Ontario's White-nose Syndrome Response Plan

Wildlife Section, Species Conservation Policy Branch
Ministry of Natural Resources and Forestry

March 31, 2015

Credit: Lesley Hale

Ontario

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EXECUTIVE SUMMARY

White-nose syndrome (WNS) is a condition responsible for killing as many as 6.7 million bats in eastern North America as of January 2015. It is dubbed “white-nose syndrome” because infected bats often have white fungus on their muzzles, ears and wing membranes. The fungus grows on bats while they hibernate in caves and abandoned mines. Throughout North America many WNS-affected bat colonies have experienced losses of up to 95 to 100 per cent within two to three years of detection. WNS is a disease specific to hibernating mammals, as cold body temperatures are a necessary condition for the spread of the causative fungus.

WNS has been found in five species of bats native to Ontario: Little Brown Myotis *(*Little Brown Bat - *Myotis lucifugus)*, Northern Myotis (Northern Long-eared Bat - *Myotis septentrionalis)*, Eastern Small-footed Bat *(Myotis leibii)*, Tricolored Bat *(Perimyotis subflavus)*, and Big Brown Bat *(Eptesicus fuscus).*

First identified in bats in a cave in New York State during the winter of 2006-2007, WNS has now been confirmed in twenty-five American states and five Canadian provinces, including Ontario in 2010. Wildlife agencies across Canada and the U.S. have expanded their surveillance activities in an effort to document the presence or absence of the disease as it continues to spread across eastern North America and into the west. Ontario began testing for WNS in bats and has undertaken surveillance since 2007.

In order to ensure Ontario is well positioned to respond to the threats posed by WNS, a multi-agency working group was established and includes representatives from the Ministry of Natural Resources and Forestry (MNRF), the Canadian Wildlife Health Cooperative (CWHC) and the Ministry of Northern Development and Mines (MNDM). Working group members have worked collaboratively to prepare the Ontario White-nose Syndrome Response Plan.

The Plan identifies the risks to Ontario bat populations associated with WNS and provides for multi-agency coordination in three key areas: prevention, surveillance and research.

The Plan identifies roles and responsibilities for potential response actions to be taken by government ministries/agencies and partners. The plan also identifies the need to collaborate with affected stakeholders and the public to ensure preventative steps and potential response actions are effective in supporting the conservation of Ontario’s hibernating bats, including those listed as species at risk.

The MNRF will periodically review the plan. The plan will be updated to provide additional guidance as needed or to respond to changes in organizations, conditions, experience, or scientific information.

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1.0 INTRODUCTION

Credit: Lesley Hale

White-nose syndrome (WNS) is a disease responsible for unprecedented mortality in hibernating bats in eastern North America. This previously unrecognized disease has spread very rapidly since its discovery in January 2007, and poses a considerable threat to hibernating bats throughout North America. WNS was first confirmed in Ontario in 2010 and continues to spread throughout the province. As WNS spreads, the challenges for understanding and managing the disease continue to increase. Given the complexity of these challenges, a coordinated effort is required of provincial agencies, partners and stakeholders to respond effectively to WNS and to conserve Ontario's bats. This plan outlines Ontario's response to WNS and documents priority prevention, surveillance and research actions to better understand and manage its impacts on Ontario's bats.

Ontario is working in collaboration with provincial, national and international partners to better our understanding of WNS, and monitor its spread and impact across North America. In May 2011, the United States Fish and Wildlife Service (USFWS) produced a National WNS Plan with input from state agencies and Canadian provinces, including Ontario. In Canada, Ontario supported the development of *A National Plan to Manage White Nose Syndrome in Canada* (Inter-agency WNS Committee, 2012). Ontario supports the principles and strategies of the US and Canadian national WNS plans by participating on technical sub-committees created to support implementation of the national plan and will endeavour to integrate Ontario's WNS response actions with the national plan when possible.

1.1 White-nose Syndrome Background

White-nose syndrome is a condition responsible for killing more than six million bats in eastern North America as of January 2015. It is dubbed "white-nose syndrome" because infected bats often have white fungus on their muzzles, ears and wing membranes. The fungus grows on bats while they hibernate in caves and old underground mine workings (abandoned mines).

WNS was first identified in bats in a cave in New York State in 2006. Since then, it has been found in bats in twenty-three American states. In 2010, it was detected in

Ontario and in Quebec, it was confirmed in New Brunswick and Nova Scotia in 2011, and in Prince Edward Island in 2013.

Figure 1 is a map showing the distribution of WNS in North America.

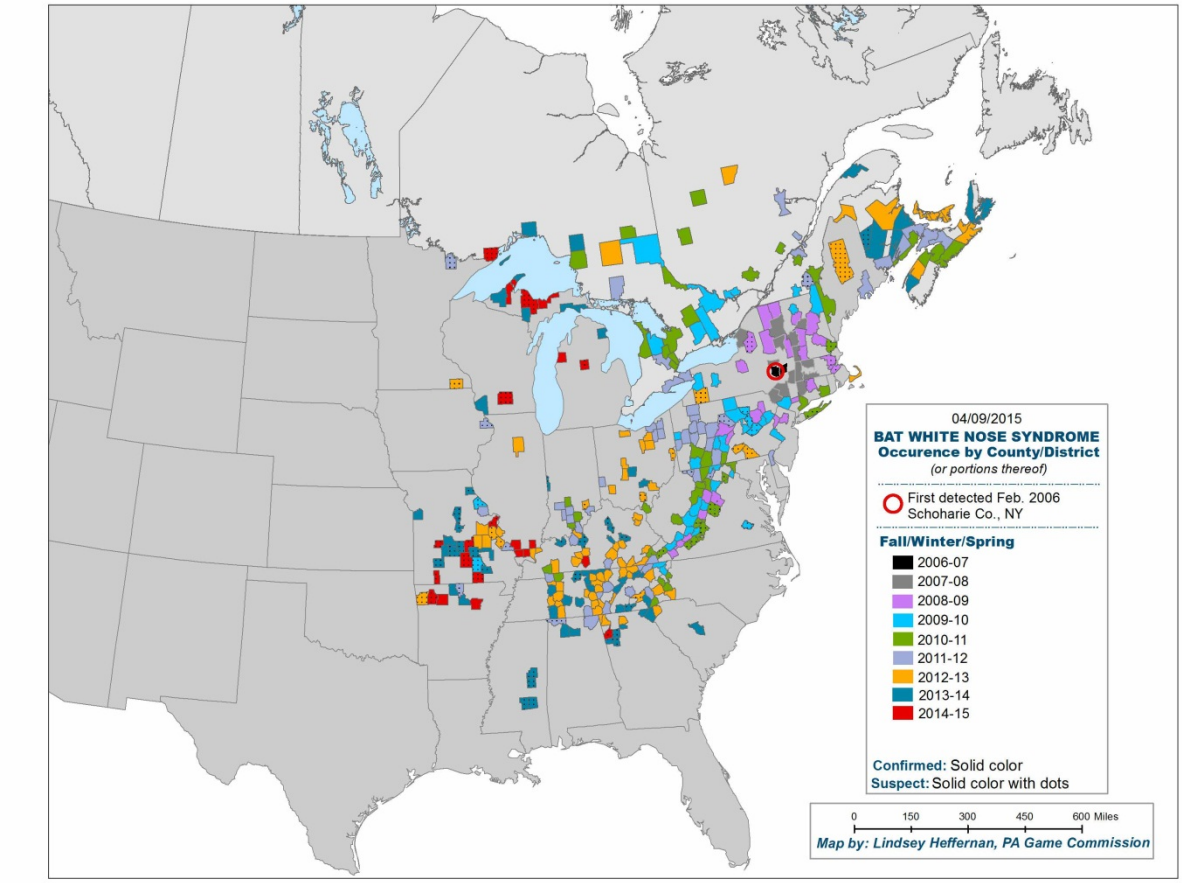


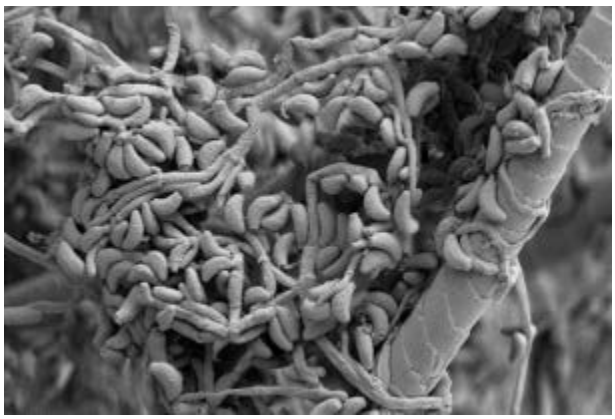
Figure 1: North American Distribution of WNS by County/District, April 9, 2015 (Pennsylvania Game Commission).

WNS affects bats during long bouts of torpor or hibernation when they are immobile and living in close contact with each other. Cave-dwelling bats are most affected due to their strategy of winter hibernation in caves and old underground mine workings with low temperatures and high humidity in which the causative fungus thrives.

"Cave bat" species in Ontario known to be susceptible to WNS are Little Brown Myotis *(*Little Brown Bat - *Myotis lucifugus)*, Northern Myotis (Northern Long-eared Bat - *Myotis septentrionalis)*, Eastern Small-footed Bat *(Myotis leibii)*, Tricolored Bat *(Perimyotis subflavus)*, and Big Brown Bat *(Eptesicus fuscus)*. It is unknown if migratory "tree bats" i.e., Eastern Red Bat *(Lasiurus borealis),* Hoary Bat *(Lasiurus cinereus)* and Silver-haired Bat *(Lasionycteris noctivagans)* - which do not regularly use caves and old underground mine workings - are affected.

Throughout North America many WNS-affected bat colonies have experienced losses of up to 95 to 100 per cent within two to three years of detection. Rapid and widespread mortality of this magnitude is unprecedented in hibernating bats. Most of the affected bat species are long-lived and have naturally low reproductive rates, typically bearing only one offspring per year. This low reproductive rate, combined with the high mortality observed in populations with WNS, reduces the likelihood of recovery of affected populations.

Pseudogymnoascus destructans, a previously unknown species of cold-loving fungus, has been identified as the pathogen causing skin infection in bats at affected sites and the primary cause of mortality associated with WNS (Lorch et al. 2011). This fungus thrives in low temperatures (5-14° C) and high levels of humidity (>90 %), conditions characteristic of many bat hibernacula.



Original scanning electron micrograph of *Pseudo-gymnoascus destructans* on a bat. Imaged by Deborah J. Springer

Skin infection by *P. destructans* appears to cause hibernating bats to prematurely emerge from torpor, engaging in abnormal hibernation behaviour which causes bats to dehydrate and consume critical fat reserves prematurely during winter. These combined effects can lead to high bat mortality rates. Abnormal behaviour documented at WNS affected sites include: shifts of bats in hibernacula to locations near the entrances or unusually cold areas; bats dispersing during the day from hibernacula, even during mid-winter; unresponsiveness to human disturbance; and occasionally, large numbers of fatalities, either inside the hibernacula, near the entrance, or in the immediate vicinity of the entrance.

Research suggests WNS may impair important wing-dependent physiological functions, such as water balance, thermoregulation and mechanical function of the wing leading to dehydration, increased arousals, heat loss, and inhibition of flight. To what extent other factors may contribute to the susceptibility of certain species or individuals to fungal infection and/or mortality is unclear and the subject of current research.

Consistent with the US National WNS Plan the following excerpt outlines functional definitions for suspect, confirmed positive and infected WNS individuals and/or sites:

> For the purpose of implementation of this plan WNS will be defined as *Suspect* when *P. destructans* DNA or characteristic conidia morphology is

detected on bats in the absence of histopathologic evidence, or when field signs associated with WNS are observed in winter bat populations within a previously confirmed WNS affected state but diagnostic tests were either negative or not performed.

WNS will be defined as *Confirmed Positive* upon histopathological characterization of skin invasion typical of *P. destructans* infection. Furthermore, a hibernaculum or area will be considered to be infected if it is associated with bats that are either suspect or confirmed positive for WNS (U.S. Fish and Wildlife Service, 2011).

1.2 Ecological Significance

Bats are an integral part of Ontario's biodiversity and a primary predator of night time flying insects. Five of the eight bat species that occur in Ontario rely on hibernation as a primary strategy for surviving the winter, when insect prey is not available. These species rely on undisturbed caves or old underground mine workings for successful hibernation, and are at risk from WNS. The spread of WNS into these sites in Ontario has considerable implications to Ontario's bat populations.

The impact of WNS on bat populations has the potential to greatly impact ecosystem function. Bats are voracious predators of insects, including many crop and forest pests. Reductions in predation pressure from bats on insect populations may lead to increased numbers of insect pests resulting in damage to forests and agriculture, and increased use of environmental pesticides. Recent studies have suggested that the loss of bats in North America could lead to agricultural losses estimated at more than $3.7 billion/year in the US alone (Boyles et al. 2011).

1.3 Purpose and Goals

The purpose of the Ontario WNS Response Plan is to establish a coordinated provincial approach to disease response. The plan calls for government agencies to work collaboratively with the public and a broad range of stakeholders, and outlines what Ontario is doing to minimize the spread of WNS throughout the province. The response strategy is intended to minimize the negative impacts of the disease on the province's biodiversity and wildlife health, the environment, affected stakeholders and the economy. It outlines the steps that each agency is taking in response to WNS and provides guidance to response personnel.

Key elements of the plan include:

- awareness and response communications,

- ongoing surveillance to help ensure early detection and monitor WNS affected sites,
- setting priorities for research, and
- response options to an occurrence.

Desired outcomes include:

- keeping abreast of science and acquiring new science,
- informing the public,
- establishing relationships and working collaboratively with stakeholders, landowners and across all levels of government, and
- as more information becomes available, the possible development of policy, legislation and regulation.

Goals of this plan include:

- standardizing management practices in response to WNS in Ontario and disease surveillance and bat population monitoring,
- ensuring consistency in data collection, and
- facilitating the interpretation and sharing of results.

Ultimately, the plan is intended to promote the conservation of Ontario's native hibernating bat species, and recovery of those species that are at risk.

1.4 Role and Mandate of Government, MNRF and Supporting Agencies

Responsibility for implementing this plan lies with representatives from the Ministry of Natural Resources and Forestry (MNRF), the Ministry of Northern Development and Mines (MNDM), and the Canadian Wildlife Health Cooperative (CWHC).

MNRF is the agency responsible for the protection and health of wildlife populations in Ontario. The primary legislation governing the protection and use of wildlife resources is the *Fish and Wildlife Conservation Act, 1997* (FWCA) and *Endangered Species Act, 2007* (ESA 2007). On January 24, 2013, Little Brown Myotis and Northern Myotis were listed as endangered under the ESA and received both species and habitat protection. On January 27, 2014 the Eastern Small-footed Bat was also listed as endangered under the ESA.

MNRF is responsible for issuing:

- wildlife scientific collector's authorizations for scientific or educational work, and
- wildlife custodian authorizations for wildlife rehabilitators who provide temporary care to injured, sick or immature native wildlife, including bats.

MNRF chairs a multi-ministry working group and coordinates WNS surveillance programs in Ontario. MNRF will maintain and pursue linkages with other provincial, national and international WNS plans, such as the US National WNS Plan, as they are developed. The Ministry is also responsible for implementing the ESA which prohibits activities which harm or harass protected bat species or damage or destroy their habitat.

CWHC is a national university-based inter-agency partnership of Canada's colleges of veterinary medicine, government agencies at all levels (including Ontario), as well as non-governmental agencies. CWHC provides wildlife health expertise and services for WNS in Ontario including: a public reporting hotline, disease diagnosis and surveillance, data/information services and participation in WNS planning and response activities.

MNDM is the lead agency for mining activities authorized under the *Mining Act, R.S.O. 1990*. MNDM will assist MNRF in determining information needs to be provided to the mining industry regarding avoiding the spread of WNS between old underground mine workings (abandoned mines), and will provide relevant expert advice and recommendations encouraging industry to take measures preventing human entry into old underground mine workings.

2.0 WNS PREVENTION

Bat-to-bat transmission is believed to be the primary vector for the spread of WNS. As such, the rapid spread of WNS may be largely attributed to the mobility of bats; however the potential exists for significant acceleration of the rate of spread of the fungus to hibernation sites through human-assisted transmission. Ontario's primary goals in prevention are to raise public/staff awareness of WNS and limit its spread by human-assisted transmission. This section outlines the public awareness communications strategy, management considerations and outreach actions to be taken by the collaborating agencies to limit the inadvertent, preventable spread of WNS through human activities.

2.1 Public Awareness and Reporting

A key element of preventing the spread of WNS is public awareness. In collaboration with Canada's national WNS Communications and Outreach Working Group, a range of communications goals have been defined, intended to provide WNS-related information to the public and stakeholders to provide general information, and inform those who may observe or come into contact with bats:

- develop common "key messages" that provide basic information on bats and their ecological importance, define the emerging threat that WNS represents, and outline steps that can be taken to conserve bats;

- develop a Canadian web presence that centralizes information about bats and WNS, including best practices, updates on current research and status of bats/WNS, and links to related (detailed) web content;
- identify stakeholder groups which may assist in conveying key messages and support outreach efforts;
- communicate research, monitoring, surveillance, management, and conservation activities among internal audiences within Canada and the US to facilitate an effective Canadian response to WNS;
- communicate about WNS as an unprecedented North American wildlife disease event with devastating consequences, with an alarming rate of spread, and with no obvious means of control;
- communicate about the importance of bats to people, ecosystems, biodiversity, and economies;
- develop and maintain a Canadian (French and English) WNS website;
- disseminate information on general bat conservation opportunities and practices.

The following communications-related actions have been initiated in Ontario by MNRF and partners in support of public awareness and reporting goals:

- collaborating with the national WNS Communications and Outreach Working Group in the development of communications strategies and dissemination of information;
- maintaining a source of general information on WNS in bats so that the public can obtain information on the importance of bats, the spread of WNS and the risk to Ontario's bat populations;
- informing the public and stakeholders about steps being taken to prevent the spread of WNS and how they can help;
- communicating that there is no known human health risk associated with the fungus *P. destructans*;
- communicating that a small proportion of bats may carry the rabies virus and the importance of not handling bats;
- encouraging public reporting of observations of day-flying bats, or dead, sick or injured bats during winter months.

Current information related to these items, and links to other web content on WNS, is maintained on MNRF's Wildlife Health website at: https://www.ontario.ca/environment-and-energy/white-nose-syndrome-bats

2.2 WNS Containment

Scientific research is underway to better understand the mechanisms of *P. destructans* transmission and how it specifically causes WNS. Based on current findings there are a number of assumptions key to combating the spread of WNS:

- *P. destructans* thrives in 5-14°C temperatures with high humidity environments
- Bat-to-bat is the main transmission mechanism
- *P. destructans* can adhere to gear (clothing, equipment)
- *P. destructans* can persist in the environment in the absence of bats

P. destructans can be spread by people visiting caves and old underground mine workings and requires no physical contact with bats. To prevent the spread of *P. destructans* between sites it is essential for individuals to avoid visiting sites where WNS has been identified or where bats may be present. In addition, individuals should disinfect all equipment and clothing after being in a cave or old underground mine working according to established decontamination protocols.

Advice and information on decontamination protocols for equipment and clothing is provided by the CWHC at (866) 673-4781.

Additional information on decontamination can be found on the CWHC website: http://www.cwhc-rcsf.ca/docs/WNS%20Decontamination%20Protocol.Oct%2028%202014.pdf
MNRF will continue to collaborate with the national WNS Mitigation Technical Working Group on the development of best practice guidelines for mitigation of WNS, including guidelines for hibernacula protection.

2.3 Outreach and Stakeholder Collaboration

Communicating with groups entering mines is essential to prevent of the spread of WNS and promoting conservation of at-risk bat species. MNRF, MNDM and CWHC are collaborating with stakeholder groups and the mining industry to distribute the latest information on WNS, recommended actions to prevent the spread of *P. destructans* between sites and steps to minimize disturbance to vulnerable hibernating bats in caves and old underground mine workings.

2.3.1 Entry to Caves and Old Underground Mine Workings

To prevent possible *P. destructans* transmission to other locations and the ensuing potential impact on bat populations, the public is asked to refrain from entering all non-commercial caves and old underground mine workings where bats may be present. This will also reduce the potential for harming bats by rousing them during hibernation (September to May), which puts considerable stress on hibernating bats with limited energy reserves.

Distribution of information notices is targeted at the public and stakeholder groups who may enter old underground mine workings or caves, including:

- cavers, spelunkers and geocachers
- commercial cave operators
- researchers and consultants
- wildlife rehabilitators
- wildlife removal operators.

Credit: www.caves.org

These notices include WNS information, recommended restrictions on entry, and decontamination protocols for those who choose to enter, or inadvertently enter a WNS-infected site.

2.3.2 Prospectors and Mining Industry

Mineral exploration and mining industry personnel require access to caves and old underground mine workings, and with proper mitigation actions can provide valuable assistance in minimizing impacts to bat populations and preventing *P. destructans* transfer between sites.

Recommendations included in notices from the MNRF/MNDM to mining industry personnel include:

- Seasonal restrictions for entry to caves and old underground mine workings; no entry into bat hibernacula from September 1 to May 31. Entry restricted to June 1 to August 31.
- Reporting of undocumented hibernacula to MNRF.
- Winter work stoppage when hibernating bats are found.
- Decontamination protocols for moving equipment and personnel between sites.
- Use of ‘bat-friendly’ closures to secure old mine workings.

Bat hibernacula are considered Significant Wildlife Habitat under the Provincial Policy Statement (section 2.3.1) and Significant Wildlife Habitat Technical Guide and eco-region schedules and as such are “protected from incompatible development”. Development and site alteration will be permitted on or adjacent to these areas only "if it can be demonstrated that there will be no

negative impact on the natural heritage feature or ecological function." As such, mineral exploration and mining industry personnel are required to contact their local MNRF office prior to work if bats may be present. Under the *Mining Act*, regulations require a report to be filed subsequent to completion of mine rehabilitation activities (where there is no closure plan already in place), including measures taken to protect bat habitat, if present.

2.3.3 Wildlife Removal Operators

Wildlife removal operators may come into contact with *P. destructans*-infected bats.

Credit: Lesley Hale

Wildlife removal operators (persons whose business is primarily to address problem wildlife situations) are considered class agents under the FWCA and may, on a property owner's behalf, harass or live-capture wildlife, including bats. Live-trapped wildlife must be released in close proximity to the capture site within 24 hours (or may be delivered to a wildlife rehabilitator if sick).

Information notices to wildlife removal operators on preventing the possible spread of *P. destructans* include WNS information, instructions for reporting and decontamination protocols for scenarios where WNS infected bats are encountered. Under the ESA 2007 endangered and threatened bat species cannot be harassed, captured or killed unless property owners enter into an agreement with MNRF. Evictions of bats must not be conducted during winter months.

2.4 Species at Risk Status

In February 2012 the Emergency Assessment Subcommittee of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) conducted an emergency assessment of the Tricolored Bat, the Little Brown Myotis, and the Northern Myotis, all of which are found in Ontario. The subcommittee assessed each species as endangered and recommended that an Emergency Order be issued placing these wildlife species on Schedule 1 of the federal *Species at Risk Act*, in accordance with Section 29(1).

On December 19, 2014 the Federal Minister of the Environment added these three species to the List of Wildlife Species at Risk in Canada, listing each as Endangered. In Ontario, the addition of these bats to Schedule I of SARA means that these species are legally protected where they are found on federal lands. These protections prohibit:

- killing, harming, harassing, capturing or taking of an individual of one of the three listed species;
- possession, collection, buying, selling or trade of an individual of one of the three listed species; and
- damage or destruction of the residence of one of the three listed species.

As required under SARA, a recovery strategy will be developed collaboratively by the Federal government to identify actions required to address the threats to these species. It will also identify critical habitat to the extent possible, or include a schedule of studies to be conducted to identify this habitat, if required.

In November 2011, Ontario's Committee on the Status of Species at Risk in Ontario (COSSARO) put four bat species (those assessed by COSEWIC plus the Eastern Small-footed Bat) on their priority list for assessment. COSSARO conducted an assessment of the Little Brown Myotis and Northern Myotis during May 2012 and provided a report to the Minister of Natural Resources in October 2012. Ontario Regulation 230/08 was amended on January 24, 2013, establishing the Little Brown Myotis and Northern Myotis as endangered species in Ontario, and on January 27, 2014, adding the Eastern Small-footed Myotis as endangered.

Species listed in regulations under the Endangered Species Act, 2007 as endangered, threatened or extirpated are protected from killing, capture, buying and selling. As well, the habitats of newly-listed threatened and endangered species are subject to automatic protection upon listing.

The Ministry will work cooperatively with other jurisdictions to develop a coordinated approach to preparing recovery strategies for the endangered bat species across their ranges. Once recovery strategies for these species are completed, they will be available for adoption under the ESA 2007. It is anticipated that the provincial recovery strategies will be adopted within one year of being completed under the federal Species at Risk Act. While Ontario is committed to preparing a recovery strategy for these three species of endangered bats, all bats hibernating in Ontario will benefit from the protection given to three bats under the ESA 2007.

These recovery strategies will support efforts described throughout this response plan. Actions recommended in the recovery strategies will be considered by the province when it prepares the response statement and identifies which protection and recovery actions will be government-led or government-supported.

Habitat protection for bats at risk under ESA 2007 may be helpful in reducing the rate of spread and impact of WNS to bat colonies by reducing human disturbance at caves and old underground mine workings occupied by bat colonies. In future, the development of techniques for fungal decontaminating of both natural and artificial bat hibernacula may become important elements in habitat protection/restoration.

3.0 WNS SURVEILLANCE AND MONITORING

3.1 Surveillance and Monitoring Goals and Objectives

The primary objective of surveillance is the detection of WNS in Ontario bats. Coordinated surveillance, focused on early detection of WNS in newly established areas, and gathering information on impact within affected hibernating colonies, is essential to monitor the spread of WNS. A key goal of this plan is to provide a framework for consistent, coordinated WNS surveillance.

3.2 Surveillance and Monitoring Priorities

Due to the rapid spread of WNS across Ontario, the focus of surveillance activities will differ within and outside of WNS-affected regions. Surveillance in areas outside of WNS-affected regions should focus on detecting the presence of WNS at unconfirmed sites. In known WNS-affected areas, bat populations should be monitored to assess impacts of infection. The priority of surveillance activities may vary based on the geographic location of sites, bat species and numbers present, land ownership and accessibility. Surveillance priorities will also be influenced by collaborating agencies' individual monitoring priorities, capacities and capabilities.

3.3 Surveillance and Monitoring Techniques

A number of surveillance techniques are available to monitor WNS in Ontario, consisting of maternity roost surveys, hibernacula entrance surveys, and acoustic transect surveys:

Maternity roost surveys: Monitor declines in female populations and document reproductive success in areas outside the WNS-affected region. Inside WNS-affected regions where declines are already in effect, monitoring focus is primarily female survivorship and reproductive success. However, declines in bat numbers in maternity colonies may not be associated with WNS, and need to consider factors in relation to other population regulators.

Hibernacula entrance surveys: Monitor entrances to known bat hibernacula (caves and old mine workings) for dead bats to identify potential WNS-infected sites and extent of WNS in Ontario. Bat detectors may be used to monitor for changes in activity patterns of passive integrated transponder (PIT) tagged bats.

Acoustic transect surveys: Utilize acoustic bat recording devices on driving transects to monitor baseline bat populations and potential declines in relation to bat acoustic activity. Data will be acquired using protocols consistent with the North American Bat (NABat) program, and shared with US counterparts in support of continent-wide bat population monitoring objectives.

The application of these techniques may differ depending on the focus of surveillance/monitoring efforts, presence of WNS in a given region, availability of known bat hibernacula and maternity roost sites and collaborating agency priorities and resources.

All surveillance activities will:

- Minimize the disturbance to bats and the potential for disease transmission.
- Gather information to assist in future surveillance efforts, such as guidance for prioritizing sites, appropriate timeframes and sample sizes to meet surveillance objectives.
- Integrate with surveillance efforts of other provincial, national and international partners where possible.

Ontario will work collaboratively with the national WNS Bat Population Monitoring and Surveillance Technical Working Groups toward implementing a national monitoring plan and surveillance protocols for WNS.

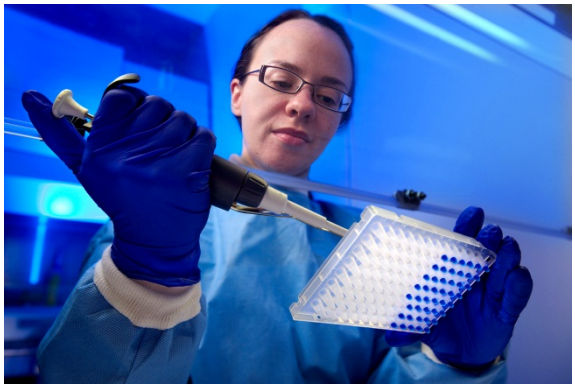
3.3.1 Public Reporting of Bat Observations

Due to the wide-ranging and cryptic nature of bats, an essential WNS surveillance technique is public reporting. The public is urged to report observations during the winter months of any day-flying bat activity, or any dead, sick or injured bats at any locality to the CWHC. This information is used to track potential occurrences of WNS, and determine whether site assessment is warranted.

3.4 Diagnostics and Testing

Guidance related to site surveillance, including acoustic monitoring and maternity roost/hibernacula surveys and sampling, is developed in association with the national

WNS Surveillance and Diagnostic Technical Working Group. This guidance provides information on surveillance techniques, specimen collection and submission to CWHC or MNRF, and will be updated to reflect current diagnostic procedures and best practices.



Credit: Centers for Disease Control (www.cdc.gov)

Bats submitted to CWHC for WNS diagnosis are autopsied, and any grossly evident abnormalities are recorded, as is state of preservation, weight, sex and body condition. Small tissue samples are removed from the muzzle and wings, including any visibly abnormal areas. They are submitted for Polymerase Chain Reaction (PCR) testing for *P. destructans*. In most cases small skin samples are also submitted for culture of the fungus.

Skin and underlying tissue from the head, including the muzzle and ear, as well as strips of wing membrane, including any abnormalities visible at autopsy, are fixed in formalin for histological examination. Tissues from internal body sites (brain, tongue, esophagus, stomach, intestine, liver, spleen, kidney, adrenal gland, reproductive tract, skeletal muscle etc., are also fixed for histological examination, provided that the carcass is in suitable condition. Regardless of the carcass condition, histology for WNS is generally attempted. Tissues remaining, including the carcass, are retained frozen for possible retrospective examination, depending on the outcome of histological examination. The skin sections are examined for the presence of *P. destructans* hyphae and conidia, and other degenerative conditions.

The observations are integrated into diagnoses: firstly whether *P. destructans* infection can be confirmed (by histology, and usually one other test [PCR or culture]); secondly, any other disease processes evident. If the bat was found moribund or dead, a cause of death would be given if possible.

3.5 Positive Case Response

Individuals submitting bat specimens for testing (MNRF staff, public, local Health Unit etc.) receive a written description and interpretation of the findings from the CWHC. A copy of the diagnosis is also sent to staff in MNRF's Wildlife Research and Development Section and Wildlife Policy Section. Positive confirmation is generally available within two weeks based on laboratory processing time. WNS negative determinations may take longer due to unpredictable time frames for fungal culture.

Upon positive confirmation, MNRF staff communicate with WNS task team agencies. This information is compiled provincially and distributed to national and international

WNS partners. Depending on the site location, and accessibly to the public, MNRF staff may also communicate with local Public Health Units, due to concerns regarding the handling of bats by people and pets and the associated risk of rabies transmission.

3.6 Data Management and Reporting

Key principles for WNS data management include establishing data and reporting standards for surveillance activities, security for sensitive information such as bat hibernacula locations, and to enable sharing of data provincially, nationally and internationally. Uniform standards for data collection, transfer and management will facilitate roll-up and analysis of data provincially and across jurisdictions and provide timely access to biological data and geospatial information specific to the investigation and monitoring of WNS.

MNRF's Natural Heritage Information Centre maintains information on bat location information in Ontario, and in collaboration with the national WNS Data Management Technical Working Group and US counterparts, will continue to adopt appropriate reporting standards and the development of supporting databases. Initially, this will involve MNRF support for the existing CWHC National Wildlife Disease Database, intended to support researchers and managers in addressing WMS data needs by supplying real-time data on WNS in forms appropriate to the needs of each.

The North American Bat Monitoring Program (NABat) initiative is an important step forward in establishing a standardized, long-term monitoring program and data collection standard for bat species across North America.

4.0 WNS RESEARCH

Effective management of WNS requires an understanding of the interactions among the disease, its host(s), and the environment. An international community of researchers including government, academic and non-government organizations have worked collaboratively to increase understanding of WNS since its discovery. However, there are still significant knowledge gaps regarding the ecology and transmission of *P. destructans.*

4.1 WNS Research Priorities

Understanding the population-level impacts of WNS are critical to predict the relative risk of extirpation of affected bat species and determining effective management strategies in Ontario. Research is still needed on relevant aspects of bat ecology and behaviour, diagnostic methods, pathology, epidemiology of the disease, presence and

persistence of the *P. destructans* in the environment, risks posed to other species and environments, genetics of cave fungi, host immune response, limits of pathogen survival, mode of mortality, bat population structure, and differential susceptibility.

Research activities will be conducted with regard to the national WNS Action Plan, through partnerships among academic entities, non-government organizations, and Provincial and Federal agencies, from Canada and other countries.

Given the associated risks of *P. destructans* transmission and potential disturbance to hibernating bats, it is essential that Ontario-based research activities connect with the surveillance and research activities of the CWHC and broader international community.

4.2 Wildlife Scientific Collector Authorizations

Bats are listed as specially protected mammals in Ontario under Schedule 6 of the *Fish and Wildlife Conservation Act*, as such; research activities involving collection of individuals from the wild may require MNRF approval. In addition to the recommended actions to limit the spread of WNS outlined in section 2.3.1, conditions are placed on scientific collector's authorizations involving cave bats intended to further prevent the spread of WNS by researchers visiting potentially infected sites. Scientific collectors are required to:

1. Coordinate all field work and collection/diagnostic testing of individual bats exhibiting signs consistent with WNS with MNRF and the CWHC.

2. Conduct collection activities consistent with current U.S. Fish and Wildlife Service Decontamination Protocols for WNS (available: http://whitenosesyndrome.org/research-and-monitoring).

3. Release all bats captured immediately after collection of samples is completed, in the area of capture.

4. Submit a report for collections carried out under the authorization outlining: any general observations; date, location and description of collection site; method of collection; number of individuals targeted and collected (killed and mounted, kept temporarily and released); and name of collector.

4.3 Disease Management

To date there are no known treatment options for WNS; as such, disease management actions in Ontario are primarily focused on monitoring of infected sites and the prevention of spread. This plan supports an adaptive approach to WNS management

and will be reviewed and adjusted based on research findings of the international community of WNS collaborators.

Key questions that will help our understanding of WNS and direct treatment options include:

- are there particular bat age/sex classes or genetic characteristics that are more susceptible to WNS than others?
- What antifungal microbes or biocontrol agents could be used to control or displace *P. destructans*?
- can natural migration from regions unaffected by *P. destructans* help restore bat populations in affected regions?
- Under what conditions can infected bats survive *P. destructans* and are surviving bats more resistant to re-infection?

5.0 LITERATURE CITED

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