Form 1100-001
(R 2/11)

NATURAL RESOURCES BOARD AGENDA ITEM

Item No. 8.B.1

SUBJECT: Informational Item: Wisconsin Department of Natural Resources White Nose Syndrome (WNS) Surveillance and Response Implementation Strategy

FOR: OCTOBER, 2011 **BOARD MEETING**

TO BE PRESENTED BY / TITLE:

Erin Crain/ER Section Chief, and David Redell/Bat Ecologist

SUMMARY:

White-nose syndrome (WNS) is a disease causing unprecedented mortality in cave hibernating bats. The purpose of the Implementation Strategy is to guide the WDNR in its statewide effort to prevent and/or minimize the spread of WNS into and throughout WI. It is a process document describing implementation of policy previously approved by the Natural Resources Board. WI holds a significant portion of the Midwestern population of little brown bats as well as other cave bat species. The three largest sites are underground mines and collectively provide hibernating refuge for over 275,000 little brown bats. There are 110 known bat hibernacula in WI, including 12 publicly owned caves. Approximately 20 hibernacula are routinely used for recreational caving, and seven are currently operating as commercial caves. Affected groups include: recreational and commercial caving, active underground mines, forestry, agriculture, cave and mine landowners, conservation community.

RECOMMENDATION: Information item, no action needed.

LIST OF ATTACHED MATERIALS:

No	☑	Fiscal Estimate Required	Yes ☐	Attached
No	☑	Environmental Assessment or Impact Statement Required	Yes ☐	Attached
No	☐	Background Memo	Yes ☑	Attached

APPROVED:

Bureau Director, Laurie Osterndorf, ER — Date 9/19/11

Administrator, Kurt Thiede, Lands — Date 9/20/11

Secretary, Cathy Stepp — Date 10/5/11

cc: NRB Liaison
DNR Rules Coordinator
Tom Hauge, WM/6
Tami Ryan, WM/6
Erin Crain, ER/6
Dave Redell, ER/6
Lance Potter, ER/6

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: September 19, 2011

TO: Natural Resources Board

FROM: Cathy Stepp

SUBJECT: White-nose Syndrome Implementation Strategy

White-nose syndrome (WNS), a devastating cave-bat disease caused by the fungal pathogen *Geomyces destructans,* was first identified in New York in 2006. Since then, the disease has spread rapidly via bat movement and probably also human transmission throughout the eastern United States and Canada, and has killed over a million bats. Named after the distinctive white growth that appears on the nose and wings of affected bats, WNS is at the time of writing only 190 miles from Wisconsin and will possibly arrive in the state during the winter of 2011-2012. White-nose syndrome poses a severe threat to all four of Wisconsin's cave bat species.

The Wisconsin Department of Natural Resources (WDNR) has developed a Surveillance and Response Implementation Strategy as an internal document to guide the state's response to this imminent wildlife health crisis. The main goals of Wisconsin's WNS response are to prevent the anthropogenic introduction of WNS into the state, slow its spread once it arrives, control the disease to the point where bat populations may recover, and to do so in a cost-effective manner that minimizes impacts to stakeholders. Specifically, this document clarifies how WDNR will coordinate with other agencies, stakeholders, and the scientific community as the strategy is implemented; outlines a communication structure; provides guidelines to establish a monitoring framework for early WNS detection; describes a host of surveillance options WDNR and partners are using to gather baseline bat population data; and identifies WNS-management options such as decontamination, cave and mine access management, disease treatment, and rehabilitation.

To ensure that the Wisconsin WNS decision-making process is well informed and makes sound, science-based resource management decisions, WDNR will create both a Science Advisory Group to provide scientific and technical expertise and a Stakeholder Advisory Group that will articulate stakeholder needs and provide input focusing on the social, cultural, and economic aspects of the issue. These advisory groups are not decision-making bodies, but their recommendations will be considered throughout the decision-making process.

Monitoring Wisconsin's bat populations is crucial for WNS management for two reasons: establishment of pre-WNS baseline data and early disease detection. Baseline data on population densities, hibernacula locations, movement patterns, and health is necessary for ongoing research on WNS. This information is also essential for accurately understanding the effects of the disease when it arrives and for planning the recovery of the bat population. WDNR field crews have already surveyed more than 90% of the Wisconsin's 120 potential hibernacula, recording information on species, estimated number of bats present, temperature, and general site conditions. This information will help determine where *Geomyces destructans* could survive or spread, prioritize future monitoring, and identify potential future hibernacula for a recovering bat population. Early WNS detection will give managers and researchers the earliest opportunity to develop and experiment with control methods focused on stopping or slowing the spread of the disease.

The overall goal of WNS management is to slow the spread of the disease into and through Wisconsin and minimize its impact where it does occur. Because the natural movement of bats cannot be controlled, the current focus of the WDNR strategy is to limit the anthropogenic spread of WNS. The main tools used to limit WNS impact are decontamination, physical exclusions at caves and mines, and disease management. Three emergency rules that came into effect in June 2011 list cave bats as threatened, name *Geomyces destructans* a prohibited invasive species, and adds White-nose syndrome management options under NR 40, including mandatory decontamination procedures when entering and exiting caves or handling cave bats. Under this authority, WDNR adopted decontamination measures that allow Wisconsin caves and mines to remain open for human use and prevent the rehabilitation of infected or presumed-infected bats until disinfection protocols can be developed. Restricting unauthorized human access is highly recommended for all caves and mines, both public and private. WDNR will work with property and business owners on a site-by-site basis to find practical and effective management strategies that meet the commercial, recreational, or other needs of the owner while at the same time slowing the spread of WNS.

Clear and consistent lines of communication are a critical feature of the overall WNS management strategy. Communication efforts include continual contact with a diverse range of management and research partners in the multi-agency effort to fight the disease, as well as outreach to educate the public and inform them of current developments. To this end, the WDNR Office of Communication will designate a Public Information Officer (PIO) to serve as liaison between personnel involved in WNS management and the media. The U.S. Fish & Wildlife Service has also written a national inter-agency and NGO 'Communications and Outreach Plan' that addresses how state agencies can receive WNS updates and how they can be contribute to WNS investigation efforts. WDNR is a leader in the collaborative continental effort to study the disease, and is also a key partner in the effort to develop a national response plan.

Wisconsin Department of Natural Resources
White Nose Syndrome (WNS) Surveillance and Response Implementation Strategy

September 2011

Bureau of Endangered Resources
Bureau of Wildlife Management

Wisconsin Department of Natural Resources White Nose Syndrome (WNS) Surveillance and Response Implementation Strategy

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Wisconsin Department of Natural Resources White-Nose Syndrome Surveillance and Response Implementation Strategy

WNS Implementation Strategy Executive Summary

White-nose syndrome (WNS), a devastating cave-bat disease caused by the fungal pathogen *Geomyces destructans,* was first identified in New York in 2006. Since then, the disease has spread rapidly via bat movement and probably also human transmission throughout the eastern United States and Canada, and has killed over a million bats. Named after the distinctive white growth that appears on the nose and wings of affected bats, WNS is at the time of writing only 190 miles from Wisconsin and will possibly arrive in the state during the winter of 2011-2012. White-nose syndrome poses a severe threat to all four of Wisconsin's cave bat species.

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I. Administration Sections

A. Introduction

White-nose syndrome (WNS) is a disease causing unprecedented mortality in cave hibernating bats. It is visually identified by the white fungus and causative pathogen (*Geomyces destructans*), that grows on the nose, ears, muzzle and/or wing membranes of affected bats, and was first observed in the United States in winter of 2005-2006 (Blehert et al 2011). Since initial detection, WNS has been documented in 16 states and four Canadian provinces, as well as confirmation of the fungus (Gd) in an additional 3 states. The disease is spreading rapidly in all directions from the first affected sites in New York. Several hibernacula surveyed before and after WNS appearance have documented bat declines greater than 75%, and in some cases 90%-100% (Blehert et al. 2009).

White-nose syndrome poses a significant threat to cave hibernating bats throughout North America and in the Northeast its effects are already devastating: models give a 99% chance of regional extinction of the little brown myotis (*Myotis lucifugus*) within the next 16 years (Frick et al. 2010). All Wisconsin cave bat species, including one federally endangered species and another candidate for federal listing, are among the six species mortally affected by the disease. Over the winter of 2010-2011, WDNR field crews conducted WNS surveillance at more than 100 known and possible hibernacula in Wisconsin representing more than 90 percent of the possible underground locations. *Geomyces destructans* was not detected in the state during these survey efforts. During spring of 2011, WNS was confirmed in southern Indiana and at a hibernaculum in Ontario approximately 190 miles from the northern Wisconsin state line. *Geomyces destructans* was identified through PCR positive in a Missouri cave approximately 225 miles from the southern Wisconsin state line. Based on previously observed patterns and rates of spread, along with the known migratory distance of at least one Wisconsin cave bat species (Kurta and Murray 2002; Humphrey and Cope 1976), DNR anticipate that WNS could appear in Wisconsin as early as the winter of 2011-2012.

Bats are major consumers of agricultural and forest pests, as well as mosquitoes, which transfer West Nile Virus. Bats eat millions of insects every year, and a single bat may consume up to 1000 insects per hour. Where bat numbers are significantly reduced by WNS, the economic impact of increased crop damage could prove severe. One study conducted in Texas estimated that bat control of a single agricultural pest in the state was worth as much as $1.7 million dollars per year (Cleveland et al. 2009). Bats may also reduce the need for insecticide application, potentially saving farmers hundreds of thousands of dollars annually. Boyles et al. (2011) conducted an economic assessment quantifying the importance of bats to agriculture and estimated the annual value of bats to the agricultural industry in North America to be between $3.7 billion and $53 billion. For Wisconsin, they calculated that the value of bats' consumption of insect pests equates to between $658 million dollars up to more than $1.5 billion dollars per year. These figures are the annual avoided-cost value that bats bring to the ecosystem that would otherwise be spent on applying chemical pesticides to crops in Wisconsin (Boyles et al. 2011). Bats are also a critical component of fragile cave ecosystems and their absence from such systems could lead to a cascade of impacts to rare invertebrate cave species.

In accordance with a core aspect of the Wisconsin Department of Natural Resources' mission "to protect and enhance our natural resources", this WNS Surveillance and Response Implementation Strategy was developed due to the threat of an anticipated spread of the disease to Wisconsin. This Strategy is an internal document discussing possible WNS surveillance and management options including decontamination, disease treatments, and rehabilitation. It was written by the agency's Bureau of Endangered Resources and the Wildlife Health section of the Bureau of Wildlife Management and reviewed by the Department of Agriculture, Trade and Consumer Protection (DATCP); state and federal disease laboratories; federal and Midwestern state wildlife agencies; and university representatives. Furthermore, the plan outlines responsibilities and communication procedures for the WDNR and its cooperators.

B. Signature Page

Responsible agencies and organizations sign the document agreeing to the plan

C. Situation and Assumptions

White-nose syndrome is a disease that fatally affects North American bats during winter hibernation. From the beginning of the WNS investigation, the fungus *Geomyces destructans* has been associated with and presumed to be the causative agent of the disease (Gargas et al. 2009). More recently two independent studies were completed to determine if *Geomyces destructans* can be confirmed as the causative agent. A consensus statement from a group of leading scientist at the WNS Science Strategy II Meeting (Austin TX, May 2009) describes the situation:

> *White-Nose Syndrome (WNS) is a devastating disease of hibernating bats that has caused the most precipitous decline of North American wildlife in recorded history. Since it was first discovered in 2006, WNS has infected six species of insect-eating bats in the northeastern and southern U.S., causing declines approaching 100% in some populations; estimated losses have exceeded one million bats over the past three years. If the spread of WNS is not slowed or halted, further losses could lead to the extinction of entire species and could more than quadruple those that are federally listed as endangered in the U.S. Such losses alone are expected to have unprecedented consequences on ecosystem health throughout North America, with unknown economic consequences. Most bat species in North America feed on night-flying insects, of which many are pests of forests, agriculture, and garden crops or pose risks to human health. The number of insects consumed annually by one million bats is staggering — equivalent to 694 tons — emphasizing the extraordinary value of these bats to the normal function of both terrestrial and aquatic ecosystems. Establishment of a national comprehensive research program is urgently needed to identify underlying mechanisms causing WNS and to develop sound management solutions.*

The six mortally affected species include the little brown bat (*Myotis lucifugus*), Big brown bat (*Eptesicus fuscus*), Eastern pipistrelle or Tricolored bat (*Perimyotis subflavus*), Northern long-eared bat (*Myotis septentrionalis*), Small-footed bat (*Myotis leibii*), and Indiana bat (*Myotis sodalis*). DNA from *Geomyces destructans* – but not the full array of clinical signs that characterize WNS - has been identified on three additional species: Gray bat (*Myotis griscesens*), Southeastern myotis (*Myotis austroriparius*) and Cave myotis (*Myotis velifer*).

Bats are a vital part of many ecosystems and white-nose syndrome has significant environmental, economic, and public health implications. These insectivorous bats consume large numbers of agricultural pests, which cost farmers and foresters billions of dollars yearly. As predators of biting insects, bats also may play an important role in reducing risk of insect-borne diseases, such as the West-Nile Virus. Bats play an important role in sustaining many unique and fragile cave ecosystems. For example, bats are the primary source of nutrients in many cave systems, and many cave-obligate species depend on such input for survival. Thus, the loss or significant reduction of bat populations from caves could have cascading affects that impact the status of many other cave species.

The distance bats travel can be estimated through dispersal and migratory data obtained through band recapture data. Distances traveled vary greatly between species, sexes, individuals, and across temporal scales (e.g., male dispersal distance in late summer vs. migration distance to wintering grounds). Band recoveries have indicated migration distances for little brown bats up

to 280 miles (Humphrey and Cope 1976). Kurta and Murray (2002) recaptured migrant Indiana bats an average of 286 miles from their summer location in Michigan. Migration distances traveled by species present in Wisconsin now exceed the distance to the nearest detected WNS affected hibernaculum.

Because many bat species form large, vulnerable aggregations at a limited number of locations during critical stages of their natural history cycle (i.e., winter hibernation and summer maternity colonies), populations are particularly sensitive to impacts and susceptible to decline. Additionally, low reproductive rates slow the potential for population recovery. In northern latitudes of the United States bat species must hibernate for an extended period when food resources are limited. Some, but not all, underground caves and mines can provide the environmental conditions that hibernating bats need to survive this vulnerable portion of their life history cycle. Hibernacula can be scarce in some areas and concentrated in others, and therefore a single suitable site can harbor large numbers of bats of multiple species, dispersing in summer over foraging grounds that cover more than a thousand square miles. Seasonal aggregation makes bats extremely susceptible to catastrophic events, but these congregations also provide opportunities to inventory, monitor, manage and protect a large proportion of these populations by focusing conservation and management efforts at these known sites.

The soil fungus *Geomyces destructans* was first described by Gargas et al (2009) as psychrophilic (cold loving) and slow growing, with no growth at or above 24°C (75°F), and with distinctive curved conidia (spores). *Geomyces destructans* growth on bats, a hallmark of WNS, has also been documented on bat species in Europe but the infection characteristic of WNS, and the associated mortality has not been observed (Martinkova et al. 2010; Wibbelt et al. 2010). It is hypothesized that a human vector is responsible for introducing *Geomyces destructans* to North American caves (Wibbelt et al. 2010, Blehert et al. 2011). North American cave bats appear to be evolutionarily naïve to this non-native fungus, and have little or no resistance to the effects of WNS.

Geomyces destructans colonizes the skin of hibernating bats. It appears as a white or gray powdery fungus in areas around the muzzle, ears, wing, limbs, and/or tail. WNS is suspected in the field during winter months when: 1) fungal growth is evident, 2) excessive or unexplained bat mortality occurs at winter hibernacula, 3) bats are thin and/or dehydrated and appear wrinkled and flaky in the furless areas, 4) bats delay arousal from torpor following disturbance, and 5) bats display aberrant behaviors (i.e. roost near the hibernaculum entrance, occur on the ground inside or outside the hibernaculum, emerge from the hibernaculum earlier than expected during cold weather when insect resources are limited, often during daylight hours).

Evidence suggests that infection of wing skin by *G. destructans* in the skin of the wing may be a primary cause of the mortality associated with WNS, but for now the exact process by which infection leads to death remains undetermined. Cryan et al. (2010) proposed several routes of life-threatening disruption to bat physiology due to WNS including: infarction or loss of oxygen supply to areas of the wing without fungal growth, loss of dermal integrity to wing skin leading to the loss of fluid or heat regulation capability, and nerve damage potentially affecting flight.

It is known that chronic disturbance of hibernating bats can lead to high winter mortality rates due to depleted fat reserves when food is scarce (Speakman et al. 1991). WNS infected bats display aberrant behaviors, such as daytime flights and roosting near cave and mine entrances with rapidly fluctuating temperatures or in colder areas, which in turn may lead to higher mortality of the infected bats. Furthermore, hibernating bats may be predisposed to infection, due to the naturally suppressed immune responses observed during bouts of torpor (Carey et al. 2003).

It is likely that *Geomyces destructans* can be transferred from bat-to-bat, cave-to-bat, from cave-to-equipment, and from equipment-to-cave. Laboratory experiments conducted at the USGS National Wildlife Health Center (Madison, WI), have suggested that healthy bats can contract WNS directly from infected bats housed in the same cage. Cave-to-bat contamination was documented in a multi-agency field experiment in which healthy bats from Wisconsin were moved into two WNS-infected hibernacula in Vermont. Although sick bats had been absent from the cave for a few months and up to a year, healthy Wisconsin bats were colonized by *Geomyces destructans,* and developed WNS (Hicks et al. 2010). Finally, cave-to-clothing/gear transfer was observed when the New York Department of Environmental Conservation, Wildlife Pathology Unit, identified spores *Geomyces destructans* on equipment and clothing worn in a contaminated cave (Okoniewski et al. 2010).

A human role in inadvertently carrying *Geomyces destructans* spores from a contaminated site to a clean site on clothing, shoes, or gear has been regarded as possible (Sleeman 2009), and is supported by the observed long-distance jumps in the spread of WNS, beyond the dispersal distances bats could carry the disease. These "jump" sites have been caves frequently visited by humans, often with small bat populations (Turner and Reeder 2009). Furthermore, the USGS National Wildlife Health Center cultured viable *Geomyces destructans* from sediment collected from a WNS infected cave demonstrating that the fungus can persist in the cave environment (Lindner et al. 2010, Blehert et al. 2011). Although the fungus was not isolated from all soil samples collected from WNS infested caves (and none from non-infected caves), its presence in the soil samples suggests that infected caves could serve as potential sources of disease spread to other sites by human activities even after a local bat population has been extirpated from a cave. Additionally, these findings suggest that caves with no known bat populations or usage could also become infected through human visitation, thereby becoming sources for additional spread through subsequent human contact.

Bats are an important component of Wisconsin's wildlife heritage. The eight bat species recorded in Wisconsin constitute 12% of the state's mammal diversity. Five species (Northern long-eared bat, Eastern pipistrelle, little brown bat, big brown bat, and Indiana bat) are considered 'cave' bats because they congregate and hibernate during winter in caves or cave-like structures (e.g., mines). The remaining three species are considered 'tree' bats because they migrate south during cold weather, seldom enter caves and typically roost in trees or tree hollows (Hoary bat, Eastern red bat, Silver-haired bat). The Wisconsin Wildlife Action Plan (WAP) recognizes 14 mammal Species of Greatest Conservation Need (SGCN), including four bat species (Hoary bat, Eastern red bat, Silver-haired bat, and Northern long-eared bat). The WAP also identifies four other bats as species with additional information needs (Eastern pipistrelle, Little brown bat, Big brown bat, and Indiana bat). As of June 1, 2011, all four cave bats

(excluding the federally endangered Indiana bat) have been listed as State Threatened species, and are therefore protected under the Wisconsin endangered species act.

Information from neighboring states suggests that Wisconsin holds a significant portion of the Midwestern population of little brown bats, and all the other cave bat species are numerous except for the Indiana bat, whose last reported observation in the state was in the 1950's. Many hibernacula have >50 individuals, and three of Wisconsin's largest sites collectively provide hibernating refuge for >275,000 little brown bats. There are 110 known bat hibernacula in Wisconsin including 12 public caves. Approximately 20 of the caves and mines in Wisconsin are routinely used for recreational caving, and fewer than 10 are commercially operated caves.

Geomyces destructans was not detected in soil samples collected from Wisconsin hibernacula during 2008-2009 (Lindner et al. 2011). During the summer and fall of 2010 a comprehensive catalogue of known and potential hibernacula was created and used to guide WNS surveillance efforts which took place at more than 100 sites in winter and early spring of 2011. Although five WNS suspect bats were submitted for testing at the USGS National Wildlife Health Center from four different counties, *Geomyces destructans* was not detected and no other indications of WNS were observed. In addition, the public has not reported abnormal bat activity or large-scale winter mortality. With the recent (spring 2010) detection of DNA from *Geomyces destructans* in Missouri and the confirmation of WNS in Ontario, Canada, the disease is expected to enter Wisconsin and the upper Midwest from the south and/or (through Michigan's upper peninsula) in the near future.

Given the potentially devastating impact of WNS on the Wisconsin cave bat community and the rapid timeline by which the disease has spread from the Northeast, the Wisconsin Natural Resources Board approved three emergency rules (WDNR 2010a, 2010b, & 2010c). The Department produced a voluntary Environmental Assessment (EA) of the management techniques with each proposed rule (WDNR 2010a) and all three emergency rules were made permanent on June 1st 2011.

The first rule (ER-35-10) lists the four native cave bat species of Wisconsin as threatened species under Ch. NR 27, Wis. Adm. Code. Listing cave bats as threatened prohibits disturbance of the bats during hibernation, prohibits the possession or transfer of the animals, and implements measures to decrease the overall number of bats taken by alternate sources of mortality. Listing the cave bat species in WI as threatened provides some protections to the animals, but it does not provide measures that are likely to affect the spread of the fungus. Hence, the second rule (IS-41-10) adds the fungus *Geomyces destructans* to the list of prohibited invasive species in CH. NR 40, Wis. Adm. Code. This listing gives the department regulatory authority to limit human transport of the fungus and requires landowners to implement a control plan once the fungus arrives at a site. A third rule (IS-47-10) adds WNS management options under NR 40, including mandatory decontamination procedures when entering and exiting caves or handling cave bats. The rule changes define how and under what circumstances the department will implement management actions needed to be in place for this winter's hibernation season.

A formal Implementation Strategy document will provide the agencies of State of Wisconsin with the necessary framework for disease surveillance and response planning in the face of this

infectious wildlife disease. WDNR has adopted these case definitions for diagnostic classifications applied to WNS-affected bats and caves developed by the WNS Diagnostic Working Group (Appendix A). Using the case definitions, a diseased bat is defined as a suspect positive or confirmed positive based on specific histopathology criteria. Furthermore a cave or mine is considered contaminated by *Geomyces destructans* based on the status of the bats sampled from that location.

D. Purpose

The purpose of the Implementation Strategy is to guide the Wisconsin Department of Natural Resources in its statewide effort to prevent and/or minimize the spread of WNS into and throughout Wisconsin. This strategy is considered to be a process document intended for an internal agency audience and providing guidelines to:

1) establish a monitoring framework for early detection of WNS in Wisconsin,
2) coordinate studies that obtain critical baseline data on Wisconsin's bat populations,
3) conduct disease surveillance,
4) institute strict protocols to minimize the risk of human transmission of *Geomyces destructans* through monitoring, research or recreational use of caves,
5) develop a strategy for responding to a WNS outbreak in Wisconsin,
6) provide a communication structure,
7) provide and test critical adaptive management to minimize the impact of WNS on the bat population of Wisconsin,
8) clarify how WDNR will work with other agencies and stakeholders in implementation of this strategy, and
9) identify and provide opportunities for applied research studies directly related to WNS management and possible solutions that may conserve the natural resource.

E. Authorities

The Wisconsin Department of Natural Resources holds the public trust responsibility for managing wildlife as embodied in State Statute 29.011 Title to wild animals (1) *The legal title to, and the custody and protection of, all wild animals within this state is vested in the state for the purposes of regulating the enjoyment, use, disposition and conservation of those wild animals.*

Chapter NR 1.015(2), Wis. Adm. Code, establishes WDNR responsibility for ensuring healthy wildlife populations: *The primary goal of wildlife management is to provide healthy life systems necessary to sustain Wisconsin's wildlife populations for their biological, recreational, cultural and economic values.*

Chapter NR 27, Wis. Adm. Code, establishes an endangered and threatened species list. Threatened species listing of four cave bats species grants WDNR authority in state statutes 29.604, 227.11, and 227.24 Wis. Stats

Chapter NR 40, Wis. Adm. Code, establishes a classification system for invasive species and regulates those in the prohibited and restricted categories. Prohibited Invasive Species listing of

Geomyces destructans grants WDNR authority in Sections 23.09 (2) (intro.), 23.091, 23.11 (1), 23.22 (2) (a) and (b) and (2t) (a), 23.28 (3), 27.01 (2) (j), 29.039 (1), 227.11(2)(a), and 227.24 (1) (a), Stats

Chapter NR 40, Wis. Adm. Code also establishes preventive measures that when followed will help minimize the spread of invasive species into or within Wisconsin. The *Geomyces destructans* and White-nose syndrome management ruling grants WDNR authority in Sections 23.09 (2) (intro.), 23.091, 23.11 (1), 23.22 (2) (a) and (b), 23.28 (3), 27.01 (2) (j), 29.039 (1) and 227.11(2) (a), Wis. Stats.

F. Concept of Operations

Wisconsin's response to WNS, as outlined in this plan, will by necessity (1) involve multiple state and federal agencies and stakeholders, (2) continually incorporate findings from ongoing WNS research, surveillance, and management, and (3) be highly and regularly adaptive to the changing status of bats and WNS in Wisconsin, and to the needs of Wisconsin's citizens, and (4) be tiered off of, and informed by, the national response plan: A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats, released May 2011.

Wisconsin will choose WNS management actions with the goals to:

1) prevent anthropogenic introduction of *Geomyces destructans* into the state,
2) prevent or slow the spread of WNS to additional sites once WNS is identified in WI,
3) attain sufficient control of the disease in affected areas to conserve bat populations and their potential for recovery to pre-WNS abundance,
4) secure the future of bats without affecting other natural systems beyond acceptable levels,
5) minimize the impacts of WNS and WNS management actions on stakeholders interests, and
6) maintain resource and cost effectiveness so that management efforts can be sustained as long as necessary.

The roles and responsibilities for the WNS Science Advisory Group, the Stakeholder Advisory Group and each agency, cooperator, or stakeholder are described below.

<u>Wisconsin WNS Science Advisory Group</u>

A white-nose syndrome Science Advisory Group will provide information and recommendations to decision-makers to help ensure that Wisconsin's management of WNS, bats, hibernacula, and associated natural communities is informed by the best available science and is consistent with the goals of the implementation strategy. The groups' responsibilities, function, and composition will be consistent with the Bureau of Endangered Resources Science Guidelines (Bureau of Endangered Resources Handbook 2011 addition) regarding science advisory groups (see

"Process and meetings for WNS Science Advisory Group and Stakeholder Advisory Groups", p. 37).

The role of the WNS Science Advisory Group is to provide scientific and technical expertise to the overall process, focusing on the biological and ecological aspects of WNS, but the group may also provide scientific and technical expertise in environmental, economic, social, and other aspects regarding WNS. The group may be asked to make recommendations related to scientific aspects of WNS (e.g., prioritized list of research needs, adaptive management approaches/scenario(s) expected to most effectively protect bats from WNS). Decision making and goal setting regarding management lie outside of the realm of the science advisory group, but the group's information, recommendations, and views regarding consequences of management goals and actions may lead to revised goals and actions.

Examples include:

- Identify and evaluate underlying assumptions
- Identify and evaluate sources of scientific uncertainty
- Assess how proposed and alternative management goals, policies, and strategies may impact populations in both the short and long term
- Identify critical research needs
- Review research proposals and findings related to WNS and bat ecology
- Identify other pertinent information or questions that are relevant to the topic at hand

The WNS Science Advisory Group will be composed of experts and/or professionals highly qualified in terms of knowledge and training and with an intellectual interest in the scientific and technical questions to be addressed. Appropriate areas of expertise for members may include: Conservation Biology, Wildlife Ecology, Wildlife Health, Population Dynamics, Statistics, and/or Human Dimensions. Participants on the WNS Science Advisory Group will include several DNR staff members including the Bureau of Endangered Resources Bat Ecologist and the Bureau of Wildlife Management Wildlife Veterinarian. The group may also include individuals from the University system, science-based conservation organizations, wildlife health laboratories, federal agencies(USFWS or USGS), and/or other scientific institutions. The WNS Science Advisory Group may include additional individuals brought in to provide expertise either on a temporary or occasional basis.

The Bureau of Endangered Resources will appoint members, working to ensure 1) that the knowledge, experience, and perspectives represented on the committee are both adequate and balanced to address the issue at hand, and 2) that no individual appointed to serve on the WNS Science Advisory Group has a conflict of interest that is relevant to the topic being considered. In some cases, however, conflicts of interest are unavoidable (e.g., there is a particularly small pool of individuals with the expertise needed, and all have conflicts of interest). When this situation occurs, the participant will be required to promptly and publicly disclose the conflict of interest to the group and to the Bureau of Endangered Resources, and to refrain from participating in within-group decision-making on matters related to the conflict. This is an

ongoing participant responsibility – if new conflicts of interest arise for participants during the process, the participant must promptly disclose the conflict(s) in a similar manner.

Wisconsin Stakeholder Advisory Group

Stakeholder input is integral to helping make sound resource management decisions. The WDNR is committed to working in partnership with stakeholders, regularly seeking and taking into account their knowledge, experience and perspectives. A designated Stakeholder Advisory group will be created for systematic input regarding WNS management decisions beyond public hearings.

The role of the stakeholder advisory group is to articulate stakeholder needs and respond to proposed management goals and policy including written documents for the WNS Science Advisory Group. Input is anticipated to focus on non-technical social, cultural, ethical and economic aspects of the issue, as well as conservation and other relevant areas.

The Stakeholder Advisory Group will be composed of individuals (in many cases representing organizations, agencies, local units of government, etc) with an interest in WNS and/or who may affect or be affected by WNS management. WDNR will work to identify all relevant and interested stakeholders at the outset and request names for an organization/agency representative or individual for membership. The Bureau of Endangered Resources will then appoint members working to ensure that the composition of the group is balanced, adequate to address the issue at hand, and reflective of a diversity of perspectives and areas of knowledge and expertise. It is anticipated that stakeholders may include mine, farm industry, and wind energy representatives, other management or regulatory agencies, local units of government, conservation groups, affected landowners, wind energy, animal control operators, tourist caves, recreational caving, bat rehabilitators and the interested public. The Bureau of Endangered Resources, as the resource manager, is a stakeholder in all decisions and will lead and participate in the stakeholder advisory group.

Participants in stakeholder advisory groups are expected to be willing and able to represent the interests of other similar individuals, businesses, organizations, communities, etc., as applicable. Conflicts of interest, financial and otherwise, are in some ways unavoidable in stakeholder advisory groups – stakeholders by definition may affect and be affected by the decision at hand. Stakeholders will be required to promptly and publicly disclose to the group and to the Bureau of Endangered Resources potential conflicts of interest at the first meeting. If conflicts of interest exist or arise that are detrimental to the functioning of the group, the individual may be precluded from (or asked to discontinue) participation in the group. This is an ongoing participant responsibility – if new conflicts of interest arise for participants during the process, the participant must promptly disclose the conflict(s) in a similar manner.

Process and meetings for WNS Science and Stakeholder Advisory Groups

- One or more WDNR staff person will participate on all stakeholder and science advisory groups. A DNR staff person will lead each stakeholder advisory group. Science advisory groups will most often be lead by a WDNR staff person, but may be lead by a member

from another organization or institution. The DNR staff on each advisory group will liaise with the Bureau of Endangered Resources and WDNR decision-making/oversight team.

- Meetings will follow standard procedural rules of order, with the primary goals being to insure that 1) participants are informed ahead of time of topics to be addressed, 2) all participants are treated fairly and respectfully and given ample opportunity to provide input, and 3) meetings and discussions move forward on schedule. If procedural questions arise, the group may reference Robert's Rules of Order and/or request guidance from the Bureau of Endangered Resources.
- Minutes will be recorded at each meeting and circulated for approval by the group prior to being finalized.
- The advisory groups will meet on an as-needed basis determined by the WDNR WNS leader (see Organization of Responsibilities, pg 19). A tentative timeline and schedule of meetings will be established at the outset of the process to inform prospective advisory group members of the approximate time commitment anticipated.
- Public notice of meetings: Advisory group meetings most often will include non-DNR individuals. As such, the DNR is required by the state Open Meetings Law (s. 19.84, Wis. Stats.) to provide public notice of the meetings.
- Observers: Members of the public may attend and listen to meetings of stakeholder and science advisory groups as observers but may not provide comment at the meeting. Names of observers may be requested.
- Guests: Advisory groups may at times wish or need to invite guests to provide information or expertise to the group. Guests will not participate in any decision making or voting that may occur.
- Decision making within the group, whether it is by consensus, voting, or other means, may only be initiated by the group leader.
- Recommendations from the Science and Stakeholder group will be developed through substantial consensus and separate minority positions may be forwarded.
- At the first meeting (and annually thereafter if the process is ongoing), advisory groups will be asked to:
    - Discuss the issues of group composition and balance, potential sources of bias and conflicts of interest, and the relevant circumstances of individual members.
    - Discuss and agree upon a preferred process for group decision making if asked to vote or reach consensus on a particular issue. The default process will be a simple majority show of hands.
    - This information will be documented in the minutes and reviewed annually thereafter should the process continue for that length of time.

- Conflict resolution: If questions or conflicts arise (including issues of bias or conflicts of interest), individuals or the group as a whole may request assistance from the Bureau, Land Division, or oversight team in addressing and resolving the issue. Prompt communication is encouraged between participants and the project leader to answer questions and resolve minor issues in the interest of moving forward and building shared understanding between all parties. If the issue cannot be resolved at this level, a team member may bring the issue to the attention of the Bureau of Endangered Resources, which will take the lead in resolving the issue. The resolution will be communicated to the group and to other parties as warranted.

State Agencies

Wisconsin Department of Natural Resources (WDNR)

The Department of Natural Resources will be the lead agency for WNS response in Wisconsin. The WDNR will collaborate with state, tribal, federal and local agencies to control the impacts of WNS in the state.
The role of WDNR includes:
1. Manage Wisconsin WNS Surveillance and Response.
2. Organize and lead the State's WNS science and stakeholder advisory groups.
3. Inventory bats and key bat sites such as hibernacula and maternity roosts.
4. Implement surveillance, field investigations and other activities associated with WNS.
5. Receive suspect WNS cases reported by partners involved with an initial health watch including: bat rehabilitators, WSLH colleague's working with bats, and nuisance animal control.
6. Prevent anthropogenic spread of WNS by:
   - Permitting only safe practices for bat rehabilitation.
   - Mandating biosecurity measures and manage cave access when appropriate and necessary
7. Lead implementation of response efforts specific to the identification of WNS.
8. Long-term database management: collect and archive data on WI WNS cases in coordination with Bureau of Wildlife Management, Wildlife Health.
9. Communicate with USFWS and other key regional and national agencies and working groups tracing the spread of the disease. (See Communications section for details)
10. Communicate with state, federal and local agencies involved with a WNS incident, and the public.
11. Coordinate outreach and public education.
12. Collaborate with the DATCP and the USDA to control of the disease including disposal of infected carcasses.

Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP)
The role of DATCP includes:
1. Assess and communicate impacts of WNS on agricultural interests within the state.
2. Assist WDNR with reporting suspect WNS cases to WDNR.
3. Assist WDNR in communication and WNS education of stakeholders such as state veterinarians.
4. Assist WDNR with WNS control efforts such as animal removal, carcass disposal, and disinfection.

Wisconsin (State, University, or Local) Laboratories:
Several state laboratories play secondary roles within the response plan for WNS. However their role in early detection is extremely important as they may see suspect cases of bats submitted to their labs. Laboratories that fall under this category include but are not limited to: Wisconsin Veterinary Diagnostic Laboratory (WVDL), Department of Health, Wisconsin State Laboratory of Hygiene (WSLH), University of Wisconsin-School of Veterinary Medicine (UW-SVM), and Marshfield Labs - a division of Marshfield clinics
The roles for laboratories include:
1. Notify WDNR of a WNS suspect bat or notice of uncharacteristic bat activity.
2. Deliver appropriate specimens of suspect bat carcasses for further investigation after consultation with WDNR and NWHC.
3. Assist WDNR with education and communication with the public.
4. Support the response effort in an overwhelming situation by assisting the USGS-NWHC diagnostics process where possible.

Federal Agencies

A national WNS response plan, entitled: A National Plan for Assisting States, Federal Agencies and Tribes in Managing White-Nose Syndrome in Bats, was prepared through the collaborative efforts of federal and state agencies with a draft released in October 2010, and final version released in May 2011 (USFWS 2011). Within this plan, the described primary federal role is: "...to provide coordination and assistance with research, surveillance, disease management, diagnostic testing, technology, communications, information dissemination, education, and funding for State WNS programs. Federal agencies will provide tools and financial assistance, when available, to States and help develop consensus-based approaches to WNS control and mitigation."

Department of the Interior:
U.S. Fish and Wildlife Service
The U.S. Fish and Wildlife Agency is charged with the protection of the nation's endangered species under the Endangered Species Act (ESA). With regard to WNS, the anticipated role of USFWS includes:
1. Assess the potential impact of WNS on the bat species under its jurisdiction.
2. Grant permits to state and federal agencies to act in the protection of bat species under its jurisdiction.
3. Assist WDNR in surveillance, field investigations and other activities associated with WNS.
4. Authority for activities involving current or future federally listed species.
5. Participate in the Wisconsin WNS science advisory group when requested.
6. Assist WDNR to disseminate accurate information to public health agencies as it relates to wildlife health.

USGS National Wildlife Health Center (NWHC)
The anticipated role for NWHC includes:
1. Assist WDNR in surveillance, field investigations and other activities associated with WNS.

2. Provide laboratory and diagnostic capabilities for WNS.
3. Assist WDNR to disseminate accurate information to public health agencies as it relates to wildlife health.
4. Provide technical assistance in identification of WNS.
5. Collaborate in research determining the extent of the threat of WNS on bats and provide science-based support for the development of recommendations to mitigate such threats.

National Park Service (NPS)
The anticipated role for NPS includes:
1. Assess and communicate impacts of WNS on National Park Service property in WI.
2. Assist WDNR with reporting suspect WNS cases to WDNR.
3. Assist WDNR in surveillance, field investigations and other activities associated with WNS.
4. Assist WDNR in communication and WNS education.

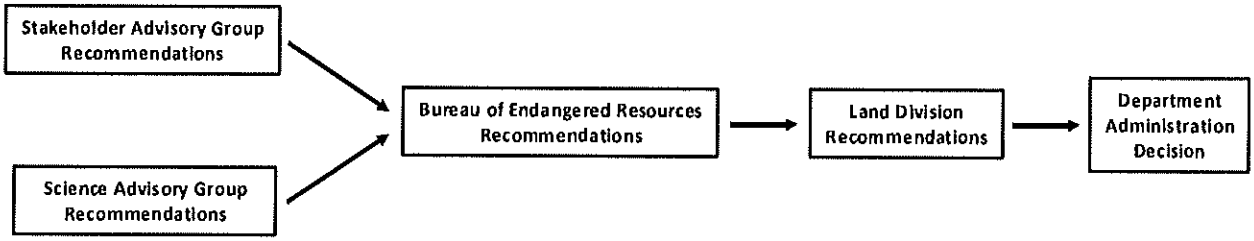
Department of Agriculture (USDA):
Animal and Plant Inspection Services (APHIS)
The anticipated role for USDA APHS includes:
1. Assess and communicate impacts of WNS on agricultural interests within the state.
2. Assist WDNR with reporting suspect WNS cases to WDNR.
3. Assist WDNR in surveillance, field investigations and other activities associated with WNS.
4. Assist WDNR in communication and WNS education.
5. Assist WDNR with WNS control efforts such as animal culling, carcass disposal, and disinfection.

U.S. Forest Service (USFS)
The anticipated role for USFS includes:
1. Assess and communicate on impacts of WNS on Forest Service property in WI.
2. Assist WDNR with reporting suspect WNS cases to WDNR.
3. Assist WDNR in surveillance, field investigations and other activities associated with WNS.
4. Assist WDNR in communication and WNS education.

Other Wildlife Diagnostic Laboratories
There are other laboratories around the nation that also have the capacity to accept specimens for testing to assist with WNS diagnostics and agree to follow diagnostic recommendations and protocols outlined by the WNS Diagnostic Working Group. These laboratories comprise the WNS Diagnostic Lab Network include but are not limited to: Southeastern Cooperative Wildlife Disease Study, Athens, GA; Colorado State University Diagnostic Medical Center, Fort Collins, CO; New York State Animal Health Diagnostics Lab, Cornell University, Ithaca NY.
The anticipated role for these laboratories includes:
1. Notify WDNR of a WNS suspect bat submitted from within the state of WI.
2. Support the response effort in an overwhelming situation by assisting the USGS-NWHC diagnostics process where possible.

G. Organization of Responsibilities

Two advisory groups, a WNS Science Advisory Group and a WNS Stakeholder Advisory Group, have been created to ensure that the department's management-related decisions are based on the best available science and informed by stakeholder input. The Advisory groups are not decision-making bodies but provide recommendations to the program. The Bureau of Endangered Resources Bat Ecologist, David Redell is the WDNR WNS Leader, charged with coordinating WNS research, surveillance, and management response in Wisconsin. The WNS leader will be expected to participate as a member of the WNS Science Advisory Group, keep members informed of current events and input from other cooperators, and suggest to the group leader that a meeting be called when needed. The WNS Science Advisory Group leader and/or members of the group may present the group's recommendations, including the scientific basis for them, and generally how stakeholder interests were addressed to WDNR program managers and/or to the Natural Resources Board. The program will ensure that all recommendations flowing from the advisory groups are presented to department though it cannot guarantee that they will be accepted. The department administration has final decision making authority



Cooperators and agencies that share responsibilities with the WDNR can work directly with the WNS Leader. The WNS Leader will represent WDNR in federal and regional WNS working groups and serve as the liaison to other groups such as WNS Science Advisory and Stakeholder Advisory Groups and cooperators.

H. Administration and Logistics

WDNR Bureau's of Endangered Resources and/or Wildlife Management will supply department personnel and contractors with surveillance and monitoring equipment, disease sampling and decontamination supplies, and personal protection equipment. Equipment in limited supply (e.g., monitoring equipment and cave entrance sensors such as PIT tag sensors) will be available for the highest priority sites first. Funds will be requested for the purchase of additional supplies depending on future goals of bat population monitoring and WNS surveillance. Endangered/threatened species permits for working with cave bat species (i.e., research that requires entry into hibernacula and/or collection or rehabilitation of cave bats) should be sought through the Bureau of Endangered Resources. Bureau of Wildlife Management Animal Caves Use Committee approval should be pursued concurrently.

Collaborative work generally provides the best use of available resources when responding to a threat such as WNS. While it is impossible to anticipate all the possible cooperative agreements WDNR could enter into, it is imperative to establish some guidelines safeguarding the use of Wisconsin's resources. Entering into a Mutual Aid Agreement (MAA) or a Memorandum of Understanding (MOU) is often the best way to outline rules of an agreement for using pooled resources. These contracts may be drawn up between the WDNR and any agency or entity to

establish a working relationship, commitment of mutual aid, or exchange of resources. See appendices B & C for MOU templates regarding research and landowner responsibilities. WNS response could lead to potential agreements of collaborative research (i.e. with a University System or agency), aid for diagnostic support, or cooperative landowner agreements to name a few.

I. Development and Maintenance

The WNS response planning process started in Wisconsin when ten states confirmed the presence of WNS and the spread of the disease across the continent appeared to be imminent. All components of this implementation strategy were written by WDNR Bureau of Endangered Resources and Bureau of Wildlife Management Wildlife Health section, using other available response plans or guidelines for assistance (see reference section for list of available plans: USFWS *WNS Strategic Decision making* (Szymanski et al. 2009), draft USFWS National (USFWS 2011) and draft USFWS regional plan guidelines, MO-DOC, TN, draft WDNR *Wildlife Disease Response Plan*, WDNR's *Environmental Assessment on rules to protect cave bats and manage Geomyces destructans, the fungus associated with WNS*, WDNR *CWD Management Plan*, and Wisconsin *Emerald Ash Borer Response Plan*). A draft outline was shared with the following cooperators: USFWS, USFS, USGS, APHIS-Wildlife Services, natural resource department representatives from Michigan, Minnesota, Illinois, Iowa and Indiana, and the USFWS regional WNS coordinator. Incorporating the comments received, a draft implementation strategy was written and again shared with the above cooperators as well as: Department of Agriculture, Trade, and Consumer Protection; Wisconsin Veterinary Diagnostics Lab, Agriculture extension; Department of Health, Wisconsin State Laboratory of Hygiene; WDNR Law enforcement; University of Wisconsin Representatives; and the National Park Service. Furthermore, a draft implementation strategy was shared with stakeholders including: UW-Milwaukee, county lands, park systems, the Wildlife Society, Midwest Bat Working Group (MBWG), state-licensed wildlife rehabilitator representatives, wildlife control companies, cavers via the Wisconsin Speleological Society, and private landowners. After reviewing stakeholder and cooperator comments, a final draft implementation strategy will be approved by department administration. While in the process of drafting the implementation strategy, WNS was confirmed within 190 miles of the Wisconsin state border and management actions including the emergency listing of four native cave bat species as threatened, the emergency listing of the fungus *Geomyces destructans* as a prohibited invasive species, and emergency rulings for management were proposed and accepted. Following a period for public comment, all emergency rulings were accepted by the Natural Resources Board in December 2010 and made permanent on June 1st 2011. Sections of the implementation strategy were re-written to incorporate these actions before the first draft was complete.

Method and frequency of planning updates

The WNS Surveillance and response Implementation Strategy is not meant to be a static document. Upon completion, the implementation strategy will be revisited every year for five years by June 30th of each year and notification will be provided to all partners. It will be updated with new information about WNS from research, and continent-wide WNS surveillance results, and guidance from the national WNS plan. New developments about WNS will also require management and response options to be updated in the annual review of the implementation

strategy. Proposed changes and updates will be reviewed by the WNS science advisory group. The implementation strategy will be reviewed and adjusted annually through the time period when it is replaced with a recovery plan. The recovery plan would be approved by the Natural Resources Board.

II. Annexes

A. Surveillance for WNS

Introduction

Monitoring bat populations in Wisconsin, considered free of WNS as of June 2011, is crucial for two reasons: pre-WNS baseline data collection and/or early disease detection. Critical baseline data on parameters such as population densities, hibernacula locations, health (e.g., pre-torpor body condition and wing damage in unaffected bats), reproductive status, and hibernacula microclimate data are needed from unaffected locations for ongoing research dedicated to understanding the disease. Furthermore, early detection will give managers and researchers the opportunity to develop and experiment with control methods focused on stopping or slowing the spread of the disease.

Monitoring involves the use of various methods to document population status and other impacts to bats that stem directly or indirectly from WNS infection. Surveillance involves the detection of clinical signs of WNS; often by surveying numerous sites and occasionally making repeated visits to a select number of sites. No single method is likely adequate for a comprehensive monitoring and surveillance strategy. WDNR has catalogued all known bat hibernacula in order to set priorities for further monitoring and WNS surveillance. Sites that are not currently available as hibernacula, due to closed entrances, were identified should a need arise in the future for a noncontaminated site.

Monitoring and surveillance activities are divided into three categories to reflect the effectiveness of detection and the level of disturbance to bats.

1. Active methods involve researchers collecting data by entering hibernacula or handling bats. These methods increase the possibility of early detection and give a more robust confirmation of WNS (and its impacts). However, these techniques require a higher level of disturbance in hibernacula or at capture sites during the summer. While healthy bats may be relatively unaffected by a small number of disturbances from invasive surveys throughout the year (Boyles and Brack 2009), WNS-affected bats may be more susceptible to the negative effects of such disturbances. Thus, it is beneficial to limit disturbances to affected bats whenever possible. However, in newly affected areas or newly affected species, active methods are the most likely to detect and confirm WNS. In order to balance research needs with concerns for limiting disturbance to bats all activities that involve handling or disturbance to bats will require WDNR Animal Care and Use Committee (ACUC) approval and an endangered species permit (WDNR 2011).
2. Non-invasive methods are methods that involve sampling bats without any disturbance to the bats. They are most effective in detecting WNS when there are overt clinical signs that commonly appear at a later stage of infection. While these methods are less powerful for detecting early infection, they reduce the need for repeated disturbance to bats.
3. Passive techniques involve compiling information from incidental reporting, such as bat submissions to rabies labs and public calls about dead bats to state wildlife agencies. Information from these sources can be non-specific for precise location, but can also

serve as a "red flag" to identify new areas for priority monitoring and surveillance. Passive data have been especially useful for documenting new occurrences of WNS and for locating previously unknown bat hibernacula.

Both passive and active surveillance are part of the state implementation strategy for pre- and post-arrival of *G. destructans* and WNS, respectively. Surveillance and monitoring methods will be reviewed annually taking into account the value of data obtained to further WDNR's understanding of WNS, site significance to bat conservation and other cave biota, practicality and logistics of monitoring a site over time, existing baseline data, and level of human activity. Preventing infection and stress to the bats is a primary consideration in the selection of methods used and number of hibernacula and roosts selected for monitoring.

WDNR is developing a single database to house existing datasets from Natural Heritage Inventory (NHI), Wisconsin Geologic & Natural History Survey (WI GNHS), Wisconsin Speleological Society (WSS), and Wisconsin bat studies. Geographic Information System (GIS) was used to map all cave and mine locations. Within the new Cave & Mine catalogue, precise cave locations and many environmental parameters will be recorded, including species, numbers observed or collected, temperature, maps, and general conditions. This information may be helpful in predicting and understanding where *G. destructans* can survive or will spread. Information gathered on known and possible bat hibernacula within the state will be used to better categorize and prioritize monitoring and surveillance activities for each location. All bat health information (e.g. any screening or diagnostic testing for WNS) will be archived in the WDNR Wildlife Health database which is maintained by the Bureau of Wildlife Management, Wildlife Health section. These wildlife health data may be shared with the proposed National WNS database if appropriate.

Goals and Objectives for state WNS surveillance

Goals:

1. Develop a consistent and strategic monitoring approach for bat populations pre- and post-arrival of WNS that incorporates effective disease surveillance for *G. destructans* and WNS.

2. Early detection of *Geomyces destructans* and WNS in Wisconsin.

Objectives:

1. Incorporate both active & passive techniques for WNS surveillance to best achieve early disease detection.
2. Use information from cave & mine catalogue and assessment to prioritize hibernacula for surveillance.
3. Choose effective and non-detrimental surveillance methods from available seasonal monitoring techniques or new technologies.
4. Pre-plan assessment surveillance for any potential discovery of the disease.

1. Detection Surveillance -Identifying WNS

Introduction

Passive surveillance through existing programs may aid in early detection of WNS. The techniques represent a variety of data sources that do not require a bat biologist to visit the field to collect data. Rather, the biologist relies on compiling reports from a number of sources and uses these results to trigger more active survey technique(s) in a particular region. Public reports or submissions to the WDNR, to the state rabies lab, or to wildlife rehabilitators when combined with active surveillance conducted by the WDNR can lead to early detection of WNS. Suspected WNS cases which can only be confirmed through histopathology and laboratory sample submissions from WI, will be coordinated by the WDNR-Wildlife Health section.

Public reporting/submissions of morbidity/mortality

Volunteers and public reports are already providing valuable data in regards to bat populations through the Wisconsin Citizen-based Monitoring Network. WDNR will continue to track all public reporting of bats displaying unusual behaviors and sick, dead or dying bats as unexplained increases in submissions of public bat reports may provide anecdotal evidence about the onset of WNS. Such data or reports may assist in locating previously unidentified hibernacula by mapping bat reports or result in a survey of nearby hibernacula or other bat roost.

Unusual behavior

A bat (or group of bats) observed displaying unusual behavior may be displaying a sign of illness and it should be considered sick. Bats observed displaying unusual behavior can be reported following the protocol below for reporting a sick bat. Behaviors that fit this category include but are not limited to: flight during daylight or in mid-winter, disorientation, or roosting in unusual places.

Sick, dead, dying bats on landscape

One or more sick and/or dead bats found can be reported by the public electronically by filling out an online reporting form (http://wiatri.net/inventory/bats/Reporting/) or see appendix D for a hard copy of the reporting form. A copy of the report is emailed to the WDNR Bat Ecologist and the WDNR Wildlife Health Lab Manager for appropriate follow up. If five or more bats are reported, the WDNR Wildlife Health program may further investigate for diseases and cause of death. Any freshly dead carcasses should be considered for collection for this purpose. Carcasses that have been dead more than 12 hours (possibly longer in winter) are generally not useful. Do not collect carcasses if there is a noticeable odor or if there are scavenging insects are present. The following is a guidance protocol for provision to citizens that may encounter a sick, dead or dying bat:

- Do not attempt to collect a live bat (contact your local DNR office for information about local services available to assist with removal of the bat if required).
- Do not handle bats unless you are certain that they are dead (bats in torpor often appear dead until handled). You may poke with a stick to make certain it is dead.
- Dead bats can be safely collected by either wearing gloves or by putting a hand into a plastic bag and using it as a glove: then inverting the plastic bag around the carcass.
- One of the following should then be done with the bagged carcass:
    - put it in a freezer;
    - put it in a leak proof container with ice to keep it cool;

    - if outside temperatures are cool (below 45°F), place it outside in a sealed container to prevent scavenging by other animals
- Wash or discard the gloves and wash hands with soap and water.
- Contact the local DNR office or submit an electronic report (http://wiatri.net/inventory/bats/Reporting/) and indicate in the comments section that you have collected one or more carcasses. DNR staff will contact you as soon as possible, but if you have questions or concerns contact your local DNR office.

If a person or domestic animal has been exposed to a bite, scratch, or saliva from a live or dead bat the local public health department should be called for further guidance in getting the bat tested for rabies and a physician or veterinarian should be consulted.

State Rabies labs

Increases in the number of bats submitted to rabies labs or submission inquiries during winter have been documented in WNS-affected states, and thus the Wisconsin State Lab of Hygiene (WSLH) could play an active role in early WNS detection for the state. The WDNR WNS leader will work with WSLH to develop a system of notification when there are increased submissions or signs of WNS are observed on submitted specimens. Submission of any bat specimen for WNS diagnostic testing should be coordinated with the WDNR Wildlife Health Lab Manager. In addition, data from rabies labs can provide information on the geographic distribution of sick/dead bats found on the landscape as well as provide a valuable source of bat samples for research purposes. At this time the WDNR has not requested data on submitted specimens nor asked that any be held but may request this in the future.

Wildlife Rehabilitators

Increases in the number of dead, dying, and disoriented bats may result in a greater frequency of rehabilitation calls. While rehabilitation of cave bats is limited in the state of Wisconsin, calls to rehabilitators can serve as an indicator to potential problems in bat populations. The WDNR WNS leader, in coordination with the WDNR Wildlife Rehabilitation Liaison, will contact rehabilitation groups or individual rehabilitators to discuss reporting the numbers of bats submitted for treatment. Data on historic submission volume to rehabilitators may be useful in detecting new trends in bat morbidity and mortality.

Sample submission

WDNR-Wildlife Health Section (Wildlife Health) should be the first point of contact for dead bats in Wisconsin. If the situation or external findings on the carcasses submitted to Wildlife Health fit the NWHC submission guidelines for WNS, then Wildlife Health will contact NWHC coordinate follow-up analyses. Wildlife Health has other conditions for which the department would want bat carcasses to further investigate issues and could triage bat carcasses, with priority for WNS investigation. Wildlife Health can help facilitate direct submission to NWHC if the situation occurs where cave bats are found with obvious visible signs of WNS, there are multiple sites with suspicious signs, or WNS is confirmed in WI. At a minimum, Wildlife Health should be copied on communications with NWHC in the event of urgent/emergency situations and included on all submissions to NWHC, from Bureau of Endangered Resources surveillance work. This will ensure that results are shared with Wildlife Health and are entered into the WDNR Wildlife Health database.

Wildlife Health currently has shipping materials stationed around the state at DNR offices for shipment of carcasses. WDNR-Wildlife Management field staff should follow the Wildlife Health procedures for carcass shipment (see Appendix E).

Prescreening by state laboratories

WDNR Wildlife Health laboratory currently prescreens all bat carcasses submitted to WDNR at necropsy for signs of WNS and determines if further diagnostics are warranted. Other state wildlife or veterinary laboratories may also prescreen for WNS but should contact WDNR Wildlife Health if they receive a bat carcass submission from the public. If further diagnostic examination is needed, specimens meeting the criteria for submission will be sent to the NWHC (see Appendix F). The Wisconsin Veterinary Diagnostic Laboratory (WVDL) in Madison has the ability to conduct histopathology and fungal cultures for samples not meeting NWHC criteria for submission. Submission of samples to WVDL will be coordinated through Wildlife Health.

Qualitative diagnostics

Laboratory techniques, including histopathology, fungal culture, and/or PCR (polymerase chain reaction), are necessary for official confirmation of WNS. Histopathology is used as the sole method of confirming WNS by identifying the presence of fungal hyphae in skin tissues of suspect or presumptive positive specimens (a "confirmed positive" finding for WNS). Fungal cultures or PCR can then characterize the fungus as *G. destructans*, the fungal isolate associated with WNS lesions. Furthermore, identification of *G. destructans* can be achieved by morphological evaluation of fungal tape lifts collected from live animals with visible evidence of fungus (muzzles are preferred to wings). Sample methods vary depending on time of year and if whether collecting from a live or dead bat. Whole body submissions are preferred for diagnosing the disease in Wisconsin for the first time in each county. While state laboratories can be used for pre-screening, any first detection suspect positive results should be confirmed at the NWHC in Madison WI. Sample submissions from throughout the state should be coordinated by the WDNR Wildlife Health and the WNS Leader following the NWHC protocols (see Appendix F).

2. Establishing Surveillance Priorities

Introduction

Establishing surveillance priorities can best be achieved with a complete understanding of Wisconsin caves and mines used by bats. Knowing where hibernacula exist, what species and how many bats use them, proximity to one another, bat movement patterns among sites, site accessibility, and survey resources available allow managers to make the most informed decisions when setting priorities in WNS surveillance.

Some of the larger and well known Wisconsin hibernacula have been monitored for years; however many sites were unknown and rarely visited to determine bat usage. To fill the existing gaps, WDNR created a Cave & Mine Catalogue, which will be used to establish priorities for surveillance.

Catalogue cave and mine location data

The Endangered Resources program has identified the importance of cave and mine hibernacula for bats. While these concentration areas make bats susceptible to catastrophic losses, they also provide an opportunity to protect, conserve, and monitor the health of cave bat populations. Knowing the locations of all hibernacula and having current data aids land managers in making decisions when questions arise, as well as improving plans for bat population monitoring and surveillance for White-nose syndrome. Identifying all known and possible bat hibernacula was the main goal in 2010. In addition to the advantages listed above, there is another key benefit to knowing the exact location of these sites. Caves and mines that are not currently used as hibernacula have the potential for future use by bats. Under the scenario of a changing climate, species' ranges may shift, and there may be changes in the suitability of current and previously unused sites as well. Sites not used today may experience temperature and humidity shifts that make them suitable for a number of bat species in the future, while currently used hibernacula may experience shifts in conditions making them less suitable under future climatic conditions. Even closed sites have future potential as managed habitat for bat hibernation; therefore knowing the location of all used and potential sites is very important. For example, sites that are closed now are likely to remain unaffected when WNS spreads through open caves and mines. These closed sites may then be reopened to provide presumptively clean sites for bat use in later years. In order to prioritize and monitor important sites, WDNR has catalogued all known and potential sites and is capturing baseline data about these sites. Cataloguing hibernacula also supports Wisconsin's Bat Conservation Plan and the North American Bat Conservation Partnership (NABCP) guidelines, goals and priority actions.

Gathering data about cave and mine conditions

The process of identifying all hibernacula began by layering existing geo-referenced databases from the Natural Heritage Inventory (NHI) and the Wisconsin Geological & Natural History Survey (WI GNHS) and incorporating paper records from the Wisconsin Speleological Society (WSS) to identify locations of all known and possible bat hibernacula within the state (spring 2010). The resulting list of potential cave and mine hibernation sites included 779 known or previously known underground locations.

Owners of all potential hibernacula locations were contacted by letter and by phone in order to receive permission for WDNR field crews to visit and assess potential sites (spring, summer, and fall 2010). Over 90 percent of landowners in the initial group voluntarily permitted access to their property. Field crews visited these potential sites to ground-truth both current and sealed entrances and assess whether sites offered environmental conditions suitable for bat use (summer & fall 2010). These initial assessments reduced the number of potential hibernation sites from 779 to approximately 120 suitable locations.

Almost all locations were visited to establish baseline data due to the almost total lack of information related to bat use at the majority of the sites (winter 2011). Again, over 90% of private landowners voluntarily agreed to allow disease surveillance and bat monitoring activities on their property. The only sites not visited were those at which the landowner refused permission to visit or could not be contacted. During the winter visits, bat species, numbers, and environmental conditions were recorded while WNS surveillance was conducted. Data collected from these field efforts were entered into a GIS database and will aid in the prioritization of future surveillance efforts, response strategies, and recovery efforts.

Currently there are four hibernacula with data loggers collecting environmental information (temperature and relative humidity) on a daily basis and downloaded once a year as part of a longer term monitoring program.

Cave and Mine assessment for survey and prioritization

While identifying all important natural and man-made hibernacula, WDNR is in the process of prioritizing sites for follow-up monitoring, management, and conservation efforts such as for sites that contain the largest or most diverse populations and the most threatened or endangered species. Cave and mine hibernacula are categorized for prioritization according to 1) Distance to nearest contaminated site, 2) total number of bats, 3) number of species, 4) level of human visitation, 5) apparent value of the site in meeting bat needs, 6) known threats if not protected, and 7) status of the species involved.

3. Surveillance Techniques

Introduction

Methods normally used to monitor bat populations and conduct bat research are viable techniques for WNS surveillance. These methods are dependant on seasonal activities of the bats and are thus represented here by season. Public reporting of morbidity/mortality as discussed earlier will be used as a surveillance tool in all seasons. Some methods below are currently being implemented, however surveillance techniques will need to be evaluated each year with changes in WNS proximity to (or within) the state and in an attempt to balance disturbance to bats (particularly in hibernacula) with surveillance needs.

Fall and spring surveillance

Harp traps/mist netting

Fall and spring trapping of bats allows biologists to gather important data on bats. This includes obtaining baseline weight and wing scoring before and after hibernation as well as collecting tissue for genetic work. When a bat is in the hand of an observer it can be examined for signs of WNS and samples for diagnostics are then easy to acquire. As WNS has not yet been discovered in Wisconsin, WDNR will proceed with plans for harp trapping at select sites when appropriate and approved WNS related research is needed. The use of harp traps will be evaluated before each season taking WNS surveillance results in to consideration and will be contingent on WDNR ACUC approval.

Emergence counts

An emergence count is a non-invasive method for measuring relative abundance at hibernacula or roost sites. Although monitoring bat activity at hibernacula with human observers is time intensive and expensive, the data from these emergence counts are useful for detecting change at a site with an extant long-term data set (to understand pre-WNS annual variation.) However, a new technique has recently been developed that reduces the labor intensity and cost (Redell et al. 2006). The system uses infrared light and directional sensing electronics to automatically tally and data-log bats entering and exiting a hibernaculum. At sites with large populations, staff calibrate the system (Redell 2005) to derive a census of the bat population to allow WDNR to monitor trends and population dynamics. The electronic system, capable of detecting the

direction of bat flight entering or leaving a cave or mine, can monitor bat movement 24 hours per day, 365 days per year. Sites that are prioritized for intensive monitoring may be recommended for installation of this system. The Directional Infrared Beam-break Detection System will allow Wisconsin DNR and partners to monitor the trends of bat populations at these critical hibernacula. Bat numbers may then be quantified based on statistically defensible information.

Acoustic surveys

An acoustic survey is a non-invasive method for detecting relative density and species richness. The surveys are achieved with an acoustic system capable of detecting and recording the high frequency calls of echolocation along with date and time of each encounter. Combined with a global positioning system (GPS), the detector automatically records the position (latitude & longitude) of each bat encountered by the surveyor along with the route traveled during the survey. Adding a personal data assistant (PDA) to the detector provides a real-time view of the bat calls, stores the data for later analysis, and ensures the surveyor that the system is functioning properly during a survey.

Acoustic surveys have been a part the Endangered Resources bat monitoring program for several years. Five stationary long-term acoustic stations have been active year-round since June 2007. Citizen volunteers have assisted with mobile acoustic survey routes throughout the state for the past four years. The acoustic surveys begin April 1st through September 30th during the right environmental condition (daytime temperature >50°F, starting at civil twilight, no precipitation, and wind speed <30 mph). The surveys are divided into three time periods to monitor species presence and movement patterns during spring migration, summer residency, and fall migration. During June and July 2010, the WI Bat Program conducted more than 350 surveys throughout the state making it the largest and most comprehensive statewide bat survey on record. WDNR will continue acoustic surveys both pre and post-WNS introduction to the state.

Summer surveillance

Acoustic surveys

Year-round acoustic surveys take place at five permanent stations while mobile acoustic surveys take place in spring, summer, and fall (see spring and fall surveillance/acoustic surveys for details). For more information visit the Wisconsin Bat Program website: http://wiatri.net/Inventory/Bats/Monitoring/Acoustics/. Dramatic changes in relative density and/or species richness are an indirect method of WNS surveillance as well as a measure of WNS impact on the bats of Wisconsin.

Emergence counts of maternity colonies

Summer roosts of cave hibernating bats are numerous and found throughout the state. Emergence counts of the summer roosts are a useful non-invasive population monitoring technique. During the summer maternity period, these roosts are often found in or around man-made structures (barns, bat houses, bridges, churches, schools, or other buildings). WDNR has enlisted the help of landowners to report roost sites and assist with emergence counts for the Wisconsin Bat Roost Monitoring Project (http://wiatri.net/inventory/bats/). Counts are conducted at different levels depending on the availability of each volunteer, from a single summer count to multiple counts both pre-flight and post-flight for an estimate of reproductive adults at each site. With consistent

effort pre and post-WNS, emergence counts will increase understanding of the impacts of the disease on bat populations in Wisconsin.

Mist-net, wing bands, and PIT tags

Using mist nets to capture bats is necessary when the bat must be handled. Examples of a situation where bats must be handled include banding individual bats, collecting tissue for genetic material and fecal samples for diet analysis, or for verifying species for acoustics. The use of mist-nets for future research and as a capture method for implanting 'passive integrated transponder' (PIT) tags will continue prior to arrival of WNS and may be considered after WNS is confirmed. The goal of both banding or PIT tagging bats is to record the individual's location at a later date either by resighting the band or tripping a PIT tag recorder and therefore recording individual movement on the landscape. Both techniques require initial trapping and handling of bats and require WDNR ACUC approval (WDNR 2011) and an endangered species permit (Appendix G). Currently, there are banded bats in Wisconsin from a Minnesota directed study of dispersal. Recapture information on these and other tagged bats will continue to be recorded opportunistically. Research to develop a practical and effective means of using PIT tag technology with bats is in progress through a partnership with WDNR and University of Wisconsin-Platteville.

Winter surveillance

Photographic surveys

High quality digital flash photos of hibernating bats are useful for gathering count data within caves. Primarily, these photos may also be closely examined for signs of white fungal growth that may not have been visible to the naked eye. Photography is a particularly effective method in sites with high ceilings, but is not necessarily suitable at all sites or with all species. Biologists from New York noted that the detection rate of visible fungus on bats roosting high in caves or mines was greatly increased through the use of digital photographs. When closely inspecting high-quality photographs, biologists have the opportunity to zoom in on the bats and visually inspect them for signs of fungus. The WDNR implemented photo surveillance in the winter of 2009/2010 and will continue to use this method during surveillance at suitable sites.

Internal survey

Entering hibernacula is an active surveillance tool. Whether conducting a rapid assessment or a complete count, the number of visits to the site and the time spent during each visit should be kept to a minimum in order to reduce disturbance to the bats. As part of the cataloguing of hibernacula, WDNR visited newly discovered caves to detect bats in early winter to make a rapid assessment of species and estimate numbers of bats present. This information is helpful for determining the suitability of these previously unknown locations. WNS surveillance took place at over 90% of known hibernacula from the end of January through the middle of April 2011. Visual and photographic survey methods were used while also looking for general bat roosting in abnormal places. If white fungal growth is observed on hibernating bats during these surveys, individuals are collected for laboratory submission when possible (see appendix F). Bat species, bat counts, and distribution information are recorded for each site. Following the winter of 2010-2011, internal hibernacula surveys should be limited to once a year unless there are concerns warranting additional entry. All surveillance, monitoring, handling and sampling of live bats must meet WDNR ACUC approval and require an endangered species permit.

External survey
External hibernacula surveys are a non-invasive technique for WNS surveillance. Caves can be visited on days normally too cold for bat activity to check for bats roosting or flying near the cave entrance. They may also be visited in late winter as well to search for carcasses and to conduct exit counts.

Landowners can potentially be trained to conduct external surveillance at cave and mine hibernacula. Many landowners have expressed interest in helping monitor the bats at their site and many have unique opportunities to report unusual bat behaviors associated with WNS and to report fatalities. Informational pamphlets are being developed to educate landowners about bats, cave and mine hibernacula, and WNS. In addition, protocols and training are in development for landowners who wish to help with external surveillance efforts at their cave or mine. Many landowners have opted to close their caves or mines to human visitation and will be key resources in the reporting of violations of cave closures. Information pertaining to recreational caving activities at non-closed caves may be provided to landowners and recreational cavers upon request.

Acoustic monitoring and beam-break technology (see descriptions above under emergence counts and acoustic surveys) are external non-invasive techniques currently implemented in multiple states including Wisconsin. These are valuable tools that can provide remote monitoring and detection of abnormal bat emergence activity during winter hibernation. However, these tools are likely to produce alarm notifications under later stages of infection whereas, an internal survey would identify the earliest signs of the disease progression.

4. Assessment Surveillance: Responding to WNS Detection

Once WNS is confirmed in a Wisconsin hibernaculum, surveillance priorities will transition from early detection to assessment (see Annex D: Communication – for Surveillance and Management Activities, for details on information dissemination following WNS confirmation in the state). The efforts of WDNR Bureau of Endangered Resources personnel will be divided between surveillance at sites not yet visited, as planned for early detection, and assessment surveillance. The finding of the disease raises questions from which the answers will help to make informed management decisions. Available management options (see Annex B3: Disease Management Options) will be considered following a full assessment of the situation. The conservation of surviving bats is given a high priority during assessment surveillance, thus managers will need to consider how to minimize human disturbance of hibernating bats. Decontamination procedures will remain in effect to prevent human transmission of *G. destructans* between hibernacula.

While the arrival of the disease can be anticipated, the actual situation when it arrives will be unique and present an unknown set of parameters that will determine what management options are available. WDNR will first assess the time of year (and potential for immediate bat movement among caves and mines) and stage of the infection. Second, WDNR will assess the landscape situation, including the importance of the infected hibernaculum or surrounding hibernacula. Questions to be answered for a full assessment include but are not limited to:

1. Is this a single incident or are there multiple infected hibernacula?
2. Is the cave/mine visited by people for any other reason than for surveillance? (Is it a commercial/recreational site?)
3. What is the distance to other known nearby hibernacula?
4. What species, and how many of each, are found in the hibernacula?
5. Are the bats centrally congregated within the hibernacula or are there multiple congregations and how large is each?
6. What percent of the hibernating bats are showing signs of the disease?
7. What time of year is it? How long before the end of hibernation?
8. How many openings to the hibernaculum are available to bats and with what certainty do we make this estimate?

Plans for statewide surveillance efforts should be re-evaluated if the fungus *G. destructans* is identified and/or WNS is confirmed in the state. Assessment post-detection may require that previously visited hibernacula located close to the affected site be reassessed. To determine if detection is an isolated incident, caves or mines **within ten miles** of the *G. destructans* confirmed site will become high priority for a first and/or second surveillance visit. If the fungus is found early in the hibernation season, these high priority sites should be visited immediately and then again in late February or early March to ensure early detection. The second priority action is to survey all caves and **mines within a 50 mile distance**, the estimated limit of seasonal bat-to-bat spread of the disease observed to date (pers. comm. with G. Turner, PAGC). If assessment surveillance is time or resource limited, WDNR will consider visiting all sites within ten miles and only a subset within a 40 mile radius. A revised surveillance plan for the remainder of the hibernation season that includes the new priorities for surveillance efforts should be made and implemented.

Resources available for surveillance do not change as surveillance shifts from detection to assessment. However, an increase in effort is desirable to answer some of the assessment questions and may be especially useful for early detection of any or all WNS affected caves and mines. The assistance of volunteers for periodic entrance/exit surveillance is an option that should be considered. If it has not already been undertaken, there should be a heightened effort to train volunteers for entrance/exit surveillance including what observations should be made and how to report observations from each survey in a timely matter.

B. Research for Management Activities (Research collaborations)

Management decisions must be based on the best available science (Bureau of Endangered Resources Science Guidelines 2011), but scientific information about emerging infectious diseases such as WNS is often limited. Additional scientific research is therefore critically needed to better understand the disease and to identify approaches to limit WNS' detrimental effect on bats and bat populations. Much of the current research will be conducted in an adaptive management framework using testable hypotheses.

WDNR has been a leading participant in WNS planning, research, and collaboration from the beginning (Szymanski et al. 2009, Hicks et al. 2010, Lindner et al. 2011), and strongly encourages further research to address remaining questions. Any person interested in cave bat or WNS research in the state of Wisconsin is legally required to obtain an Endangered and Threatened Species (E/T) or Scientific Collectors Permit before commencing. Applicants need to submit a research proposal to the WDNR Bureau of Endangered Resources as part of the application process (Appendix G). Proposals must be submitted by September 1st each year for work to be conducted between November 15th of that year and October 31st of the following year. The Bureau will make decisions about research permit applications no later than November 1st if a complete application is received at least eight weeks prior. Proposals will be reviewed by the Bat Ecologist who may request a review by the science advisory group. This timetable for proposal submissions and acceptance allows WDNR to coordinate efforts and minimize the number of cave/mine visits (e.g. combining surveillance and research visit to a hibernaculum). WDNR will facilitate collaboration among researchers within Wisconsin and outside the state, work to minimize stress and disturbance of bats whenever possible, and reduce redundancy in sampling efforts.

All E/T and Scientific Collectors permits require annual reporting on approved activities. Further conditions may be applied to permits, both because cave-bat and WNS research must be coordinated within a continent-wide context and because such research is immediately and critically relevant to ongoing adaptive WNS management. The permittee(s) will be informed of additional conditions in advance. Conditions may include an expectation to 1) work with WDNR in discussing/presenting research plans with the WNS investigative group, 2) present results to the WNS Investigative group within a year of collecting the data (presentation of results can be in a formal or informal setting), and 3) make a copy of all collected data available to the WDNR within a specified period of time. Publishing rights will remain with the researcher. The standards and deliverables will be clearly spelled out and agreed upon in a signed contract before a permit is issued and before research begins. Any work done in collaboration with the WDNR, or WDNR funded research, is required to meet the standards of the Bureau of Endangered Resources Science Guidelines (2011a).

C. Management: Managing WNS

Introduction

The goal of WNS management is to limit and slow the spread of the disease to Wisconsin caves and mines and minimize where it occurs in the state. If the fungus becomes present within the state, the priorities will be to minimize and prevent further spread of the disease along with disease management which includes minimizing the effects of WNS on cave bat populations.

Tools available to delay the spread of the disease include: 1) decontamination measures 2) physical exclusions at caves or mines and 3) disease management. As there are few instances where WDNR has the ability to control the natural movements of bats, the department's main focus is on limiting anthropogenic spread of the disease. Three emergency rules protecting Wisconsin's natural resources were adopted as permanent in June 2011. The first rule gives protections to cave bat species by listing them as threatened, the second rule names *Geomyces destructans* as a prohibited invasive species thus prohibiting the transfer of the fungus to and within the state and the third rule requires implementation of practical decontamination procedures. Under the authority of afore mentioned rules or otherwise, immediate actions of the WDNR include:

- Adaptation of decontamination measures in an effort to allow Wisconsin caves or mines to remain open for human use,
- Rehabilitation of cave bats using decontamination measures (to avoid cross-contamination into a guild of bats (tree bats) otherwise not in danger of contracting the disease).
- No rehabilitation and release of suspected, presumptive or confirmed WNS infected bats in the State of Wisconsin until safe and effective treatment procedures have been developed.

With certain exceptions, the rules also call for owners and operators of caves and mines to develop and submit to the WDNR a written prevention plan for each cave or mine to prevent the introduction and transmission of *Geomyces destructans* (white-nose syndrome fungal pathogen). The prevention plan must include a description of practices that will be installed or implemented by the owner or operator to prevent the introduction or transmission of *Geomyces destructans* via human transmission. The plan may include practices such as screening visitors, cleaning equipment, gear, clothing and other objects before they are brought into the cave or mine or upon their removal; the use of dedicated equipment, gear, clothing and other objects; and modification of the cave or mine environment to make it unsuitable for establishment and transmission of *Geomyces destructans*.

In managing WNS' spread to and among Wisconsin caves the department will work with owners of privately managed caves. WDNR recognizes the unique educational and recreational opportunity in keeping commercially operated cavse open. Restricted cave access is not meant to be a permanent solution for disease management and other options can be explored if necessary. For example, one management action for caves with minimal bat use would be to remove all interaction between humans and bats by setting up bat exclusions to that cave; another action could be the establishment of a disinfection protocol for all authorized cave visitors. The

department will work with cave owners to find the best solutions when cave closures become the sole means of preventing the spread of *G. destructans*.

The best possibility of keeping a healthy population of cave bats is to slow the spread of the disease in Wisconsin. Once WNS has been discovered within the state, the tools available to manage the disease are few. With new knowledge from ongoing research and disease management in the Northeast, the department will constantly update and implement best known practices of disease management to keep the WNS impact on bats at a minimum. During an early stage of disease management, where little information has been tested, the WDNR will rely on an adaptive management strategy.

Goals and Objectives for state WNS risk management

Goals:
1. Slow the spread of *G. destructans* by reducing the potential to spread the disease due to anthropogenic activities.
2. Develop strategies to increase hibernating bats ability to resist or cope with the effects of the disease.
3. Eliminate the chance of cross contaminating bats while in rehabilitation centers.
4. Prevent release of infected bats on the landscape to further spread the disease.
5. Allow continued bat rehabilitation but minimize state risk for WNS.

Objectives:
1. Require gear, footwear and clothing decontamination procedures at all state managed caves and mines.
2. Require decontamination of any gear coming into contact with bats before the gear is used again.
3. Control access to state managed caves and mines by allowing only authorized entry.
4. Work with private landowners of caves or mines, including commercial cave owners, to minimize potential spread of the disease.
5. Understand the pros and cons of potential disease management strategies.
6. Allow release of WNS rehabilitated cave bats only after a method for treatment or decontaminating bats of *Geomyces destructans* has been approved.

WNS has been found within a distance that bats could travel to and from Wisconsin thus making it possible for bats to carry *G. destructans* into the state. Management decisions must take into account the proximity of WNS to Wisconsin. Changes to the decision-making process for WNS management will occur when suspect, or confirmed WNS is documented within the state. This structure of management is a way for the state to be proactive and yet reasonable about the WNS response.

1. Decontamination Management
Introduction

Certain fungi and their spores (conidia) are ubiquitous in the environment, and many infectious diseases are spread by air, environmental contact, or contact between individuals (Postgate 2000, Anaissie et al. 2009). Environmental and bat-to-bat routes of WNS infection are likely, but human-vectored spread of WNS is a mode of transmission that can be managed, and therefore one WDNR targets for reduction or elimination. Decontamination measures should be used to prevent *Geomyces destructans* introduction to environments that support its growth. All human use within caves may play a role in the transfer of the fungus and therefore decontamination measures must be applied to all users (casual and commercial cave visitors, technical cavers, researchers, etc). Furthermore, bat use of a cave often goes unobserved and for this reason WDNR will not make the distinction between bat-used or non-bat-used caves in Wisconsin. Hence, all caves have the potential for bat use and decontamination measures must take place at all times of the year for every cave and mine in Wisconsin. Rock shelters, defined as a shallow cave-like opening at the base of a bluff or cliff, are not considered caves for these purposes.

Decontamination Actions:

- Equipment, gear, footwear and clothing or other objects may not be brought or placed into or near a cave or mine if they have been in or near a cave or mine located outside of Wisconsin.

- Equipment, gear, clothing and other objects that have been in or near a cave or mine located in this state must be cleaned following department-approved protocols (see Appendices H & I) before they can be brought into another cave or mine in this state.

- The cleaning process [following department-approved protocols (see Apendices H & I)] for all equipment, gear, clothing and other objects that have been in or near a cave or mine in Wisconsin must begin immediately upon exit.

- All equipment, gear, clothing and other objects that will be or have come in contact with bats (including but not limited to nets, traps, weighing tubes, bat bags, biopsy punches, rulers, clothing, gloves, electronic equipment and exclusion materials) and all individuals handling bats must decontaminate prior to and immediately after contact when work has been completed.

- Owners and operators of active mines and of commercial caves and mines must ensure that individuals entering or leaving their caves or mines comply with department-approved cleaning protocols.

These requirements are already in effect under rule IS-47-10, permanently adopted by the Natural Resources Board in June 2011 to reduce the risk of human-assisted spread of *Geomyces destructans* between caves. Until definitive evidence indicates otherwise, all WDNR collection permit holders, researchers, technical cavers, department staff, and responders to WNS outbreaks will be required to decontaminate clothing and gear before entering any caves or mines on state land. WDNR-approved protocol for disinfection can be found in Appendices H & I. The WDNR decontamination protocol follows closely the USFWS protocols (Appendices J & K) all of which will be updated as new information becomes available on transmission routes and control techniques. Authorized cave users should consult the website below to stay up to date on any

changes. Anyone working in the Midwest (USFWS Region 3) under a Federal Research Permit or operating under Section 6 authorities should also reference the protocols that have been incorporated into USFWS Region 3 permits.

Decontamination for casual cave visitors of commercial caves or for land owners with caves
Property managers are required to implement bio-security precautions for visitors to public caves. This is not only a way to help reduce risk for spread of the fungus, but also gives managers and educators a chance to engage the public and provide information about WNS. The department will work with landowners to implement appropriate protection options for their situation.

Two options that can be used to engage visitors are as follows:

1. Casual cave visitors, such as those visiting developed tourist caves, should be allowed entry only with mud free shoes* passed through a footbath to disinfect shoes at cave or property entrances (see Appendix H).
   **footbath are not effective on dirty shoes or boots (see Amass et al. 2000)*
2. Use a WNS outreach and education program similar to that designed for Mammoth Cave National Park. In brief, visitors for guided tours or paid trips will be asked about previous cave or mine visits and if needed, they will be asked to change or follow disinfection protocols before entering the cave (appendix H). (also see Mammoth Cave National Park website for general information for cave visitors to determine necessity of disinfection: http://home.nps.gov/maca/whitenose.htm)

2. Cave & Mine Access Management

Introduction
Any cave or mine, regardless of its rank as a high or low priority cave, may be visited by bats (Brack et al. 2003, Brack et al. 2005, Brack 2005, LaVal and LaVal 1980). If that cave or mine harbors *G. destructans*, it can serve as a potential reservoir for the causative agent of WNS, infecting bats that enter on an occasional or transitory basis. A blanket closure policy, regardless of the numbers of bats in each cave or mine, provides a strong stance and perception to all concerned about cave species and their habitats that human transmission is possible and manageable. Restricting cave use can be controversial, but partial cave closure will not likely be successful in slowing the accidental spread of WNS given the nature of the fungus and biology of bat species.

Following risk analysis results of the structured decision making process (Szymanski et al. 2009) and based on available scientific data, the USFWS has recommended a moratorium on cave entries, and many federal and state public lands have been closed to human access. In Wisconsin, the USFS has closed abandoned mines on their lands, and a few private landowners have excluded unauthorized human access to their sites. Due to the proximity of the nearest known WNS infected bat cave, several Midwestern states, including some of Wisconsin's neighboring states, have closed all visitor access to state managed bat caves: Indiana on May I 2009, Missouri on April 20 2010, Illinois on April 26, 2010, and Iowa on April 29 2010.

In Wisconsin, decontamination measures are required at caves and mines, a management action that not only aids disease control but also benefits all cave biota. These protocols will remain a requirement for individuals who, under authorized circumstances, must enter caves for research, surveillance, monitoring, or in cases where closure is not selected. Restriction of human access to infected environments is considered a universal precaution to reduce inadvertent spread of WNS through human assisted *Geomyces destructans* transmission. Thus, restricting cave access to unauthorized human activity is highly recommended for all caves and mines, including privately managed caves for WNS management. Cave access restrictions are a temporary disease management strategy and thus WDNR does not anticipate permanent cave access restrictions except where the landowner wishes otherwise.

Access to caves is governed by the property's specific prevention plan. WDNR will work with property and business owners of caves or mines to find effective and practical management strategies at each site that both meet the commercial, recreational or other needs while still slowing the spread of the fungus.

Cave Access Management Actions

- WDNR develops the criteria for cave and WNS-related use permits (E/T permits or scientific collectors permit), which are issued by the Bureau of Endangered Resources and may be subject to a review by the WNS science advisory group.
    - All cave and bat-related permits require that cave trips and bats observed be reported within one week to the WNS Leader.
- All state controlled caves are closed to public access without an E/T permit or Scientific Collector's permit.
    - All closures include WDNR staff without a monitoring/research/enforcement need.
    - Decontamination measures are to be followed as established in previous section
    - The WNS Leader may grant access to a few closed caves for holders of essential, WNS-related Scientific Collector's Permits, essential WDNR monitoring, and important, ongoing mapping projects and research. Rescue and enforcement activities may be carried out without necessarily contacting the WNS Leader; however, these activities must be reported within 24 hours to the WDNR and prior to entry in any new cave in order to use appropriate decontamination methods.
- The WNS Leader will continue to train WDNR staff and partners in WNS decontamination.
- Electronic devices will be installed to monitor disturbance at high priority caves for information and enforcement purposes.
- The WNS Leader will begin training cave stewards for monitoring selected caves for WNS or human disturbance.
- Trained cave stewards or WDNR staff will monitor the cave entrances in late winter for WNS related behavior using a permit and protocol issued by the WNS Leader.

Removing cave access restrictions procedures

Cave access management within the state is not a permanent solution for WNS management and WDNR will make a good-faith effort to re-open caves. Removing cave access restrictions will be considered based on new information about a cave, case-by-case risk management depending on *Geomyces destructans* presence and proximity to other caves, and alternative management tools (e.g., bat exclusions or effective treatment that does not affect other cave biota). Consideration will take place annually when the Implementation Strategy updates take place for the first five years and as the plan is periodically updated after that or with the development of a WNS Response Plan.

Cave owner assistance

WDNR will have cave closure signs available for private cave owner use when requested. WDNR will work with private cave owners to install human intrusion monitoring devices, and/or bat friendly gating that prevents unauthorized human entry.

3. Disease Management Options

Introduction

The outlined disease management options may be relevant and will be considered both for preventing the introduction of WNS into new areas and for control of WNS where it is detected. The results of the assessment phase of surveillance (see Annex A.4 'Assessment Surveillance'.) should be available before there is full consideration and initiation of possible control actions. The WNS science advisory committee will review findings from the surveillance report and consider all factors related to a site before recommending the appropriate management action.

When disease management options need to be chosen in response to a specific WNS detection event, chosen actions will be based on the specifics of the situation, including, for instance: the species and number of bats judged infected or exposed, the seasonal timing of WNS or *G. destructans* detection, the characteristics of the cave/mine (including but not limited to ownership, access, physical features, or presence of other cave biota) , the potential for implementing various control treatments at the site, the geographic area, and proximity to other hibernacula.

The science of WNS and *G. destructans* control is in its infancy, however many questions have been answered in a short amount of time and many of the questions critical to the successful management of the disease are currently underway. Research is needed on many of these approaches and should be supported immediately and intensively. It will be important that the information and strategies outlined in this management section be regularly updated and reconsidered, as more is learned about WNS and its management. If new findings arise prior to the annual review of this plan, WDNR may choose to amend a section to include new and proven response options.

Management of the Causative Agent (the fungus, *Geomyces destructans*)

Rationale: Especially in terms of controlling the spread of WNS into Wisconsin and into new areas of the state, control of spread of the fungal agent, *G. destructans* is one approach. A key strategy to control spread of *G. destructans* is to concentrate on agents potentially carrying or harboring *G. destructans*, specifically humans, bats, and caves.

Considerations:

1. Currently, there is little known about the efficacy, and most important, the practical application, of various fungicidal agents or techniques to *G. destructans* outside of the laboratory [add current research moving in to the field (lab trial complete now moving to field trials)].
2. The risk of collateral damage to other cave biota, especially micro-organisms, from materials/approaches used to control *G. destructans* is a critical consideration. Therefore, at least initially, *G. destructans* management should only occur in mines, not natural caves (until more is known about impacts on other cave biota).

Tools and Options:

1. Fungicide applications to cave environments
2. Bio-controls
3. Close caves to bats at risk for carrying *G. destructans*
4. Manage human assisted movement of the fungus
5. Decontaminate gear (bio-controls) for authorized surveillance & monitoring

Research Opportunities:

Search for a fungicide that destroys *Geomyces destructans*, an effective application method within a cave environment, and research its potential effect on cave biota.

<u>Management through Manipulation of Bat Populations</u>

Rationale: Host biology is always a key factor in the occurrence and management of disease. Research to date has shown that *G. destructans* can co-exist with some bats in caves without disease, and that mortality from WNS may result partially from primary or secondary problems, e.g. wing damage, nutritional depletion from *G. destructans*-associated increased arousal and activity. Therefore, it is worth considering manipulations of bat populations that will either decrease the transmission of *G. destructans* through a colony, decrease the onset time for the disease, or increase the resistance of individual bats or colonies to WNS mortality.

Considerations:

1. Infected bats can spread the WNS agent to new sites. Preventing these movements may be important to reduce the spread and impact of WNS.
2. Non-lethal removal of *G. destructans*-infected bats may reduce the load of pathogen in a colony (and thus reduce transmission risk to other bats).
3. Population density reduction for ex-situ treatment/experiments may reduce the risk of bat-to-bat contact and potential transmission.
4. Anything that can be done to conserve bat populations will reduce the impact of the additive mortality from WNS. Therefore, other key parts of the state's bat management

program, such as wind farm impact assessment and mitigation, the protection of key bat habitat, protecting and reducing the disturbance of maternal colonies, etc. are also integral components of WNS management.

5. Anything that can be done to improve overall bat health and reduce other health impacts may increase survival in infected colonies.

Tools and Options:

1. In selected situations (e.g. sole WNS detections in the area, other key bat hibernacula in the area at risk, etc.), remove affected bats from the colony. Removed bats may be transported to treatment facilities for experimentation, used in critical WNS research, or be euthanized and stored for genetic material.
2. Selective reduction of *G. destructans*-infected bats and nearest neighbors using a carefully designed research study to determine the role of fungal load and infection rate in subsequent years.
3. Mid-winter containment of infected bat colonies to prevent early emergence and transmission to nearby sites.
4. Exclusion of bats from Gd contaminated caves.
5. In-situ captive management and propagation to confine the *G. destructans*-infected colony to that cave, until recovery is possible.
6. Ex-situ captive management (remove bats from cave).
7. Exclude bats from commercial sites regarded as having a higher risk of human transmission.
8. Listing cave bat species as threatened to minimize disturbance and take beyond WNS.

Research opportunities:

1. Experimentation regarding the use of bunkers as 'clean' hibernacula, treatment facilities, or experimental locations.

Treatment/Immunization for WNS affected bats

Rationale: It is unlikely that Wisconsin will avoid the introduction of *G. destructans* and WNS. Therefore, a realistic goal is to minimize the impact of WNS on bats and the ecosystem, and to develop treatments and vaccines that reduce morbidity and mortality.

Considerations:

1. Proven treatments for bats affected by WNS or vaccines to prevent the development of the disease when a bat is exposed to *G. destructans* do not currently exist; however, supportive care (raise bat's euthermic temperature and nutritional support) alone has been demonstrated to have a high recovery rate of wing lesions (Meteyer et al. 2011).
2. Developing effective methodologies to apply treatments or vaccines to free-ranging populations is at least as difficult as developing them.
3. Any treatments or vaccines developed would need to have minimal impact on other cave biota to be of significant use in WNS mitigation.
4. Knowing the extent to which WNS is present in bat hibernacula throughout Wisconsin to determine if slowing the spread remains a goal.

Tools and Options:

1. Fungicidal treatment of individual or colonies of bats.
2. Move subset of bats into captivity to keep them alive (provide food water and shelter) and then release.
3. Vaccination in situ (once something is known about immune response, protection, etc.)
4. Treat dehydration (in situ) and provide food sources (ex situ).
5. Treat with immuno-stimulants.

Research opportunities:

1. Band late season bats affected with WNS to determine if there are resistant individuals that may return the following year. That is, continue the research conducted in VA, PA, and NY that has identified survivors. Though it is not yet known if these individuals actually develop resistance to subsequent exposures.
2. Study the efficacy of any treatments, including affects on survivorship and fecundity of treated bats

Management through Environmental Modification

Rationale: Environmental factors may play a role in the development/mortality impacts of WNS when *G. destructans* infects population within a cave. Studies show that bats themselves appear to practice "environmental modification", e.g. moving to different areas of a cave, once they are infected by WNS. In theory, portions of a cave environment could be modified to reduce *G. destructans* load, or to improve bat health and therefore susceptibility or survival.

Considerations:

1. Almost nothing is currently known either about the optimal strategies for modifying WNS-affected cave environments, or how best to implement those strategies in various kinds of cave habitats.
2. Current airflow modifications exist that may help achieve changes in temperature and possibly humidity that could produce effective environmental conditions for suitable hibernation while limiting fungal growth.
3. It will be critical to assess and monitor the impact on other cave biota of any environmental modifications. Modifying environmental conditions in mines is recommended over modifying natural caves
4. Supporting other environmental aspects important to a bat's health, such as the proximity of water sources to roost sites, could reduce the mortality associated with WNS.
5. Enhancing other habitat management programs that support other stages of bat's lives, e.g. protecting alternate roost sites, will also enhance WNS management.

Tools and Options:

1. Modify hibernacula temperature (by modifying airflow) to affect fungal growth. Create cold and warm air traps for additional roost selection opportunities
2. Modify humidity to a lower moisture level making the cave dryer to slow growth of Gd.
3. Assess and control other mortality factors on site.

4. Provide artificial roosting opportunities near the cave entrance that buffer extreme outside conditions yet remain cold and stable for bats moving toward the entrance.
5. Reduce roosting opportunities in areas prime for *G. destructans* growth, forcing bats to roost in areas less suitable to fungal growth, yet still suitable for successful hibernation

Research opportunities:

1. Prior to the arrival of WNS at a site, build and test alternative roosts near entrance and assess best way to buffer highly variable conditions using temperature data loggers.
2. Investigate cave environment conditions that both promote and deter growth of *Geomyces destructans* as well as each bat species' preferred and tolerable cave environment conditions for hibernation.

Management of Human Activities

Rationale: Because human-facilitated introduction and spread of *G. destructans* is a significant risk, and because human disturbance of hibernating bats likely can significantly increase the mortality of bats from WNS, it is critical to consider and manage all human activities in hibernacula.

Considerations:

1. Management of human activities in caves is likely an important and a straightforward approach for WNS management.
2. Since WNS mortality will be an additive factor for the health of bat populations in the state, it is critical to also assess and manage other anthropogenic risks to the state's bats (e.g. wind farms, pesticide use, summer roost destruction, etc.)
3. This is currently one of the few existing and viable management option that may help slow the spread and transmission probability while research for other management options continues.

Tools and Options:

1. Cave access restrictions and closures (see Annex C.2.)
2. Permit and schedule coordinated research entry to caves (see Annex B.)
3. Rigorous decontamination of people and their gear. This is mandatory under the WDNR plan.
4. Require the use of dedicated gear
5. List *G. destructans* as a prohibited invasive species.

Research opportunities:

1. Test site with environmental sampling methods to determine if the presence or absence of *G. destructans* is a viable technique having a high degree of statistical significance.

4. Rehabilitation Management

Introduction

The rehabilitation of bats becomes a complicated process with the introduction of a new and poorly understood disease like WNS. Currently, there are two major issues that have not been reconciled. First, there is the threat of releasing seemingly healthy bats back into the wild if they remain as carriers of the fungus, and second, there is the threat of cross contamination, not only of non-infected cave bats, but also of potentially introducing the disease to non-cave bats which otherwise would not have come into contact with the fungus.

Bats submitted for rehabilitation with no sign of WNS may still be carriers of the fungus. For example, bats at a maternity roost with no clinical signs of WNS were still found to be carriers of *G. destructans* conidia in both late spring (May 15th) and late summer (Aug 15th). Recovery from WNS wing lesions in a rehabilitation setting has been documented, but again it is unknown if the fungus was completely eliminated from individual bats. At the time of writing, studies to find ways of 'cleaning' bats of fungus are making progress but no method has been scientifically verified or is available for use. WDNR will continue to make the assumption that all cave bats are potential carriers of *G. destructans* and should be treated as such. Under this premise, WDNR has developed bat rehabilitation policies within this Implementation Strategy.

Bat Rehabilitation Actions:

- Strict decontamination measures for cleaning bat caging should be implemented and tree bats should never be housed in caging that previously housed a cave bat species (see appendix H for decontamination procedures).
- Release of cave bat species is temporarily prohibited until a disinfection/treatment protocol for the bat itself has been scientifically proven safe and effective.
    - When prohibition is lifted, release of any rehabilitated cave bat is to take place only in the months after winter hibernation and before fall swarming behavior (between April 15th and Oct 15th).
    - When prohibition is lifted, release of any rehabilitated cave bat must take place within 5 miles from the site where the individual was recovered.
- No rehabilitation of bats showing signs of WNS until otherwise authorized.
- Rehabilitation procedures for federally endangered species of bat (*Myotis sodalis*) will continue to be dictated according to federal permitting.

No further actions are dictated if WNS is reliably reported or confirmed in any Wisconsin cave until changes are made to the implementation strategy.

Wildlife rehabilitators must be licensed in the state of Wisconsin and there are requirements and restrictions specific to bat rehabilitation (Appendix L). Rehabilitation of bats afflicted with WNS is currently not allowed in the state of Wisconsin. However, there may be special circumstances when rehabilitation is a prudent course of action and would thus only be allowed in facilities that meet the standards of care described in the 'Wildlife Rehabilitator Protocol for WNS' (appendix M). Special cases for which permitting for WNS bat rehabilitation may be allowed include: use for WNS research, use for stockpiling potentially viable bats, or use for captive propagation.

Release of bats will happen only when it has been scientifically proven that rehabilitated bats can be treated and pose no threat of reintroducing the fungus into the environment when released.

It is currently recommended that cave bats be left where they are found because of the potential for a sick bat to be carrying rabies. Sick bats threatening exposure of illness to humans should only be handled by personnel that have received the rabies vaccination and are trained to handle bats. If there is any reason to suspect WNS on a sick bat, the WDNR WNS response coordinator should be contacted immediately. Rehabilitators that receive WNS-infected bats should keep them isolated from all other animals outside of their facilities and immediately notify David Redell, the WDNR Bat Ecologist.

Re-evaluation of WNS rehabilitation policy

The current ban on WNS positive bat rehabilitation and mandatory decontamination procedures for cave bat rehabilitation is not meant to be permanent. In the WNS Implementation Strategy annual review, WDNR will revisit the question of bat rehabilitation given the presence of WNS. The department will continue a dialogue with bat rehabilitators as the risks and benefits of WNS rehabilitation are weighed. Current situations exist where WNS bat rehabilitation may be permitted and it is hoped that with ongoing and future research, WNS bat rehabilitation will be a viable option to assist bat survival.

5. Conservation and Recovery

The threat of WNS to the Wisconsin cave bat population makes conservation the main concern of WDNR. Planning for cave bat population recovery following a potential WNS "epidemic" event, while not the main focus of the Implementation Strategy, is under consideration. Preparatory steps currently being pursued by the department include pre-WNS life history data collection and development of a population viability analysis (PVA) to help determine minimum viable population recovery management options. Similar to a PVA done for Northeastern bat populations (Frick et al 2010), a Wisconsin-based PVA will take into consideration additional sources of mortality (e.g. wind farm mortality) and will help propose future needs and future protections (e.g. bat gates and summer habitat) for the bat community. The department is also exploring ideas for hibernacula protection, artificial hibernacula (i.e. already existing sealed mines), possible fungal treatments and bat rehabilitation. A recovery plan will be developed based on the WNS impact to Wisconsin bat populations in the coming years and with the development of a WNS response plan.

D. Communication- for Surveillance and Management Activities

Introduction

An organized program for disseminating information about WNS and affected bat populations will enable those involved to cooperatively develop clear and effective communications. Addressed here are two important communication lines. First is the 'Response Communication,' or communication that needs to transpire among cooperators involved in the collaborative partnership to control and manage the disease and minimize mortality in bat populations. Second is the 'Outreach Communication' to help educate and keep the public up to date with current events. To bridge the two lines of communication, a Public Information Officer (PIO), designated by WDNR Office of Communication, will be the liaison between personnel involved in the outbreak, and the press.

Concurrently with the development of the WDNR Implementation Strategy, a national inter-agency and non-governmental organization 'Communications and Outreach Plan' (USFWS 2010) for the National Plan (USFWS 2011) was written. The Communications and Outreach Plan outlines a continent-wide flow of information (Appendix N) to ensure that key audiences receive and understand information about WNS in a timely manner. It addresses how state agencies, including WDNR, receive WNS updates and how they can be involved in continental WNS investigation efforts. Currently WDNR is an active member of the national WNS Investigative Team participating in the bi-monthly federal conference calls and developing a national response plan.

Goals and Objectives for State Communication

Goals:

1. Ensure effective communication within the Wisconsin WNS Science Advisory Group, response team(s), and among partner agencies and organizations in order to maintain a coordinated effort to address the situation.
2. Provide continual public communications to update and increase understanding of the disease and explain any changes in actions or goals.

Objectives:

1. Develop communication plan for managers and decision makers about new WNS information, surveillance updates, and management decisions.

2. Develop a communication plan for the state WNS response team.

3. Establish a procedure for press releases about new WNS developments (e.g., discovery of an index case within a state, surveillance updates, and cave closures) providing accurate, timely, and consistent information.

4. Develop a consistent message on WNS for use with decision-makers, stakeholders, cooperators, media, and/or general public.

1. Response Communication

Communication with Cooperators

Communication among cooperators can take place by conference call with a follow-up email detailing points of the conversation, or by written memo sent by email. Depending on the nature of the information, if in-person discussion among cooperators is necessary, a meeting will be scheduled. The WNS leader will be responsible for setting meeting times, arranging conference calls with one of the WDNR numbers and distributing memos when there is news. If a cooperator has information to distribute, it should be arranged with the WNS leader who will maintain a current list of cooperator contact information (see Appendix O). Communication among cooperators will take place:

- with WNS Implementation Strategy updates,
- with end of seasonal surveillance results and laboratory test results,
- following the identification of the index case, and
- following WNS science advisory group recommendations to WDNR administration on management options.

If comments or responses are desired from an email communication it will be clearly noted.

Communication with regional and national WNS investigative teams

The WDNR WNS Leader will continue to participate in monthly conference calls of the Mid-west bat working group and bi-weekly conference calls of the national WNS Investigative Team as well as attend all national and regional conferences regarding WNS discussions. Contacts for both can be found in Appendix O. Participation with these groups is critical for multi-state collaborative research, conversations on regional and national management options and sharing of WNS research results in a timely manner. A National Communications and Outreach Plan (USFWS 2010) outlines communication actions and proposes an interagency organization chart for the flow of information.

Communication plan for response teams

WNS response teams will be called to action by the WNS leader following the identification of the index case and priorities have been set with the WNS Science advisory group. The WNS response team should report their findings to the WNS leader immediately following the investigation of a WNS suspect bat and cave or mine hibernaculum, followed by a written report within three working days. A final report will be written after all laboratory tests are returned, and sent to the WNS leader. The WNS leader will forward final response team reports to: the regional biologist where the work is taking place, other response team leaders, the WNS science advisory group, Cooperators, and the lead PIO.

2. Outreach Communication

Outreach communication is critical as it not only keeps the general public informed, it also informs cooperators, stakeholders and cave or mine owners. Clear and effective communications disseminating information about WNS and affected bat populations should always incorporate the following messages:

- WNS is a wildlife health crisis of unprecedented proportions, devastating bat numbers and proceeding unabated with currently no known cure despite the considerable efforts of scientists;
- Bats play a vital role in the environment;
- Many agencies and organizations are involved in a concerted and collaborative partnership to control and manage the disease and minimize mortality in bat populations; and
- Research continues in North America to identify key questions related to the disease and provide crucial information for management agencies to develop suitable options.

The following tools of outreach communications include current efforts of WDNR to disseminate information as well as suggested steps for further proactive actions. As wildlife disease outbreaks are of interest to local media: e.g. newspaper, television, radio, or through education displays at local nature centers and public venues, only those individuals receiving authorization from the WNS Leader may be interviewed by or comment to the media. Personnel should direct all media inquiries to the acting PIO.

Public press releases

The public has already shown an interest and heightened awareness of bat activities and mortalities in many parts of the country due to WNS. Therefore, press releases will need to be developed about, but not limited to, the following events in Wisconsin: WNS surveillance, the index case (for examples from other states announcing index cases see current and archived news press releases at http://www.fws.gov/whitenosesyndrome/index.html), subsequent cases, public reporting of dead bats, and current cave access restrictions. Press releases should be modified to include the details of the current situation by the PIO only in consultation with, and with final approval from, the WNS Leader. The WDNR PIO and WNS Leader may work with cooperative agencies when press releases are needed (i.e. USGS and USFWS). The Bat Ecologist should be notified before any press release is made public in the state of Wisconsin; the Bat Ecologist will in turn notify appropriate cooperators.

Printed education materials

Printed materials are informative, easy to make, often re-iterate any talking points, and provide a way for interested public to find out more on current information and ways to get involved. Publications such as brochures, pamphlets, or handouts, are being developed for the following topics: 1) background on WNS and its threat to bats, the ecosystem, forestry, agriculture and public health, 2) explanation of cave closures, and 3) public reporting of dead bats. These materials should be carried by surveillance teams, taken to public meetings, and handed out to cave owners and the public. See Appendix P and Q for brochures that were handed out to cave owners during the summer 2010 inventory and surveillance efforts and an informative brochure created by the USFWS.

Internet-based education materials

The simplest way to get information to interested public is to make it available on the internet. Currently, WDNR Public relations have a 'Wisconsin Bats Media Kit' that allows the public to search recent press releases and links to information available on the bats of Wisconsin. The Bureau of Endangered Resources' webpage has information on WNS which focuses on current

research, supplies information on how citizens can help, and provides a link to the Wisconsin Bat Monitoring Program Website. Also provided is a link to the USFWS website on WNS, which in turn provides more links with WNS information including decontamination and bio-security protocols. Information on the WDNR website should be updated with any critical findings (i.e. discovery of the index case), and should provide a copy of the final WNS Implementation Strategy and subsequent response and recovery plans. A link to the Endangered Resources WNS information will be posted on the WDNR Wildlife Health Section.

Other tools available for information dissemination include:
'Public Service Announcement' or radio information clips of up to 60 seconds in lengths, commercial advertising, and community forums.

Assessment of Communication Tools
An assessment of the communications plan will be part of the Implementation Strategy annual review. At question will be whether information was disseminated in a timely manner both as part of any response and outreach communications as well as effectiveness at providing information to a large proportion of stakeholders and the public.

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III. Appendices and Addendums

Appendix A. USGS NWHC working case and cave definitions for White-nose syndrome and *Geomyces destructans*.

Updated Jan 13, 2011

White-nose syndrome (WNS) is a disease of bats infected with the fungus Geomyces destructans. The standard terminology that diagnostic laboratories and resource managers use to report WNS in bats, including identification of field signs suggestive of disease, detection of G. destructans by PCR, fungal tape strip and/or culture, and confirmation of WNS by histopathology has been simplified into 3 categories (Negative, Suspect, or Confirmed) described below. The former "Presumptive positive" classification has been eliminated. The criteria for confirming a diagnosis of WNS requires histopathological evidence of infection with G. destructans. "Suspect WNS" classification warrants testing additional submissions from the area to confirm WNS. For management purposes, hibernacula should be considered contaminated with G. destructans if they contain at least one bat (regardless of visible field signs) that tests positive for the fungus or WNS by any one or more diagnostic method. A contaminated hibernaculum retains this designation indefinitely.

Case Definitions for Bats

Negative:

- No (or nonspecific) field signs are observed AND neither WNS nor G. destructans is detected by diagnostic tests (PCR, culture, fungal tape, and/or histopathology).

Suspect positive for WNS:

To identify a bat as suspect for WNS, one of the following must be true:

- Field signs are suggestive of WNS AND
- A bat is PCR positive meaning that DNA from G. destructans is present although the viability of the organism is unknown. Field signs are not required. No histopathology was performed or is negative. WNS was previously confirmed in the county or in an adjacent county. Further diagnostics (PCR, culture, fungal tape and histopathology) were either not performed or are negative.
- A bat is culture positive meaning there is viable G. destructans present. Field signs are not required. No histopathology was performed or is negative.
- Fungal tape strip of bat fur or skin is positive for G. destructans-like conidia. Visible fungus is required. No histopathology was performed or is negative.

Confirmed positive for WNS:

- Confirmed positive bats are those that fulfill histopathologic criteria for the disease. These criteria require the identification of a specific pattern of fungal colonization in the epidermis which may extend to invasion of the dermis and connective tissue. Histopathology can also support the presence/identity of G. destructans if distinctive conidia are observed. Field signs, PCR, fungal tape strip, and culture can be negative for bats that fulfill the histopathologic criteria for confirmed WNS. Follow-up PCR/DNA sequencing or fungal culture should be considered to confirm the identity of the organism in geographic regions with no prior or unknown history of WNS.

Field Signs Associated with WNS in bats

NOTE - not all signs must be present but confidence levels improve with increasing number of signs observed

- **Winter/Spring** - excessive or unexplained mortality at/near hibernaculum; visible fungus on flight membranes, muzzle, and/or ears of live or fresh dead bats; abnormal behaviors including daytime activity, population shift to entrance of the hibernaculum, decreased arousal with disturbance inside hibernaculum; moderate to severe wing damage in nontorpid bats*; thin body condition*
- **Summer/Fall** - wing damage and depigmentation* through late May; bats with wing damage collected between June-October have tested negative for G. destructans and WNS.

  * considered a nonspecific field sign when observed by itself

Case Definitions for Hibernacula

Negative hibernaculum: None of the below criteria have been fulfilled

Suspect positive

- Hibernaculum that contains bats with field signs of WNS but no other diagnostic work has been performed.
- Hibernaculum that contains bats that are PCR positive, culture positive, or tape strip positive for G. destructans. These bats do not need to have visible field signs of WNS.
- Hibernaculum containing bats with field signs suggestive of WNS and WNS has been previously laboratory confirmed in the county; no further diagnostics performed.

Confirmed positive

- Hibernaculum contains bats that fulfill the histologic criteria for WNS (as in the confirmed positive WNS category above).

* considered a nonspecific field sign when observed by itself

http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/wns_definitions.jsp

Appendix B. Reporting Sick/Dead Bats Data Form

White Nose Syndrome (WNS): Investigation and Response to an Emerging Wildlife Health Threat

Please fill out an on-line Sick/Dead bats form here: http://wiatri.net/inventory/bats/Reporting/
or you can complete the form below and send it to:

Wisconsin DNR
Endangered Resources
David Redell
101 S. Webster St.
Madison, WI 53707-7921

* Indicates Required Fields

* Name: _____

Address1: _____

Address2: _____

* City: _____

*State: _____ Zip Code: _____

* Phone #: _____

* E-mail: _____

* Number of Bats Found: _____

* Date of Observation: (mm/dd/yyyy) _____

* County of Observation _____

* Description of Location:

_____
_____
_____
_____
_____

Additional Comments:

_____
_____
_____
_____
_____
_____

Appendix C. Procedures for shipment of wildlife carcasses (WDNR-Wildlife Health)

10/2010

WDNR Wildlife Health Carcass Shipping Procedures

Do not ship any carcass that has a strong odor, is covered with maggots or carrion beetles, or is missing major organs through a large body opening. All carcasses shipped to Wildlife Health must have a Necropsy Submission e-form 2300-143 submitted electronically to WM Necropsy and a copy of the completed form included in the shipping box.

All carcasses must be double-bagged (zip lock bags are fine for small carcasses) with both the outer and inner bags closed tightly. Insert absorbent material in between the inner and outer bags to soak up any potential seepage during shipping. The outer bag must be tagged with a specimen/carcass tag (2300-144) with complete collection information included on the tag.

The recommended shipping container is a Styrofoam cooler that has an outer cardboard box. Hard plastic coolers may also be shipped as long as the lid is securely taped shut and any drain holes are securely covered to prevent leakage. You may want to check with the carrier you use to make sure hard plastic coolers are accepted.

Line the shipping container with an open plastic bag. Place the double-bagged carcass into the open plastic bag liner. Place enough ice packs on top of the bagged carcass to cover the carcass, and securely tie up the plastic liner. Fill any empty space remaining in the cooler with newspaper or other type of filler material. Filling the dead space will help keep the carcass cool and from shifting during shipping.

If using the Styrofoam cooler with outer cardboard box, tape the Styrofoam lid shut, tape the Necropsy Submission form to the top of the Styrofoam lid, and then tape the cardboard box shut.

For hard plastic coolers, put the Necropsy Submission form into a ziplock bag, place it on top of the contents of the cooler, and securely tape the cooler shut.

Write "Exempt Animal Specimen" on the outer container.

You must send the package by overnight delivery.

Contact Wildlife Health (608-221-5375) before shipping any carcass overnight to confirm that someone will be available to get the carcass into the cooler or freezer.

Only ship on Monday through Wednesday in case of unexpected delays during shipping that may cause the package to sit in transit over a weekend.

Use the current State of WI contract shipper if available in your area. In 2009, the state contract for shipping was awarded to SpeeDee. If this service is not available in your area you may use the available shipping service in your area.

Wildlife Health shipping accounts: (only for use for shipping to Wildlife Health)
SpeeDee: no account number- use activity code 212 WMWH 1614 WMAY
FedEx: #2738-7360-0
UPS: #5EA049

Ship to address:
WDNR-Science Operations Center
2801 Progress Rd.
Madison, WI 53716
608-221-5375
Attn: Nancy Businga

Styrofoam shippers with the cardboard outer box can be requested from Wildlife Health and many DNR offices have already been supplied with these. These shippers or any hard plastic cooler sent to Wildlife Health will be returned, along with ice packs and other packaging material, so that they will remain available at the DNR office for future use.

Appendix D. USGS NWHC Bat White-Nose Syndrome (WNS) Submission Guidelines Summer/Fall 2011 Season. Available at http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/USGS_NWHC_Bat_WNS_submission_protocol.pdf

Appendix E. Wisconsin Department of Natural Resources Endangered and Threatened Species Permit application. Available at http://dnr.wi.gov/org/land/er/review/permits.htm

Appendix F. Wisconsin Department of Natural Resources Decontamination Procedures for Preventing the Spread of WNS in Bats. Available at http://dnr.wi.gov/org/land/er/bats/pdf/WNS_decon_protocols.pdf

Appendix G. Wisconsin Department of Natural Resources Decontamination Protocols for Wisconsin Caves and Mines. Multimedia. Available at http://dnrmedia.wi.gov/main/Viewer/?peid=63cd4b5b1c184d199ff2daee8c6b49e3

Appendix H. Disinfection Protocols for Bat Field Research/Monitoring U.S. Fish and Wildlife Service – June 2009. Available at http://www.fws.gov/northeast/whitenose/FINALDisinfectionProtocolforBatFieldResearchJune2009.pdf

Appendix I. Recommended Procedures to Prevent the Spread of White-nose Syndrome (WNS) U.S. Fish and Wildlife Service June 2009. Available at http://www.fws.gov/northeast/whitenose/FINALContainmentandDecontaminationProceduresforCaversJune2009.pdf

Appendix J. Wisconsin Department of Natural Resources Wildlife Rehabilitation license application: information and requirements for taking the examination to become a licensed *wildlife rehabilitator* in Wisconsin. Available at: dnr.wi.gov/org/land/wildlife/whealth/rehab/permitting.htm

Appendix K. Requirements for WNS Bat Rehabilitation

WNS-affected bat rehabilitation is not permitted in the State of Wisconsin at this time (Summer 2011). This ban is not meant to be permanent and in anticipation of a time when it is revoked, a protocol has been developed. The following federal government recommended steps will be adopted if and when WDNR permits the rehabilitation of WNS–affected bats.

Requirements for WNS Bat Rehabilitators:

Rehabilitation is a labor-intensive process and requires a large time commitment. State agencies should only provide bat rehabilitation permits to rehabilitators who either specialize in bats or who have prior experience working with bats. The following should be required before a state issues a permit to care for WNS-affected bats:

- Rehabilitators must have proof of prior experience with bats or be willing to train with experienced persons prior to caring for bats
- Rehabilitators must have pre-exposure rabies vaccination
- Rehabilitators must follow established principles of wildlife rehabilitation (e.g. adherence to NWRA's professional ethics)
- Rehabilitators must have access to veterinary care
- Rehabilitators must be willing to use euthanasia when appropriate
- Rehabilitators must follow the Quarantine, Isolation, and Handling Protocols detailed in this document
- Rehabilitators should be trained on wing-scoring protocol
- Rehabilitators must have state wildlife rehabilitation and endangered/threatened species permit to handle and maintain listed species
- Photo documentation will be required if a state biologist is unable to verify the species due to difficulty in distinguishing *M. lucifugus* and *M. sodalis*; additionally, rehabilitators must maintain data sheets on bats taken into rehabilitation and submit them annually to the state WNS coordinator
- Rehabilitators must contact WDNR Bat Ecologist and Wildlife Rehabilitation liaison before releasing rehabilitated bats

Transportation

The general public should not handle live bats. Trained and vaccinated volunteers/animal control officers should be recruited to transport live bats using the following guidelines (volunteers without the rabies vaccination should never handle the bats but may handle the secured box carriers):

- Individuals transporting bats should follow decontamination protocols found in Appendix E.
- Bats should be transferred in a secure box with lid using items that may be easily disinfected and discarded
- The transport box should be placed inside another box or bag before being placed in a vehicle
- Bats should be transferred to wildlife rehabilitators outside of the bat care facility and the box should not be opened until inside a dedicated quarantine room

Quarantine, Isolation, and Handling Procedures

1. The bat quarantine area should be a separate, contained room housing only WNS-suspect bats. Outside flight-conditioning cages should be separated from other species by a minimum of 20 ft.
2. DO NOT house bats from different locations (greater than 5 miles) or from different time periods (greater than 3 weeks) together at any time, including in pre-release flight cages. Bats from the same hibernaculum may be housed together, while bats of uncertain hibernaculum origin should preferably be housed in separate rooms. If separate rooms are not possible, separate equipment must be used for each housing unit.

3. Once an animal has entered the quarantine room it should be considered exposed to WNS.
4. A dedicated set of supplies should be kept in the quarantine room and only used for WNS-affected bats. Do not mix these with supplies from outside the room.
5. Clean and disinfect quarantine room items separately from the rest of facility supplies.
6. All bats entering the rehab facility should be held in the quarantine room for a minimum of 30 days before being transferred into a pre-release flight cage.
7. Bats received from known WNS-affected areas should be housed in a separate room from all other animals. If they cannot be isolated, then these bats should not be accepted as patients.
8. Bats from WNS affected sites should be handled only after other bat patients have been handled to reduce the risk of cross-contamination.
9. Bats should only be handled using protective disposable exam gloves and wearing dedicated protective clothing that should be removed prior to exiting the room. Disposable shoe covers or rubber boots that can be cleaned and disinfected are recommended.
10. Disinfectant foot baths should be used upon exiting any bat holding area. Use a boot brush to wash all upper and lower surfaces of boots while standing in the bath.
11. Launder protective clothing at least once weekly or when they become soiled. It is highly recommended that personnel working in quarantined areas shower upon exiting room/flight cages.
12. Animal cages should be located as far away as possible from doors, fans, and vents to reduce the risk of aerosolization of fungal spores.

Disinfection Protocols

1. All items to be removed from quarantine areas for thorough cleaning should be initially cleaned and sprayed with disinfectant in the quarantine room. Items should then be securely bagged for transport
2. All non-disposable items (cloths, feeding equipment, clothing, etc.) in contact with bats must be cleaned with hot water and detergent in accordance with FWS recommendations.
3. All disposable items and trash should be sprayed with disinfectant and placed in a dedicated waste receptacle. Trash should then be double-bagged and discarded in the regular trash when the receptacle is full.
4. Vacuum bags should be burned and discarded. Furnace and air conditioning filters should be sprayed daily and discarded weekly.
5. Bat quarantine rooms should be disinfected thoroughly three times at the end of the season or once all bats have been transferred to pre-release cages.

Bat Care Guidance

Most WNS-affected bats collected during cold periods will be suffering from exposure in addition to emaciation and dehydration. These bats require critical care procedures and must be

carefully evaluated. Bats determined to be non-releasable should be humanely euthanized. Bats should also be checked for injury. Minor cuts and abrasions can be treated twice daily with topical application of an antimicrobial cream. Severe injuries should be treated by a veterinarian.

Initial and Subsequent Feeding and Rehydration

Bats must be adequately hydrated prior to feeding. Severely emaciated bats receive Vital HN or another liquid recovery diet after rehydration. Bats must be rehydrated with subcutaneous boluses of Lactated Ringers Solution warmed to body temperature; oral fluid therapy is not sufficient. Pale yellow urine is a reliable indicator of normal hydration. Bats may be temporarily housed on white cotton sheeting so urine is more visible.

Once stabilized, bats should be transitioned to a blended diet. Bats should be taught to eat live mealworms from dishes (do not assume they will recognize them as food) as soon as they are eating, urinating, and defecating normally. Bats that require hand-feeding of either blended food or mealworms should be fed twice daily, as much as they can consume, approximately twelve hours apart. Mealworms must be gut-loaded via the substrate they are kept in. They should be fed high-protein baby food cereal in which the grains are fine enough to be sifted. Mealworms must also receive moisture food and be supplemented with Vionate before feeding to the bats.

Let bats naturally reach normal body temperatures (i.e., warm to the touch). If a bat is not responding normally (i.e., shivering or not warming on its own) it may be necessary to use an additional heat source such as an incubator or warm-water bottle. However, nonresponsive bats must never be placed lying down on any heat source as damage to internal organs may result.

Housing and Food/Water Stations

Bats can be temporarily housed in a JEEP soft crate model #JP5526GG or similar soft-sided crate or cage. Rehabilitators must have enough crates to house WNS bats separate from any other animals. Additionally, there should be enough WNS-dedicated crates so that bats can be shifted to clean crates while used crates are being disinfected and/or laundered. Blue surgical towels, cotton/linen table napkins (in dark colors), or flannel receiving blankets can be draped and secured over the interior framework of the cage to provide roosting spots for the bats. Enough cloths should be provided to cover at least three walls of the cage. Roosting pouches may also be used.

Water dishes such as plastic pill containers or contact lens cases, which can be found at most pharmacies, can be secured to the support poles inside the cage using Velcro. Narrow, shallow trays or finch-sized coop cups (small d-cups or honey cups are preferred) should be used for both training and for self-feeding bats. If aggressive bats are preventing other bats from self-feeding, more dishes should be placed on an opposite side of the cage. Feeding stations can be partially obscured by draping, or silk or plastic foliage so that less aggressive bats can feed in comfort. This material must adhere to the decontamination protocol.

A small reptile heating pad on a dimmer switch set to half power, a human heating pad set to low, or a reflector light with a 25-watt red bulb should be provided for supplemental heat. Pads should be inside a fabric case and placed on the outside of a cage wall, never on the floor. Debilitated bats cannot escape floor heat and will sustain life threatening damage. Once bats are stabilized, heating sources should be removed and replaced with a heat bulb to remove spot heat. Cave-dependant bats are known to preferentially roost on heat sources, which contributes to chronic dehydration.

Maintaining a humidity level of 60-80% is crucial. Residential air-conditioning and heating systems typically force humidity levels that are akin to desert conditions. In these conditions, bats suffer from skin conditions suspected to result from chronic low-grade dehydration. The underlying causes of observed skin and wing conditions has yet to be identified, but maintaining proper humidity levels and temperatures that do not allow bats to enter into long-term torpor seems to reduce the development of severe skin problems. In winter, when WNS bats can be expected, humidity must be supplied artificially. Whole room humidifiers and air washers can be used to maintain high humidity levels. Bats must be watched closely for stiff wing membranes or flaky dry skin, as they are typical indicators of too-low humidity. Hygrometers and thermometers should be installed to monitor relative humidity and ambient temperature.

Lighting should include access to full-spectrum light, bearing in mind that fluorescent units are only effective at approx 18" from the light source. In addition, compact fluorescent bulbs emit a great deal of ultrasound. Ballasted incandescent bulbs are available that are effective over greater distance; however, these bulbs put out great deal of heat and also contribute to a decrease in humidity. Lighting should be timed such that natural seasonal photoperiods are maintained.

Cage furniture should be provided to create an enriched environment that stimulates natural behaviors, however, enrichment materials must adhere to decontamination protocols. Provision of companions (if possible) and multiple roost and feeding sites are the best means of enrichment. But other methods such as providing cloth slings, horizontal roost sites, natural or artificial foliage, tunnels, paper towel tubing, etc., can be used. These methods can be constructed from spare bedding material or other materials that can be disinfected or disposed of. Natural enrichment such as leaves, branches, etc., can be heated in microwave to kill parasites and other organisms and then disposed of as necessary.

Daily Management

All bats should be given daily physical examinations. This is the only way to ensure that individual bats are accounted for, are maintaining weight, and are not developing disease or sustaining injury. Daily exams allow for quick detection of developing problems, thereby increasing the likelihood of successful treatment. Bats have been observed to become familiar with an individual and to exhibit signs of stress when unfamiliar persons interact with them. In order to maintain healthy bats, personnel changes must be minimized. Fecal matter should be removed from floors daily. It is not recommended that cage walls or roost materials be cleaned daily as removing all traces of scent markers may be distressing. Portions of cage walls can be cleaned on a rotating basis using a 10% bleach solution followed by thoroughly rinsing with cool

water. Bats should be removed temporarily during cleaning and rinsing if the rehabilitator does not have a second cage available.

Water and food dishes should be washed with dish soap and hot water and thoroughly rinsed with cold water. Fresh dishes of water must be provided to the bats. Tap water may be used but if regional tap water is suspect; filtered water or store-bought is preferable. Water can be treated with Calcimize®, a water conditioner that provides trace amounts of calcium, but not in amounts that can jeopardize animal health.

Roosting pouches and sheeting should be washed daily. Hot water and mild unscented laundry soap are adequate for cleaning fabric roosting materials.

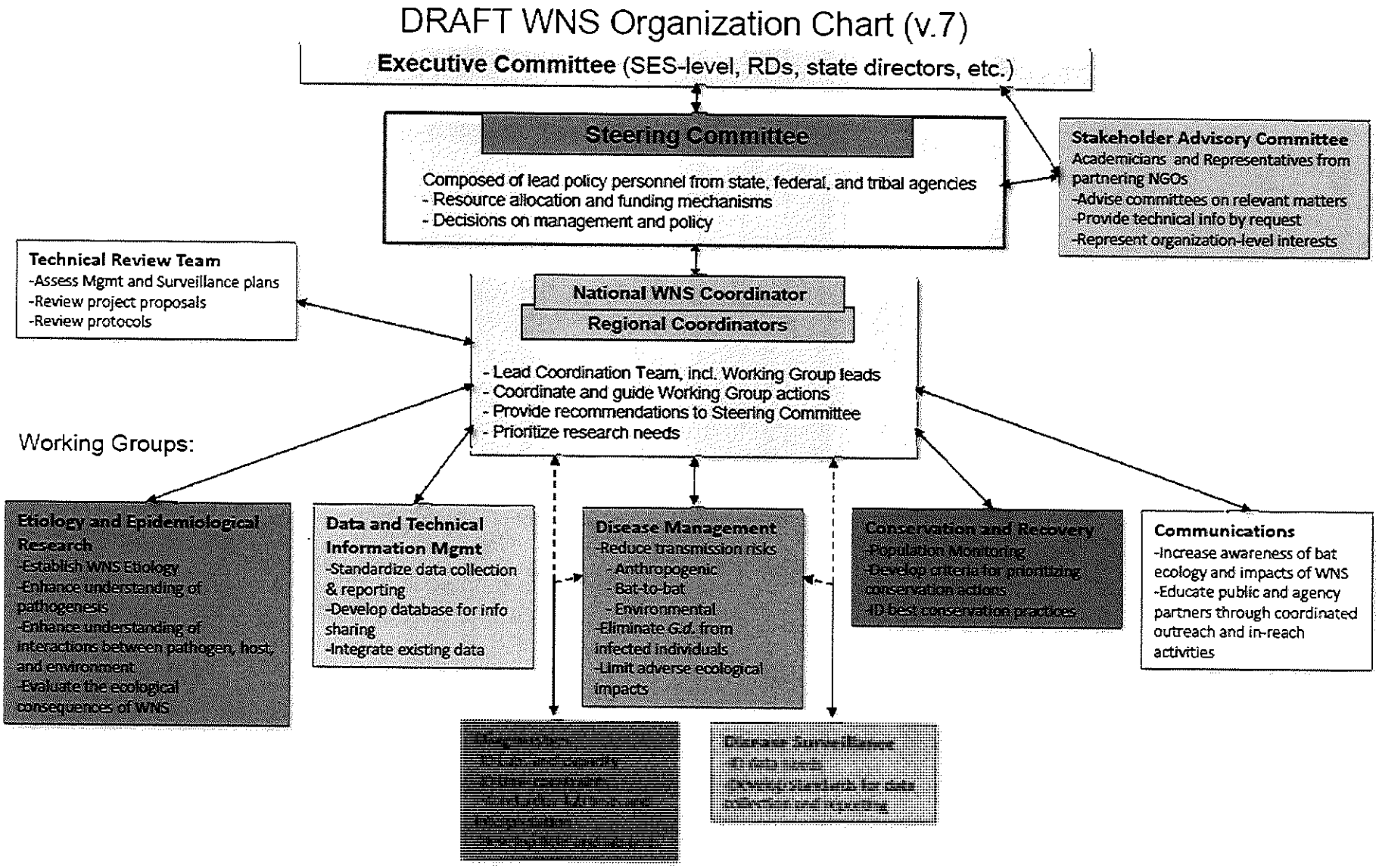
Euthanasia

Euthanizing bats is a potential management tool listed in Annex C.3. It may also be necessary in the rehabilitation setting. Whenever possible, euthanasia should be performed with inhalant anesthesia such as Isoflurane or Halothane. Because of bats' high tolerance for carbon dioxide (CO2), it is considered an inhumane method of euthanasia. Euthanasia methods must conform to AVMA guidelines causing minimal stress and a rapid loss of consciousness before death. To properly dispose of a cave bat carcass it should be sealed in a zip lock bag and placed into a second sealed bag along with plastic gloves or disposable equipment that may have touched the carcass (see http://www.fws.gov/whitenosesyndrome/audio.html, a USFWS video on "How to dispose of a dead bat").

Flight Conditioning

If the WDNR has determined to permit the release of rehabilitated WNS-affected bats, pre-release flight conditioning will be necessary. Free-standing pop-up screen tents make good, temporary flight cages. Floors should be padded and secured to prevent escape. Roosting areas and feeding and watering areas can be hung directly on screen walls. Branches and silk foliage can be suspended from the ceiling to provide enrichment and practice for obstacle avoidance.

Appendix L. Communications and Outreach Plan Appendix 1 of The WNS Inter-agency Organization for A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-nose Syndrome in Bats.



Appendix M. List of cooperator contact information.
*participant in meetings with the Midwest bat working group
°participant in the national WNS investigative team

***Add: tribal and university representatives and other missing info...*

State/ Agency	Contact Name and Location	Email Address	Phone Number
State of Wisconsin			
WDNR	David Redell *° Bureau of Endangered Resources Madison, WI	David.Redell@Wisconsin.gov	608-261-8450
WI-DATCP	Dr. Robert Ehlenfeldt :	robert.ehlenfeldt@datcp.state.wi.us	608.224.4880
WVDL	Melissa Behr Madison, WI	Melissa.Behr@WVDL.wisc.edu	608-262-5432
WSLH	Jim Powell	jwp@slh.wisc.edu	608.262.7323
UW-SVM			
Federal			
USFWS	Jeremy Coleman° Cortland, NY	Jeremy_coleman@fws.gov	Office 607-753-9334 Cell 413-265-1441
USFWS Region 3	Richard Geboy C*° Bloomington, IN Georgia Parham M Bloomington, IN	Richard_Geboy@fws.gov	812-334-4261 Ext 210 Ext 203
USGS NWHC-Madison, WI	LeAnn White Anne Ballmann * David Blehert°	clwhite@usgs.gov aballmann@usgs.gov	608-270-2491 608-270-2445
USFS	Becky Ewing	rewing@fs.fed.us	
Midwest States/Region 3			
IL-DNR	Joe Kath Springfield, IL Div. of Nat. Heritage	Joe.kath@illinois.gov	217-785-8764

IN-DNR	Scott Johnson C* Div. of Fish & Wildlife Bloomington, IN Phil Bloom M Div. of Fish & Wildlife Indianapolis, IN	sjohnson@dnr.IN.gov	812-334-1137 317-232-4003
IA-DNR	Daryl Howell C Kevin Baskins Des Moines, IA	Daryl.Howell@dnr.iowa.gov	515-281-8524
MI-DNRE	Chris Hoving Lansing, MI Bill Scullon Baraga, MI	HOVINGC@michigan.gov SCULLONH@michigan.gov	517-373-3337 517-373-6705 906-353-6651
MO-DOC	Bill Elliott*° Jefferson City, MO Tony Elliott Kirksville, MO	Bill.Elliott@mdc.mo.gov Tony.Elliott@mdc.mo.gov	573-522-4115 Ext 3194 660-785-2424 Ext 257
MN-DNR Eco Res.	Gerda Nordquist * Richard Baker Lori Naumann St Paul, MN	Gerda.Nordquist@DNR.STATE.MN.US	651-259-5124 651-259-5073 651-259-5148
OH	Jennifer Norris Huron, OH	Jennifer.Norris@dnr.state.oh.us	419-433-4601

Appendix N. WDNR WNS info brochure for cave owners 2010

Appendix O. USFWS The white-nose syndrome mystery *Something is killing our bats*