to serve as secretariat to the Working Group on Communication and Outreach

E. *Technical Working Group on Data Management*

The purpose of this working group is to identify and implement the data management tools and systems required by the other working groups and the Interagency WNS Committee as a whole. It also will work with US agencies to achieve whatever sharing of data is agreed to between US groups and the Canadian Interagency WNS Committee. Members will be people with expertise in information management drawn from the CCWHC and government agencies. This will be a small technical working group.

Working Group activities in 2013 will include:

- Determine the information management needs of
    - Population monitoring
    - Disease surveillance
    - *G. destructans* surveillance
    - Mitigation efforts

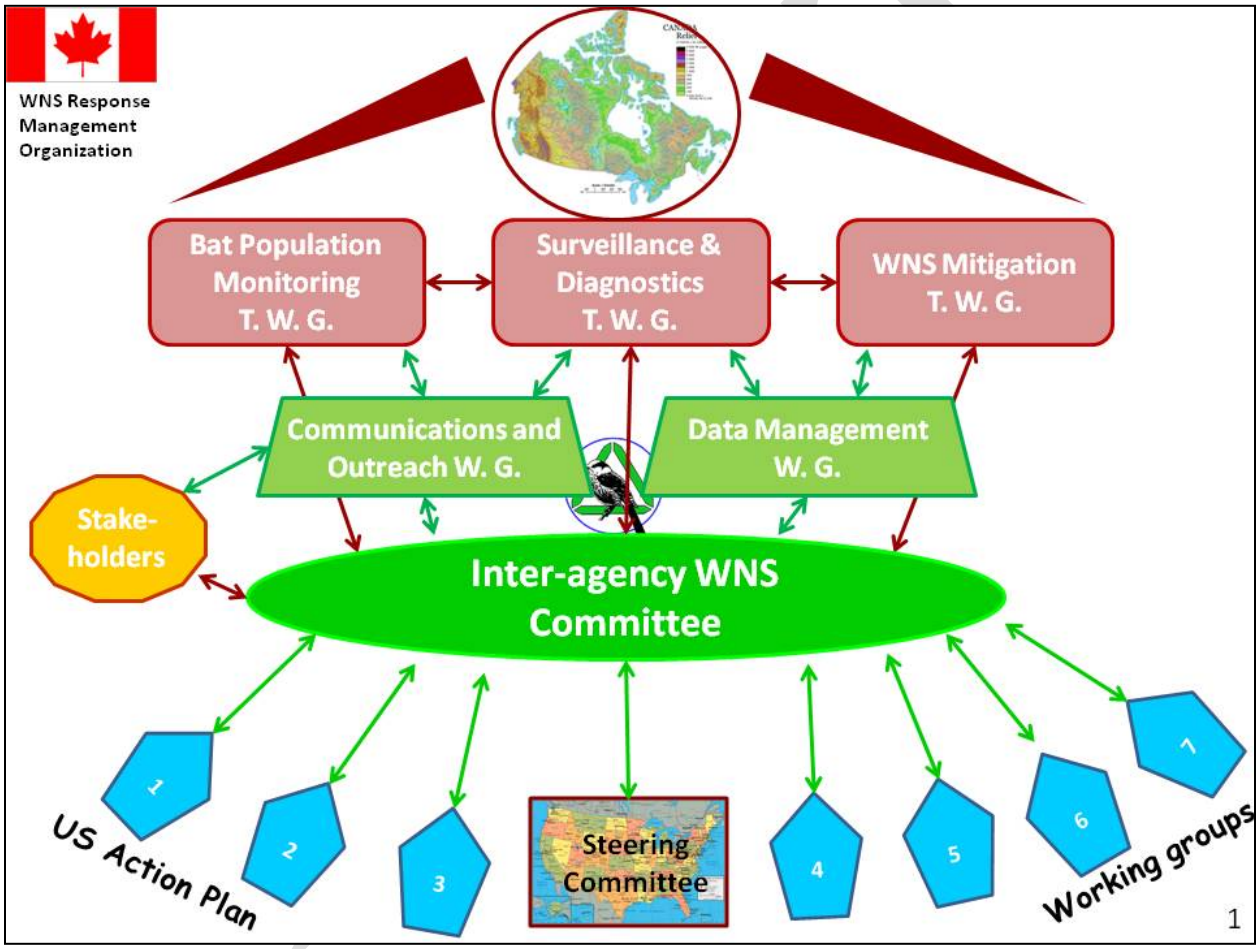
    - Communication and outreach
- Propose the technical methods by which those data management needs can best be met
- Implement data management systems agreed to by the working groups and the Inter-agency Committee, and for which resources are available.

Current participants in Canada's Inter-agency WNS Committee

Barclay, Robert
Bollinger, Trent
Boysen, Eric
Brigham, Mark
Broders, Hugh
Brownson, Beth
Campbell, Doug
Coleman, Jeremy
Curley,F
Dallaire, Andre
Davis, Richard
Dungavell, John
Elderkin, Mark
Elkin, Brett
Fenton, Brock
Forbes, Graham
Francis, Charles
Fraser, E.
Hale, Lesley
Harms, Jane
Henderson
Heydon, Chris
Howes, Lesley-Anne
Hwang, YeenTen
Jardine, Claire
Joly, Damien
Jung, Thomas
Lausen, Cori
Leighton, Ted
Lelievre, Frederick
Luzny, Wade
Masse, Ariane
Massey, Cheryl
McAlpine
McBurney, Scott
McGuire
Misra, Vikram
Pardy, Shelley
Pormsbee
Pybus, Margo
Riddell, Heather
Rodrigues, Bruce
Schwantje, Helen
Shury, Todd
Simard, Anouk
Smith, Dale
Soos, Catherine
Stetson, Deb
Vanderkop, Mary
Vanderwolf, Karen
Watkins, William
Willis, Craig
Wilson, Christine
Wilson, Joanna
Xu, JP
Zimmer, Patrick

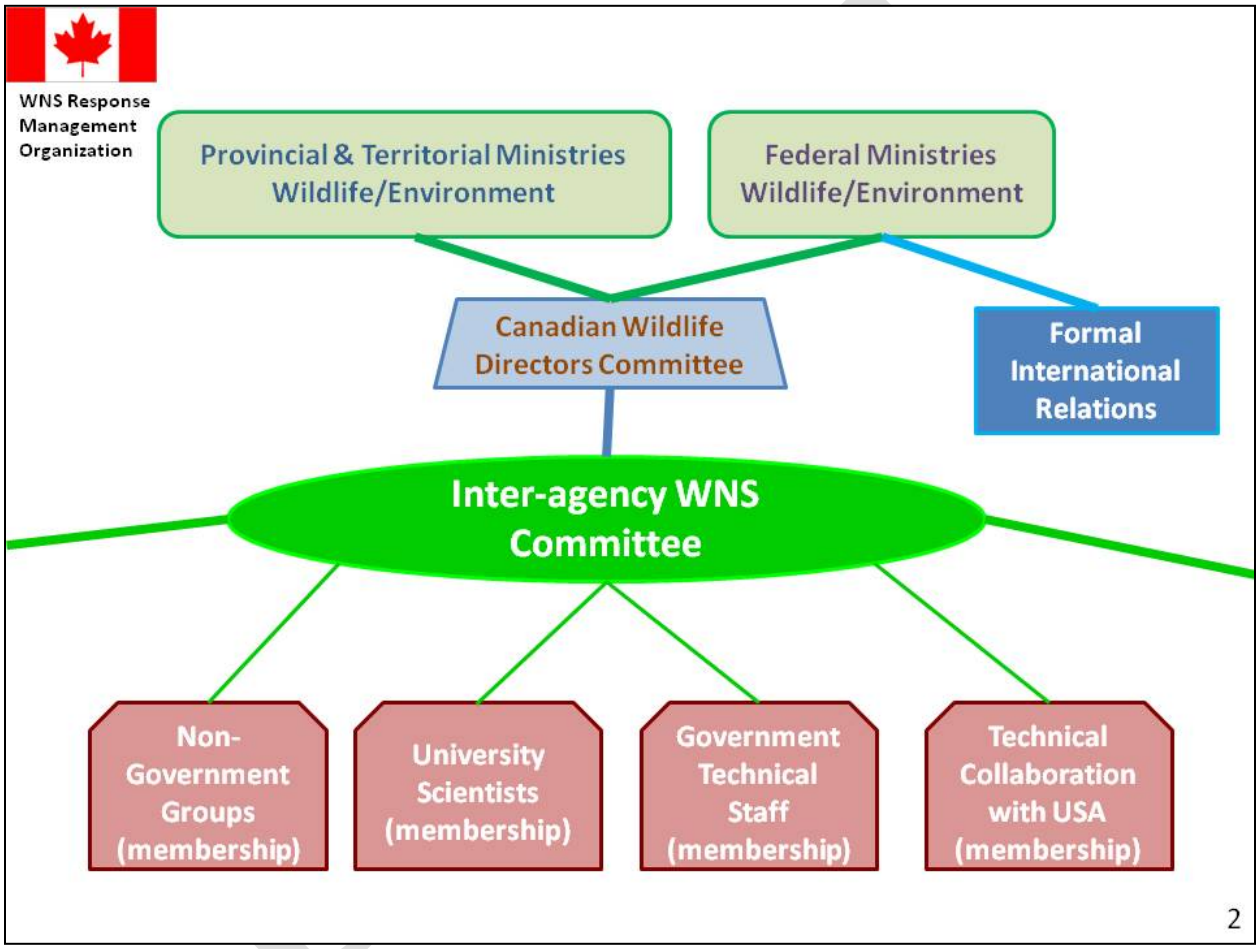
WNS Response Organization in Canada: Diagram 1. (Arrows indicate general pathways of dialog and communication)

The Inter-agency WNS Committee is the central national organization and is supported by the CCWHC as secretariat and coordinator. Five working groups are established as subcommittees of the Inter-agency WNS Committee to carry out specified priority WNS response actions. The Inter-agency WNS Committee will have representation on each of the seven US Action Plan Working Groups. The CCWHC Executive Director will serve on the US WNS Steering Committee. The WNS Coordinator for the USFWS will be a member of the Canadian Inter-agency WNS Committee and others who are active in the US WNS program will be invited to participate in Inter-agency WNS Committee teleconferences as advised by the US coordinator.



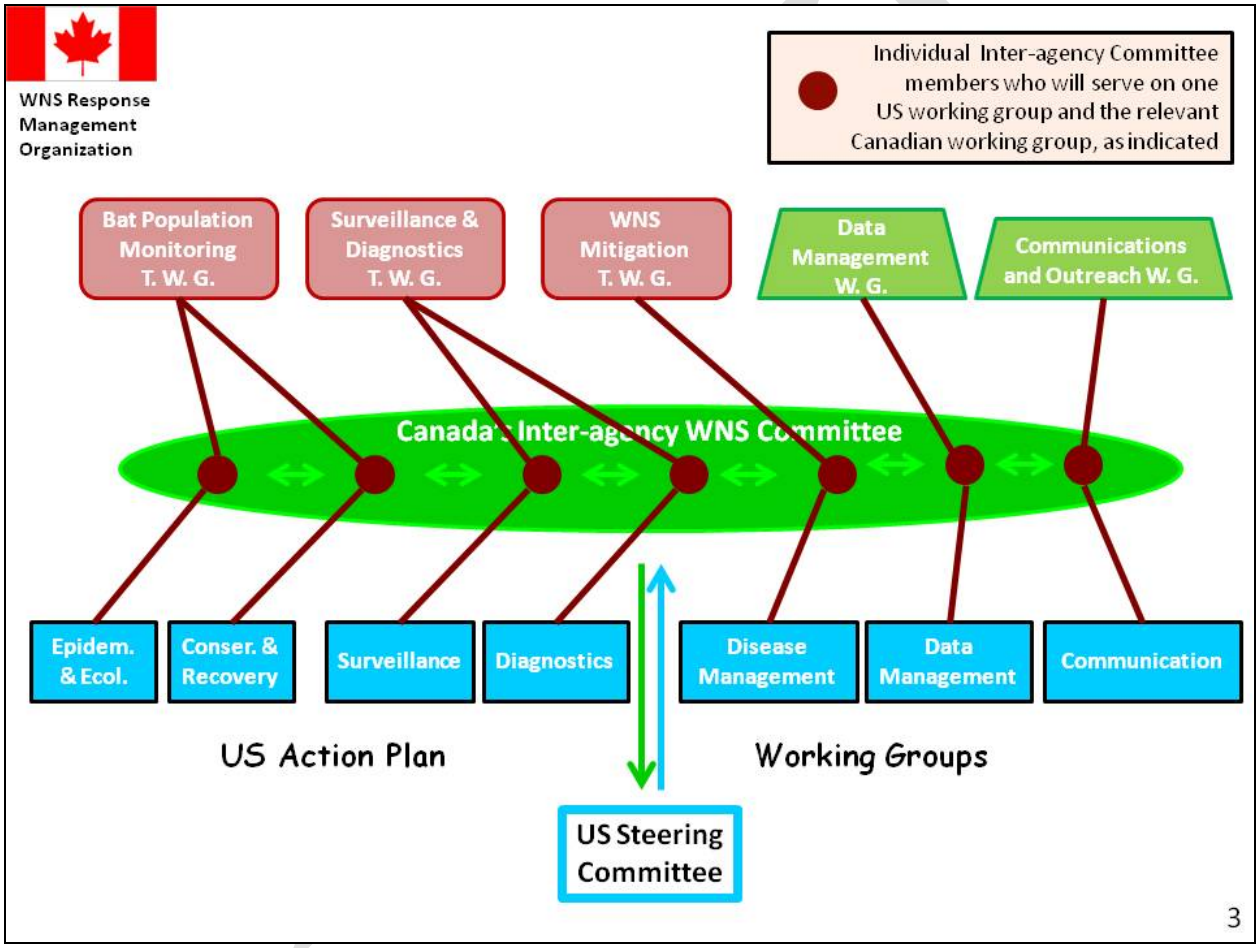
WNS Response Organization in Canada: Diagram 2

Relationships among the Canadian WNS response organization and legal authorities: The Inter-agency WNS Committee operates under the advice and endorsement of the Canadian Wildlife Directors Committee. Aboriginal interests and jurisdictions with respect to WHS responses also are recognized. Until further defined, the input from Aboriginal jurisdictions to the Inter-agency Committee is through existing wildlife management agreements and understandings such groups now have with provincial, territorial and federal government bodies.



WNS Response Organization in Canada: Diagram 3.

Relationships among the US WNS Action Plan Working Groups and the Canadian WNS response organization: Individual members of the Interagency WNS Committee will be identified who will serve on one US Action Plan working group and also on a relevant Canadian working group. There are important additional overlaps among some of the Canadian and US groups: e.g. the US Response and Recovery Action Plan group is considering activities potentially relevant to Canadian working groups on mitigation, surveillance and communication & outreach. This additional overlap will be managed through dialog within the Inter-agency Committee, indicated by green arrows.



Appendix 5. Handbook of Inventory Methods and Standard Protocols for Surveying Bats in Alberta

Attached separately and available at:

http://srd.alberta.ca/FishWildlife/WildlifeManagement/documents/Handbook-InventoryMethodsStandardProtocols-SurveyingBatsInAlberta-Dec06.pdf

Developed by:
Alberta Fish and Wildlife Division
Edmonton, Alberta

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Appendix 6. Bats in American Bridges

Brian W. Keeley
Merlin D. Tuttle
Bat Conservation International, Inc.
Resource Publication No. 4

Attached separately and available at:
http://www.batcon.org/pdfs/bridges/BatsBridges2.pdf