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Kentucky WNS Response Plan Updated January 2014

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Kentucky WNS Response Plan Updated January 2014



Northern long-eared bat with visible signs of white-nose syndrome in B&O Cave, Breckinridge County, KY.
Photo Credit: Mike Armstrong/USFWS KFO

Prepared by:

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Kentucky's plan was the first state plan completed and has been used as a model for other states desiring to slow and contain the spread of WNS.

This plan has been prepared to address pre- and post- WNS arrival in Kentucky. We feel these measures, to the best of our knowledge, have been effective in slowing the spread of WNS into Kentucky when compared to how quickly the disease spread through Northeastern states. This document is available to other states for use in developing their own WNS response plans.

Questions regarding this plan can be directed to Brooke Hines at brooke.hines@ky.gov or 502-564-3400 ext 4573 and Mike Armstrong at mike_armstrong@fws.gov or 502-695-0468 ext 101.

Kentucky WNS Response Plan: Updated January 2014

I. Pre-WNS Arrival in KY

a. Baseline Monitoring

- i. Reichard Wing Damage Index (WDI) must be used on all bats captured in KY
 1. If bats score 2 or higher:
 - Take pictures of bats wings following WDI
 - Contact KDFWR and KYFO
- ii. Bat Population and Habitat Data Collection:
 1. Acoustic transect project
 2. Gray bat and Virginia big-eared bat annual summer emergence surveys (KDFWR & KYFO)
 3. Baseline data collection to document usage of hibernacula by bats during the summer.
 - Beam-break system(s) recording activity at selected hibernacula year-round
 - Acoustic monitoring at selected hibernacula year-round
 4. Continue long-term monitoring projects and start new ones as dictated by research needs
 5. Deploy Hobo data loggers in cave roosts to document microclimate variability.
 - Gray and Virginia big-eared bat summer caves to document summer roost microclimate variability
 - Selected winter hibernaculum to document winter roost microclimate variability

b. Presence/Absence Survey Guidance for KY's Endangered Bat Species:

- i. Summer mist net guidance for Indiana bat
 1. Delay mist netting until June 1st for ALL presence/absence surveys
 2. Strict decontamination protocols for all equipment (see current USFWS protocol)
 3. Consider shifting techniques used for presence/absence surveys to include more acoustic monitoring (or assume presence) to address transmission concerns.
- ii. Fall/spring Indiana bat potential hibernacula guidance modification
 1. Utilize Phase I assessment to determine potential bat use and minimize amount of harp trapping at caves/mines
 2. Strict decontamination protocols for all equipment (see current USFWS protocol)

- c. Management of Caves
 - i. Develop, purchase, and provide cave closure signs to Federal, State, and private land owners
 - ii. Coordinate with State and Federal land managers, and private cave owners (including commercial) to educate, request support, and coordinate temporary, voluntary cave closures
 - iii. Install beam-break at selected sites
 - iv. Consider purchase of cave monitoring equipment to provide to interested fed/state land managers and private landowners
 - v. KDFWR & KFO letter to KY Cave Owners asking for closure of private lands caves
 - vi. Meetings with KSS, KGS, Grottos, etc... to educate, request support, and coordinate temporary, voluntary cave closures
- d. Continually Coordinate with Researchers on High Priority Projects as defined by the following National WNS Response Plan Working Groups
 - i. Disease Management Working Group
 - ii. Conservation and Recovery Working Group
 - iii. Diagnostics Working Group
 - iv. Epidemiology, Etiology, and Ecology Working Group
 - v. Surveillance Working Group
 - vi. Others
- e. Winter Surveillance and Bat Population Monitoring
 - i. Identify point of contact's and coordinate responsibility for field work with appropriate agencies, NGO's, and landowners:
 - 1. Mammoth Cave National Park (MACA)
 - 2. Carter Caves State Resort Park (CCSRP)
 - 3. Daniel Boone National Forest (DBNF)
 - 4. KDFWR & KYFO scheduled T&E hibernacula monitoring
 - 5. KDFWR & KYFO non-scheduled T&E hibernacula monitoring
 - 6. NGO's (e.g., grottos) other unknown hibernacula (most likely non-T&E)
 - 7. Other privately owned caves
 - ii. Conduct annual monitoring of scheduled hibernacula with surveillance of all other hibernacula:
 - 1. A 3 tier system for WNS Monitoring and Surveillance:
 - Tier 1: Population Monitoring - conduct annual monitoring (count plus digital photography) of scheduled hibernacula. Will require decontamination.
 - Tier 2: Spot checks - researchers with experience at the hibernacula will enter selected (by KFO & KDFWR) non-scheduled hibernacula and check for the presence of fungus, of bats roosting in abnormal places, etc. Will require decontamination.

- Tier 3: Entrance checks - visit many hibernacula and check for bat activity or bats roosting near the cave entrances. Make sure these visits are on days that would normally be too cold for bat activity. Does not require decontamination.

f. Outreach:

i. Nuisance Wildlife Control Operators (NWCO) -permitted by KDFWR

1. Educate on WNS

- Inform permitted NWCO in KY by educating them on WNS and directing them to WNS Control/Mitigative Protocols

2. Provide directions on what to do if bats are discovered showing signs of WNS (e.g., flying around in winter, dead on landscape in winter)

- Before bats are collected, KDFWR/KYFO should be consulted to determine the deposition for the specimens.
- If bats are collected:
 1. body condition should be assessed
 2. wing damage index (WDI)
 3. either sent off for analyses or frozen for later use
- Disinfection protocols should be followed by any person handling WNS affected bats on the landscape (USFWS Protocols and video)

ii. Rabies Labs/NWCO/ KDFWR Conservation Field Officers

1. Educate on WNS

- Inform permitted NWCO's about WNS
- Coordinate with Health Department
 1. Establish an MOU that allows rabies negative bats to be released to KDFWR for identification and WNS lab testing
- Educate KDFWR CO's on what to expect regarding calls from public about potentially sick bats

2. Provide directions on what to do if bats are discovered showing signs of WNS (e.g., flying around in winter, dead on landscape in winter)

- Before bats are collected, KDFWR/KYFO should be consulted to determine the deposition for the specimens.
- If bats are collected:
 1. body condition should be assessed
 2. wing damage index (WDI)
 3. either sent off for analyses or frozen for later use
- Disinfection protocols should be followed by any person handling WNS affected bats on the landscape (USFWS protocols and video)

g. Miscellaneous Tasks

- i. Compile band recoveries and map for Indiana bats and gray bats within KY and to other states
- ii. Send T&E Monitoring to USFWS Species Leads and share WNS Surveillance data with appropriate State/Federal managers
- iii. Beware of data needs for researchers throughout the US working on WNS. Help out with specimen collection as much as possible as long as appropriate justification is provided for collection of samples and the removal of bats from roosts doesn't result in a significant reduction in individual or overall species population at the roost.
- iv. Provide guidance on sample collection. Follow the USGS/SCWDS Bat WNS Submission Protocols.
- v. As there will likely be more dead bats observed (even if it is not related to WNS, but instead a response to increase vigilance), State/USFWS biologists should make plans for specimens to be sent to museums.
 - 1. The American Museum of Natural History is set up to collect specimens. Coordinate with Dr. Nancy Simmons to determine the number of specimens that can be accepted and the requirements for submittal.
- vi. Purchase response materials (wildlife netting, exclusion materials, etc.), bins for equipment, decontamination liquids, etc.
 - 1. TYVEC suits (provided by KDFWR and KYFO) for ALL cave entry

II. Post-WNS Arrival Response

a. Acoustic transect project

- i. Collect data pre- and post-WNS arrival throughout the State
- ii. Analyze and compare pre- and post-WNS data
- iii. Determine population status, trends, and population estimates of bat species occurring in KY during the summer

b. Gray bat and Virginia big-eared bat annual summer emergence surveys (KDFWR)

- i. Collect data pre- and post-WNS arrival at known maternity sites
- ii. Analyze and compare pre- and post-WNS data
- iii. Determine population trends and juvenile recruitment

c. Field Response to WNS:

- i. Monitoring & Surveillance based on the 3 tiered approach described above
- ii. Develop site/complex-specific WNS Response Plans for sites/complexes once confirmed positive for WNS (see Appendix 1)
- iii. Any additional response within the site/complex-specific response plan will reflect species present, number of bats (last current Tier 1), the type of summer cave roost and/or hibernacula (i.e., cave or mine), and how the roost is utilized (summer bachelor, summer maternity, hibernacula, or any combination).

1. Entrance Netting - use wildlife netting to cover all known entrances to eliminate egress/ingress of bats during winter only (if feasible)
 - a. WNS affected bats should not be allowed to transmit the fungus to new sites in the immediate area.
2. Roost Exclusion-to exclude specific roosting areas within the cave where WNS infected bats were observed (if feasible)
 - a. WNS affected bats should not be allowed to transmit the fungus to new roosting areas within the site.
3. **Test approved chemical and biological controls**
 - a. **Obtain lab results of compounds or biological agents**
 - b. **Conduct field trials during fall swarming or in the absence of bats at selected hibernacula**
 - c. **After DMWG review, move forward with management applications**
4. If feasible, collect affected bats or swab:
 - a. Send to lab for confirmation - especially species not previously documented to be affected (e.g., Virginia big-eared)
 - b. Transport affected bats to holding facility for ex-situ treatment with approved biological or chemical treatments

d. Strategy/Follow-up Response to WNS

- i. Notification of Necessary Individuals:
 1. KDFWR Commissioner
 2. Service FO supervisor
 3. landowner/manager
 4. select group of biologists
 5. press/public
- ii. Decontaminate all gear used in affected cave following current USFWS Decontamination Protocols.
- iii. Identification of known roosts/hibernacula within a 10 miles radius of newly affected site and focused surveillance of these identified sites (could extend radius beyond 10 miles if only small number of roosts/hibernaculum exist).
- iv. Investigate visitation at infected site to inform how transmission may have occurred.
- v. Place WNS affected cave/mine sign outside entrance
- vi. Specific Follow-Up Response Options (if feasible):
 1. Re-check site as needed to monitor rate of transmission
 2. Continue swabbing affected bats for new species confirmation

e. Documentation

- i. Document % infected by species

- ii. Document roosting locations of all bats on cave map, if possible, or detailed description in field notebook
- iii. Photograph clusters, visibly infected, roosting locations
- iv. Record site visit details and any WNS research in bat database

Appendix 1. Example Site/Complex Specific WNS Response Plan for KY

KY WNS SITE SUMMARY, MANAGEMENT OPTIONS, & RECOMMENDATIONS

Site Name: [REDACTED] Cave

Location: Breckinridge County, KY (Lat/Long: [REDACTED])

Ownership: Private (lives on-site); [REDACTED]

Gate Status: Gated in 6/2012

Bat Species Use: A total of 7 species documented to use [REDACTED] Cave as a winter hibernaculum. Species include: *Myotis sodalis* (MYSO) (federally endangered); *Myotis grisescens* (MYGR) (federally endangered); *Myotis lucifugus* (MYLU), *Myotis septentrionalis* (MYSE), *Myotis leibii* (MYLE), *Perimyotis subflavus* (PESU), and *Eptesicus fuscus* (EPFU). No summer use of this cave by cave obligate bat species is known at this time.

Timeline – At 11:45 AM EST on January 10, 2012, Brooke Hines (KDFWR bat ecologist) and Jim Barnard (KDFWR bio tech), Mike Armstrong (USFWS bat biologist), and Price Sewell and Teresa Wetzel (Contracted bat surveyors from Copperhead Consulting) arrived at [REDACTED] Cave and completed a 15 minute Tier 3 entrance survey to document if any bats were exiting the cave. No bats were observed exiting the cave during this Tier 3 survey.

At 12:00 PM, we entered [REDACTED] Cave to conduct a Tier 1 population survey of the hibernating bats. After making the short crawl and approximate 15 foot drop to the first small “entrance” room, we observed that significantly more bats were present within this room than during past surveys. As we continued into the entrance room section, we noticed a cluster of five MYLU tucked in a crevice. One of the five MYLU was observed to have WNS¹. This bat was located approximately 8 inches into the crevice and could not be extracted for collection, euthanization, and lab submission. The decision was made to continue with the survey to document the extent of visible fungal growth and if a more easily reachable specimen showing similar signs of infection could be found. Within a few minutes a mixed cluster of eight MYLU and MYSE were observed with five of these individuals showing signs of WNS infection around the muzzle. One MYSE was selected from this cluster, collected, and euthanized for confirmation of WNS. At the same time, a cluster of two PESU were found with one of these individuals also showing signs of infection around the muzzle and a significant portion of hair and skin on the dorsal side of the bat was missing. The decision was made to also collect this individual for testing and WNS confirmation. No other bats were collected or euthanized during the remainder of the population survey.

¹ For the purpose of estimating percentage of infected bats by species during this population survey, the decision was made that only bats observed with the classic white fungal growth around their muzzle would be considered WNS positive. This decision was made partly because [REDACTED] cave has a significant amount of gypsum dust that often times is observed on the forearms of healthy hibernating bats in the cave, thus we didn't want to risk over-estimating the percentage of infected bats. As a result, significantly more bats could have been infected but were not counted as such because they lacked the classic, visible white fungal growth around the muzzle and some of the bats may have aroused and groomed off the visible fungal growth.

A brief discussion of how to proceed resulted in the quick decision to continue with the population survey through the remainder of the cave with the added task of documenting the percentage of individual bats present, by species that were WNS positive. The following two tables document the findings of the population survey and estimate of percentage of bats infected by species. Table 1 includes bats observed in the first small “entrance” room and Table 2 documents the majority of the bats counted within the main passage. Several clusters and individual bats in the main passage were located too far away from surveyors to allow the confirmation of visible infection; thus, photos were taken of the majority of the larger clusters of these bats so that a closer inspection could be completed back in the office. After further inspection of photos in the office, no additional bats were discovered showing visible signs of WNS. The estimates in the tables below for infected bats includes bats that were close enough for visual WNS infection with the naked eye as well as additional bats that were examined in the office by photo documentation.

Table 1. Population estimate and percentage infected with WNS by species (entrance room).

SPECIES	Total # of Individuals	# of Infected Individuals	% Estimate of WNS Infection
MYSO	N/A	N/A	N/A
MYLU	108	2	2%
MYSE	22	7	32%
MYGR	N/A	N/A	N/A
MYLE	1	0	0
PESU	17	2	12%
EPFU	1	0	0
TOTAL	149	11	7%

Table 2. Population estimate and percentage infected with WNS by species (main passage).

SPECIES	Total # of Individuals	# of Infected Individuals	% Estimate of WNS Infection
MYSO	3,271	0	0
MYLU	1,686	32	2%
MYSE	18	2	11%
MYGR	6	0	0
MYLE	N/A	N/A	N/A
PESU	179	6	3%
EPFU	N/A	N/A	N/A
TOTAL	5,160	41	0.80%

Overall, a total of 5,309 bats were estimated within █████ Cave during this Tier 1 hibernaculum survey. Of this total, we estimated 1,794 *Myotis lucifugus*, 3,271 *Myotis sodalis*, 196 *Perimyotis subflavus*, 40 *Myotis septentrionalis*, 6 *Myotis grisescens*, 1 *Myotis leibii*, and 1 *Eptesicus fuscus*. A banded female Indiana bat was observed with band number B09499. This bat was captured by Copperhead Consulting on 10/5/11 at Ft. Knox during a fall migration study. Ft. Knox is approximately 50 km (30 mi) from █████ cave.

Note: The last Tier 2 WNS surveillance of [REDACTED] Cave was completed on February 4, 2011, no signs of WNS were observed during that survey. No suspicious bats were observed or taken for lab analysis. A banded, male Indiana bat was observed with band number INB1391. This bat was originally banded at [REDACTED], IN on 10/19/2009.

Population at last Survey:

1. Hibernation Use: A total of 4,617 bats were estimated within [REDACTED] Cave during the last Tier 1 hibernaculum survey on February 12, 2010. Of this total, we estimated 1,484 *Myotis lucifugus*, 2,924 *Myotis sodalis*, 207 *Perimyotis subflavus*, 2 *Myotis septentrionalis*.
2. Summer Use: On 6/22/1998, an ocular estimate was conducted at the cave and 168 bats emerged, species unknown. No follow-up visits are documented.

Type of Bat Use: Winter hibernaculum, unknown species summer use

Other Known Bat Cave Roosts within 20 miles of Site: See Figure 1.: Breckinridge County:

[REDACTED]
(See Figure 1).

1. Hibernation Use: [REDACTED] caves have documented winter use by T&E and non-T&E bats.
2. Summer Use: [REDACTED] may be former MYGR summer site

Type of Bat Use: Winter hibernaculum, questionable Summer MYGR maternity roost

WNS Management Options: (per latest version of KDFWR/KYFO WNS Response Plan)

1. Population Monitoring (Section II. b & II.c.1 of WNS Response Plan): Because [REDACTED] Cave is a winter hibernaculum for MYSO and a small number of MYGR, we will continue with scheduled winter hibernaculum surveys. [REDACTED] Cave is scheduled for next winter hibernaculum Tier 1 survey in 2014.
2. Field Response to WNS (Section II.c-e. of WNS Response Plan):
 - i) Monitoring & Surveillance based on the 3 tiered approach described above ([see 1 above](#))
 - ii) Any additional response will reflect the species present, number of bats, and the type of summer cave roost and/or hibernacula (i.e., cave or mine).
 - (1) Entrance Netting – use wildlife netting to cover all known entrances to eliminate egress/ingress of bats during winter only – [Because WNS was first observed early in the winter hibernation season, the use of entrance netting may be a useful tool to eliminate egress/ingress of bats during the hibernation season. Surveillance of other known hibernaculum within 20 miles of \[REDACTED\] cave will be critical in the decision whether or not this management option should be pursued further. If other caves within this radius are also found infected and any of these caves could](#)

not also receive the same exclusion netting, then it is less likely the use of entrance netting at [REDACTED] cave would be helpful in reducing transmission of Gd and WNS. Given the small size of the only known entrance, we believe this would be easy to accomplish with a small amount of wildlife netting at [REDACTED] cave. Disadvantages of eliminating ingress/egress of bats is that it would remove the opportunity for these infected bats to leave the cave and potentially find some food and water during what has been an unusually warm winter thus far in 2012. There is growing support among bat researchers (see Boyles et al proposal) working on WNS that one reason why infected sites in the more southern range of WNS have not to date observed significant mortality is because of the shorter hibernation seasons and warmer climate that could allow bats to leave the infected site to forage and drink and basically find relief from the infection by somewhat replenishing their reserves.

- (2) WNS affected bats should not be allowed to transmit the fungus to new sites in the immediate area. – There are several known hibernacula and other caves within the 20 mile radius to [REDACTED] cave.
- (3) If feasible, collect affected bats: - Submitted one MYSE and one PESU from [REDACTED] Cave for testing on 1/12/2012.
 - (a) Send 2-3 to lab for confirmation – especially species not previously documented to be affected (e.g., Virginia big-eared and gray bats) – The only species present within [REDACTED] Cave that has not been previously documented as susceptible to WNS is MYGR. This species has been confirmed PCR+ for the fungus (Gd) in Missouri but not confirmed for WNS. Therefore, we will continue to closely monitor this species and submit one individual for testing if it becomes apparent that the species may be showing signs of infection (Due to its federal listing status, only one MYGR may be collected from the site and submitted for WNS testing).
 - (b) Transport affected bats to holding facility for ex-situ treatment with fungicide –not an option at the current time because lack of a captive holding facility. However, there is a possibility of taking bats to a holding facility for use in WNS related research.
 - (c) Removal of individual moribund bats from clusters – We considered removing all non-federally listed infected bats from [REDACTED] Cave that are showing signs of WNS infection at the time of discovery of infection. This would attempt to slow the spread of the disease to other bats both within the site as well as at other sites nearby. This management option was quickly dismissed for the following reasons: the number of obviously infected bats was already significant, those observed infected individuals were spread throughout the entire hibernacula, a large number of the infected bats were beyond the reach of surveyors, and the presence of a large number of MYSO (federally endangered) immediately adjacent to the target non-federally listed bats limits any opportunity without causing undue stress on MYSO. In addition recent research coming out of the Northeast, suggests that some MYLU are surviving WNS infection (Fort Drum paper in recent JFWM).

(d) Removal of dead bats from hibernacula – We will remove all dead bats from the hibernaculum that are in good condition and may be used by researchers. Scavenging by predators may limit our ability to collect dead bats at this site.

(4) If collection of affected bats is impossible (ceiling too high, etc.) then consider harp trapping in the spring to collect affected bats for confirmation, transport to holding facility, and/or removal from population. –Harp trapping bats this spring may be used as a means to monitor infection, confirmation of MYGR, and removal from population non-federally listed species). The presence of MYSO and MYGR at the site will be a consideration in determining if this method of surveillance and monitoring the population should be used. It may be that the use of this method would be too stressful on the MYGR, especially given the fact that there is currently no indication that MYGR are susceptible to WNS beyond carrying the fungus.

b) Strategy/Follow-up Response to WNS

i) Notification of Necessary Individuals:

(1) Service FO supervisor – notified by text on 1/10/12

(2) KDFWR Commissioner –Sunni Carr was notified by text on 1/10/12

(3) landowner/manager –has not been notified at the current time due to home phone disconnected and mobile phone not accepting calls. Brooke Hines spoke to mother of [REDACTED] on 1/18/12 and let her know that WNS was observed in the cave. She said she would pass the information along to her daughter and son-in-law and have them contact Brooke Hines.

(4) select group of biologists –KBWG, adjacent states' wildlife agencies and federal counterparts - have not been notified at the current time

(5) press/public – We do not anticipate a joint KDFWR/FWS KYFO press release at this time; however, we recommend the development of a one-page white paper that could be posted on the KDFWR and FWS KYFO websites about the confirmation of WNS at a new site in Breckinridge County.

ii) Isolate all gear used in affected cave by double bagging the equipment and placing in a plastic box to ensure gear is only used in affected caves in future. – All future work at the site will follow this protocol.

iii) Identification of known roosts/hibernacula within a 20 mile radius of newly affected site and focused surveillance of these identified sites.- See “Other known bat cave/roost within 20 mile radius” for list of caves/hibernacula. Focused surveillance of these sites occurred immediately with Tier 1 surveys being completed at all significant known hibernacula on January 17, 2012. We have also looked to see if any MYGR summer roosts are known in the immediate vicinity of this site and talked with local cavers/landowners to inquire about the potential for additional sites to be present.

iv) Investigate visitation at infected site to inform how transmission may have occurred.

– [REDACTED] Cave is the closest known hibernaculum in KY to infected sites in Crawford County, IN. Therefore, we certainly would expect that bat to bat transmission may be

responsible for the arrival of WNS at this site. Also, no indication that human visitation has occurred at [REDACTED] cave recently (pers comm. Glenn Driskell, caver and member of Fort Knox Grotto).

v) Place WNS affected cave/mine sign outside entrance- The landowner was not home upon completion of the population survey so we were unable to notify them that their cave is WNS positive. The landowner must be contacted prior to any press or broad scale release of this information beyond the KDFWR and FWS KYFO. Upon contact, we will not only notify them that the site is WNS positive but also educate them of the importance of limiting all future human visitations within the cave for non-WNS monitoring research activities in order to limit the potential for transmission of *Gd* to uninfected caves. KDFWR will also offer to post “Absolutely No Admittance beyond this Point” Signage near the cave entrance.

vi) Specific Follow-Up Response Options:

- (1) Re-check site every 6-8 weeks to monitor rate of transmission - Yes
- (2) Continue collecting affected bats for new species confirmation, treatment, and removal of moribund bats – No, with the exception of future observation of visible signs of WNS on MYGR within [REDACTED] cave. All other species present within the site have been previously confirmed to be affected by WNS.
- (3) Continue removal of dead bats at affected site - Yes
- (4) Release ex-situ treated bats back outside of hibernacula after confirmation of spring emergence by remaining hibernating population. –N/A, see above discussion.
- (5) Euthanize some ex-situ treated bats and send to lab to determine success of treatment- N/A
- (6) Remove wildlife netting immediately prior to spring emergence- Maybe, see above discussion and note that as research opportunities are currently prioritized we would consider this if #1 could not be completed.

c) Documentation

- i) Surveillance Data Sheets
- ii) Photographs

Field notebooks – record of what is implemented to determine result of implemented response

Additional WNS Research Opportunities:

1. We have an opportunity to evaluate the possibility that activity during winter is important to survival of bats affected by WNS. Specifically, we could study winter activity of bats outside [REDACTED] cave. We will focus our efforts primarily on MYGR, MYSE, PESU, and MYLU. MYGR is federally endangered, and although infection by *Gd* has been reported in this species, there is, as yet, no evidence of mortality. In contrast, WNS-associated mortality of MYLU, PESU, and MYSE has been exceedingly high in northern parts of the range of both species. Preliminary bat activity data collected in KY and TN with acoustic detectors during winter 2010-2011 suggest

winter-time activity outside hibernation sites, especially in the southern United States where insects are episodically available, may be important for the survival of bats infected with *Gd*. To test this hypothesis, we could measure bat activity on the landscape and assess their diets from fecal pellets. In addition, swab samples could be collected from wings and pelage of bats captured while active in winter. These swabs will be tested for the presence and abundance of *Gd* DNA as part of an effort that is independently funded at no cost (Kunz et al study). Establishing the presence and fungal load of *Gd* on bats throughout winter will address an additional priority of the FWS RFP, i.e. understanding “which season(s) is the most critical for *Gd* transmission or movement”. (Boyles et al research project).

2. Does *Gd* and/or WNS continue to persist on bats that are using the infected cave during the summer (non-hibernation) season? There were 168 unknown species of bats which emerged in June 1998 but no follow-up trapping or netting effort was completed. Summer trapping should be done to determine if this research idea could be viable for this site.
3. Can banding of bats upon spring emergence give us an idea of how many survive the summer, return to the site, and when signs of infection are visible?
4. Can we document *Gd* in the air by using an air sampler within the cave?
5. A banded MYSO found within the cave during the population monitoring was discovered to be from a well studied maternity colony at Fort Knox (approximately 30 air miles). Can we possibly locate this bat again in the cave (at spring emergence) or a handful of other female bats (MYSO or other species like MYLU or MYSE that are showing signs of infection), place transmitters on them at spring emergence, track them to their summer maternity colony and begin a study of how long *Gd* persists on infected bats within its summer colony and whether it transmits *Gd* to other individuals within the summer colony? (Ford Study?)
6. We should definitely use this site as a sample site to support NWHC studies into fall swarming bats (Ballmann).
7. We should definitely use this site as a sample site to support NWHC studies into fungal loads of *Gd* in caves (Blehert).
8. We could compare torpor bouts of varying species of infected bats throughout the winter with iButtons. We would select only obviously infected bats (white muzzles) and place TS transmitters on an equal number of these bats and release the bats back within [REDACTED] cave. At the same time placing a receiver and antenna(s) within the cave to record data.
9. We are interested in learning from infected states in the Northeast if they assessed the health (e.g., weight or some other measures) of individual bats as they emerged from infected hibernaculum prematurely (prior to end of hibernation season). If they have this information, then it would be interesting to monitor the bats at [REDACTED] to determine when (if) bats begin a similar premature emergence from the site this winter and also assess health of our bats to compare to the Northeast bats. It may be that our bats emerge significantly healthier than those bats in the Northeast did; therefore indicating that they might survive .

Recommendations: We believe at a minimum that all actions highlighted above that are already included in our KDFWR/KYFO WNS Response Plan should be implemented immediately. We also believe that research opportunities #1, 2, 6, and 7 above should be strongly considered as well as potentially #3, 5, 8, and 9 dependent upon what we learn as the winter progresses.

Figure 1. Known Hibernaculum and other Caves within 20-miles of [REDACTED] Cave.

Figure removed to protect cave names/locations

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