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Presenter Information

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Continuing Measures in Response to White Nose Syndrome at Mammoth Cave National Park

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Abstract

Since the arrival of White Nose Syndrome (WNS) at Mammoth Cave National Park (MACA) in January of 2013, park populations of some bat species have fallen 80%. In addition, changes in bat behavior have led to an increase in bat-human contacts and concerns about potential rabies transmission. For these reasons, actions to understand and combat this disease have become increasingly important. In conjunction with strategies already in place, a 2014 National Park Service (NPS) Disease Outbreak Investigation Team (DOIT) workshop developed additional measures that have been put into practice at MACA. These measures to improve human safety and monitor bat response to the disease included safer bat handling procedures, increased communication for public safety and education, better coordination of state and federal officials, and increased monitoring of bats. As seasonal daily monitoring data is recorded and our understanding of the disease implications grows, adaptive management strategies are being employed as needed.

Introduction

White-nose syndrome (WNS) at Mammoth Cave National Park (MACA) was first discovered in January of 2013. Measures to combat the disease and slow its spread into and at the park have been executed since 2008. In 2011 the initial responses were presented as a park wide management plan (Toomey and Thomas, 2011) that focused largely on efforts to keep the disease from coming to the park, monitoring for the disease presence, and initial responses to the arrival of the disease. Since the arrival of the disease, further strategies to address and monitor its presence and effects continue to be implemented.

The park is currently drafting a more compact revision of the management plan that focuses on on-going responses. Several

recent additional practices stem from the Disease Outbreak Investigation Team (DOIT) Workshop. The DOIT were invited to the park in December 2014 to evaluate the current situation and especially the challenges of White Nose Syndrome related to increased bat-human contacts stemming from changes in bat behavior due to WNS.

This interagency panel of experts identified four key management tasks that were addressed during the conference (Wong and Cherry, 2015):

- Conduct risk assessments for potential human-bat encounters
- Identify new/enhance existing prevention and response activities
- Identify other areas that require actions to be taken

- Develop communication and educational materials for park employees, external stakeholders and visitors

As of February 2015, these tasks had been extensively investigated and on-going actions are addressing them.

Park Response to WNS

This paper focuses on the changes to the park's response that have been made since the arrival of the disease in 2013, as well as, responses resulting from the DOIT report. Toomey and others (2013) provided a brief review of the park responses culminating in the arrival of the disease on park.

Post-tour walk-over bioremediation mats are one of the primary methods to prevent tourists who take walking tours of the cave from spreading spores of the fungus that causes WNS. The use of the bioremediation mats at the park started in 2011, when WNS was first identified in Kentucky. These mats consist of a 14-foot length of carpet and a 6-foot long foam mat with a cleaning solution that people walk across when they exit the cave. The short, carpeted ramp preceding the mats at the Historic entrance helps remove dirt and mud containing possible spores before walking across the mat.

The bioremediation mats have changed over time. Originally the mats were filled with a Lysol™ solution as described in the national WNS decontamination protocols. However, because of concerns about the potential for peoples' skin to come in contact with the solution and the fact that Lysol™ is not labeled for use on footwear, the park stopped using Lysol™ solution in the mats in 2014.

After a discussion of possible cleaning products to use in the mats, the park chose to use a Woolite™ solution in the mats. Woolite™ is safe for human skin contact and

can be used to clean footwear. In addition, Shelley and others (2013) found Woolite™ can kill the fungal spores that cause WNS.

Visitors are required to walk over the mats upon exiting the caves. Walking over the carpet and mat helps clean spores off visitors' shoes, and thus greatly reduces the potential that they could take WNS to other places.

As an important public safety and education tool, tour guides now give a short talk on WNS and also warn visitors about the dangers of contacting bats and ask that any bat contacts be reported to the rangers. This talk provides a chance to inform people about the impacts WNS has had on bat populations, to provide visitors with information on the importance of bats, and allows the park to make sure people get the important safety information about the dangers of bat-human contacts. In addition, signs warning the visitors to avoid contact with bats are displayed in the visitor center and at the cave entrance.

The numbers of human-bat contacts have increased at MACA since the arrival of WNS. In 2014, twelve people had contact with a bat on the park. Most of these people had a bat fly into them while they were in the cave. Eleven of the bat-human contacts occurred between February and April, in spite of the fact that the majority of park visitation is in the summer (the twelfth bat-human contact was in October). In 2015, the pattern repeated itself to some extent, with seven bat-human contacts between January and April and three in the summer.

The seasonal increase in bat-human contact suggests to us that the contacts are occurring because WNS infected bats are coming out of hibernation and some of these sick bats are accidentally flying into visitors in the cave.

This increase in bat-human contacts concerned park leadership and state and national public health officials. For this reason, Superintendent Craighead requested assistance from a NPS Disease Outbreak Investigation Team (DOIT) in late 2014. Their report became the basis of continued bat monitoring and of park response to bat-human contacts.

The DOIT discussions resulted in standardizing park response to bat-human contact incidents. When a bat-human contact is observed or reported, park staff provides immediate first aid. They then provide contact information for Kentucky state and NPS public health officials, so the person can discuss the contact and determine whether any rabies post-exposure prophylaxis is required. The park also records contact information for the person contacted by a bat and information about the circumstances of the contact. In addition, the park contacts public health authorities (Dr. David Wong, NPS-Public Health Service; Dr. Danielle Buttke, NPS One Health Program; and Dr. John Poe, Kentucky Cabinet for Health and Family Services) to alert them of the contact.

The DOIT suggested daily monitoring of bat numbers and their locations was needed, at least for toured areas, to see if we could determine under what circumstances bat-human contacts occur. Results of this monitoring could potentially predict when conditions are right for contacts and allow actions to avoid them.

Two interns were hired through the Student Conservation Association to conduct daily monitoring beginning January 2015. Due to the extensive amount of work, an additional two interns were hired for the 2016 season for a total of four 2016 winter bat monitoring interns. Primary duties include daily bat

monitoring activities, moving downed bats from areas of potential human contact, and reporting WNS behaviors and infected bats. Additionally, dead or moribund (near death) bats are collected, processed, and sent for testing.

Collected specimens are shipped to the National Parks Wildlife Health Branch in Fort Collins in cooperation with Colorado State University pathology lab, where they are tested for rabies and WNS. The park submits bats to the Southeastern Cooperative Wildlife Disease Study at the University of Georgia, if a bat potentially is a new county or species record for WNS. These partnerships are longstanding and in-line with interagency protocols.

As a result of the risk assessment aspect of the DOIT conference, it was determined that certain routes would be more prudent to monitor due to a higher probability for human-bat contact. A three tier system of monitoring caves was an aspect of the 2011 management plan at MACA that the DOIT utilized during their risk assessment.

Bats moving forward towards cave entrances is an aberrant behavior of WNS. To detect this type of behavior, entrance checks (Tier 3 monitoring) were instituted at Long Cave, Colossal Cave and Dixon Cave. A fifteen minute survey is conducted where the surveyors will watch for any flying bats, collect dead or moribund bats, and note the number of bats near the gate when a gate check is conducted. Additionally, temperature readings at the cave entrance and at the surface are documented, as well as, current weather conditions.

Tour trail monitoring and cave entrance checks occur on a variety of schedules depending on the area. They also varied by year, due to an increase in staffing in the winter/spring of 2015-16 (Table 1, 2).

Table 1: Cave entrance and tour route monitoring schedule for winter 2014-15.

First year (2014-2015) cave tour route surveys		
Route	Survey frequency	Mileage
Full Historic	Daily	2 mile loop
Domes and Dripstones	Every other day	¾ of a mile
Cleveland Avenue	Weekly	1 mile round trip
Great Onyx	Weekly	½ mile
First Year (2014-2015) Entrance Checks		
Route	Survey frequency	Mileage
Dixon Cave	Daily	n/a
Long Cave	Weekly	n/a

The major change between the 2014-15 and 2015-16 monitoring seasons was the alteration in the Historic tour route. The Historic tour route is under construction (2015-2016) which has led to an increase in Domes and Dripstones tours to account for the lack of Historic tours run during the winter.

At the beginning of the season, the Historic short route was monitored twice a week and a Historic full route once per week. Due to noise concerns from construction that was occurring near a known Indiana bat (a federally endangered species) winter roost, the decision was made by the Science and Resource Management division to return to daily monitoring of the short route.

While the majority of the surveillance is conducted through Science and Resource Management, opportunistic surveillance is also utilized. By employing interdivisional cooperation, tour guides and other park employees are asked to inform their shift supervisors of any bat activity or dead/moribund bats while conducting their

daily duties. The shift supervisors relay the message to Science and Resource Management where the information can be properly documented for future reference. A binder with data sheets for employees to record where and when they had seen a flying bat(s) were placed in each division within the park.

Another recommendation from the DOIT was to have “bat kits” placed along toured routes so that problematic or moribund bats could be handled safely and efficiently. Kits were put in extra-large Ziploc™ bags (or in hard plastic tubs if subjected to woodrat damage) and placed in conjunction with first aid kits along toured routes for easy access.

The kits include a collapsible net to place over a distressed or downed bat on the ground, gloves and tongs to handle or pick up dead bats, and smaller Ziploc™ bags

Table 2: Cave entrance and tour route monitoring schedule for winter 2015-16.

Second year (2015-2016) cave tour route surveys		
Route	Survey frequency	Mileage
Full Historic	Weekly	2 mile loop
Short Historic	Daily	1 mile
Domes and Dripstones	Daily	¾ of a mile
Cleveland Avenue Entrance Stairs	Daily	250 ft
Cleveland Avenue	Weekly	1 mile round trip
Great Onyx	Weekly	½ mile
Second year (2015-2016) cave entrance checks		
Route	Survey frequency	Mileage
Dixon Cave	Daily	n/a
Long Cave	Weekly	n/a
Colossal Cave	Biweekly	n/a

plus a marker to write pertinent information on the collection bag. Light sticks are an additional item included in the kit to place beside the net covering a moribund or dead bat if whoever found it was not comfortable with placing the specimen in a bag. An information sheet with the bat handling procedure was also included.

With safety being of paramount importance, it should be noted that only people with rabies pre-exposure vaccinations would use these kits on live, active bats. While any employee is able to handle dead or moribund bats and move them off trail wearing the proper PPE included in the kit, they are allowed to decline the duty and report it to the bat interns for addressing according to their comfort level. For instance, a person without the vaccination could trap a moribund bat with the net, but actual handling would be left to those with rabies pre-exposure vaccinations.

Employees throughout the park divisions were selected to receive rabies shots or boosters so that every division has a representative who could handle potentially rabid animals, including bats, if needed. A total of thirty one employees in the park now have these vaccinations/boosters.

A WNS resource binder is also available to educate other park divisions and staff about the disease, its spread, and how the park was addressing the issue. The binder is updated as new information and studies regarding WNS are published. The availability of this resource binder, in addition to the efforts by the Interpretation division to inform the public, directly addresses the final task from the DOIT conference to develop communication and educational materials for visitors, external stakeholders, and park employees.

Conclusion

Moving forward, education and outreach efforts will remain of paramount importance and will be continued in an attempt to preserve areas untouched by WNS and teach visitors the importance and value of bats. Systematic winter monitoring conducted by interns from the Student Conservation Association will also remain important as a key contribution to daily observations.

Mammoth Cave National Park has been responding to WNS since 2008. This response has varied with changing circumstances, and it has become more intense since the arrival of WNS on park in 2013. In the future, the park will continue to use adaptive management strategies to combat other issues as they arise.

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