



**2011 White-nose Syndrome
Monitoring and Bat Population
Survey of
Hibernacula in Tennessee**

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*Cover photo of white-nose infected tri-colored bat (*Perimyotis subflavus*) in Cooper Creek Cave taken by Cory Holliday of The Nature Conservancy*

Acronyms

AAFB.....	Arnold Air Force Base
APSU.....	Austin Peay State University
NPS.....	National Park Service
PCR.....	Polymerase Chain Reaction
SLP.....	Salt-peter
TCS.....	Tennessee Cave Survey
TDEC.....	Tennessee Department of Environment and Conservation
TVA.....	Tennessee Valley Authority
TWRA.....	Tennessee Wildlife Resources Agency
TNC.....	The Nature Conservancy
USGS.....	United States Geological Survey
USGS-NWHC.....	United States Geological Survey's National Wildlife Health Center
USFWS.....	United States Fish and Wildlife Service
WNS.....	White-nose Syndrome

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Introduction

To monitor the recovery success of endangered bat species in Tennessee, agencies and non-governmental groups within the state have historically conducted winter bat hibernaculum censuses. These have been on either a bi-annual basis or staggered every three years depending on the species involved and availability of personnel. Surveys generally focus on the two endangered species of bat found in Tennessee, *Myotis sodalis* (Indiana bats) and *Myotis grisescens* (gray bats). However, with the new concern of bat population decline due to White-Nose Syndrome (WNS), there is an increased awareness of the need to not only continue monitoring the status of these endangered species, but to also assess the numbers and health of the common species of cave hibernating bats.

WNS and the related *Geomyces destructans* fungus were first recorded in Tennessee in the winter of 2010. The fungus was found on three species of bats (*Myotis lucifugus*, *Myotis septentrionalis*, and *Perimyotis subflavus*) in six caves and in six different counties (Table 1). The documented occurrences included two confirmed infection sites where bats showed histological confirmation of fungal infection within the tissue, and four suspect sites. In suspect sites bats observed showed some signs of *G. destructans* but only tested positive for the fungus through genetic testing and did not show the histological fungal infection necessary for a confirmed WNS case.

In accordance with the 2010 Cooperative White-Nose Syndrome Monitoring and Surveillance Plan for Tennessee (Lamb and Wyckoff, 2010), the winter 2010-2011 hibernaculum monitoring was conducted with the following goals in mind:

- Minimize the potential for monitoring and research projects to contribute to the spread of WNS.
- Continue the WNS surveillance begun in 2009.
- Document the degree of mortality at WNS infected hibernacula.

The first of these goals was accomplished through strict adherence to the U.S. Fish and Wildlife White-nose Syndrome Decontamination Protocols found on the service's website (<http://www.fws.gov/whitenosesyndrome/research.html>). The remaining goals were addressed through surveys at a total of sixty-one caves in twenty-six Tennessee counties with increased emphasis on common species of bats and banding efforts. It is important to note that although significant effort was made by all agencies and individuals involved in this year's surveys, the number of caves visited represents less than 1% of the approximate 9,600 caves found in Tennessee. Any conclusions or predictions concerning the spread of WNS in Tennessee and its affect on the bat population should take this into consideration.

Table 1. 2010 affected caves and infection description.

2010 White-nose Syndrome Occurrences in Tennessee		
Cave Name	County	Infection Status
Grindstaff Cave	Carter	Confirmed, histology positive
Worley (Morril's) Cave	Sullivan	Confirmed, histology positive
Dunbar Cave	Montgomery	Suspect, PCR positive
East Fork Salt Peter Cave	Fentress	Suspect, PCR positive
White Oak Blow hole Cave	Blount	Suspect, PCR positive
Camps Gulf Cave	Van Buren	Suspect, PCR positive

Methods

The 2010-2011 winter hibernacula surveys were conducted between February 2nd 2011 and April 1st 2011. The surveys were purposefully scheduled later in the season compared to previous years to allow for the development of WNS symptoms which seemed to appear later during the 2009-2010 hibernation season. Sixty-one caves were surveyed during the 2010-2011 season by members of eight different agencies or organizations (Table 2). The Cooperative White-Nose Syndrome Monitoring and Surveillance Plan for Tennessee (Lamb and Wyckoff, 2010) set the objectives of the 2010-2011 hibernacula surveys which fell into one of four categories with overlap in some cases.

1.) WNS Surveillance

Conducted at all the caves visited, WNS surveillance followed a tiered approach designed to detect possible WNS infection and to minimize disturbance during surveys (Lamb and Wyckoff, 2010). Tier 1 surveys, in which a full hibernaculum count, examination of all accessible bats for signs of WNS, and band placement and/or recovery (where appropriate), occurred at forty-four caves. Tier 2 surveys, where a quick population estimate, examination of all accessible bats for signs of WNS, and band recovery (where appropriate), occurred at ten caves. And tier 3 surveys which involved observations made outside of cave entrances to check for unusual winter bat behavior (e.g. daytime activity in the cave entrance) occurred at seven caves with multiple visits made to two sites. A summary of caves visited and corresponding survey tier can be found in Table 2.

2.) WNS Mortality Monitoring

The six caves that were either confirmed or suspected to be WNS positive in 2010 were visited to assess the levels of mortality that may have occurred during the 2010-2011 hibernation period. These surveys were essentially Tier 1 surveys as described in the previous section on WNS Surveillance but specifically targeted WNS sites that may not have been normally scheduled for visitation in 2011.

3.) Biennial Indiana Bat Census

These surveys followed the normal monitoring protocols established by the USFWS draft recovery plan (USFWS 2007) and the Cooperative White-Nose Syndrome Monitoring and Surveillance Plan for Tennessee (Lamb and Wyckoff, 2010) with the exception of the survey dates. Again, in an attempt to increase the chance of detecting WNS symptoms, the survey dates were adjusted and surveys took place between February 2nd 2011 and April 1st 2011. Seventeen known *Myotis sodalis* sites were visited and one additional new occurrence was noted at Signature Cave in Franklin County. Tier 1 surveys were performed at all of these sites. Banding and band recovery took place at six of these caves, where individual bats could be safely retrieved (Table 5).

4.) Gray Bat (*Myotis grisescens*) Census

Although high priority gray bat hibernacula were surveyed during the winter of 2009-2010 (Samoray 2010) Rattling Pit Cave in Cocke County was not surveyed for logistical reasons. As stated in the Cooperative White-Nose Syndrome Monitoring and Surveillance Plan for Tennessee (Lamb and Wyckoff, 2010) an attempt to survey this cave during the 2010-2011 hibernation period was planned. However, again for logistical and scheduling reasons, this cave was not surveyed during this season's surveys.

Table 2. Cave survey schedule for winter 2011

Cave Name	County	Tier	Survey Date	Surveyors
Alexander	Perry	1	3/11/2011	TNC
Bat Cave	Sumner	1	3/31/2011	TNC
Bellamy	Montgomery	2 and 3	02/10/2011, 03/10/2011	TNC, TWRA
Bone	VanBuren	3	1/23/11, 2/3/11	TDEC
Bridge Creek	Putnam	1	3/24/2011	TNC
Bridgewater	Smith	1	2/15/2011	TNC
Buis Farm Cave	Claiborne	1	3/31/2011	TWRA
Bull	Blount	1	2/5/2011	NPS
Buzzard's	Jackson	1	3/17/2011	TNC
Cagle SLP	VanBuren	1	3/4/2011	USFWS, TDEC
Camps Gulf	VanBuren	1	3/17/2011	USFWS, AAFB, USGS
Caney Hollow	Franklin	1	3/15/2011	AAFB
Carlton	Franklin	2	02/17/11	TWRA
Cooper Creek	Montgomery	1	2/9/2011	TNC
Cornstarch	Fentress	1	2/17/2011	TNC, USFWS
Cumberland River	Jackson	1	3/17/2011	TNC
Devil Step Hollow	Cumberland	3		TDEC
Draper	Jackson	1	3/17/2011	TNC
Dudd-Haile	Jackson	1	3/15/2011	TNC
Duke's River #1	Jackson	1	3/17/2011	TNC
Dunbar	Montgomery	1 and 3	2/22/11, 2/8/11, 2/15/11, 3/2/11, 3/7/11, 3/17/11, 3/22/11, 3/29/11	TDEC, TWRA, APSU
Durham	Sumner	1	3/31/2011	TNC
East Fork SLP	Fentress	2	3/16/2011	TNC, USFWS, USGS
Flynn's Creek	Jackson	1	3/15/2011	TNC
Grassy Cove SLP	Cumberland	3		TDEC
Great Expectations	White	2	2/16/2011	TNC
Gregory's	Blount	1	03/16/11	TWRA, NPS
Grindstaff	Carter	1	2/24/2011	TNC, TWRA
Hardin	Davidson	1		
Herron	Rutherford	2	3/17/2011	TDEC
Hubbard's	Warren	2	3/2/2011	TNC, AAFB

Table 2 (continued). Cave survey schedule for winter 2011

2011 Hibernacula Survey Schedule				
Cave Name	County	Tier	Survey Date	Surveyors
Indian	White	1	3/3/2011	TNC
Indian Grave Point	Dekalb	2	2/4/2011	TNC, TWRA
Johnson	Putnam	1	3/25/2011	TNC, TCS
Keith	Franklin	1	4/1/2011	TNC
Kelly Ridge	Blount	1	2/6/2011	NPS
Little Bat	Warren	1	3/2/2011	TNC, AAFB
Little Jack Creek	Fentress	1	2/17/2011	TNC, USFWS
Lost Creek	White	2	2/16/2011	TNC, TWRA, USFWS
Marble Bluff	Roane	3	3/17/2011	TVA
Measles Gulf	White	1	3/1/2011	TNC, AAFB
Meredith	Campbell	1	3/22/2011	TNC
New Mammoth	Campbell	1	2/22/2011	TNC, TWRA
Norris Dam Cave	Campbell	1	2/23/2011	TVA
Oaks	Union	1	03/01/11	TWRA
Old Squire's SLP	Smith	1	2/15/2011	TNC
Pearson	Hawkins	2	03/23/11	TWRA, TNC
Rainbow	Blount	1	2/5/2011	NPS
Red Bud	Fentress	1	2/17/2011	TNC, USFWS
Rice	VanBuren	1	3/4/2011	USFWS, TDEC, AAFB
Rose	VanBuren	2	03/16/11	TWRA, AAFB
Salt peter	Blount	1	2/26/2011	NPS
Scott Gap	Blount	1	2/26/2011	NPS
Signature	Franklin	1	02/17/11	TWRA, AAFB
Tobaccoport SLP	Stewart	1	2/10/2011	TNC
White Oak Blow hole	Blount	1	3/27/2011	USFWS, NPS
Whiteside	Marion	1	03/07/11	TWRA, AAFB
Windlass	Cumberland	3	2/10/2011	TDEC
Wolf River	Fentress	1	3/18/2011	TNC, TWRA, USFWS
Worley (Morrii's)	Sullivan	1	2/24/2011	TNC, TWRA
Zarathustras	Fentress	1	3/23/2011	USFWS, AAFB

Results

WNS and Mortality Monitoring

Of the sixty-one caves surveyed, only eight showed signs of *G. destructans* infection (Table 3). Six of those eight caves were considered suspect or confirmed caves in 2009-2010. The two newly infected caves were Cooper Creek Cave in Montgomery County and Bellamy Cave, also in Montgomery County. A more detailed account of the surveys at these caves is given later in this report.

Table 3. 2011 Mortality survey results.

2011 Mortality Survey Results					
Cave Name	County	Survey Date	Species Affected	Evidence of WNS	WNS % Affected
Bellamy	Montgomery	3/10/2011	MYLU	Yes	<1%
Camps Gulf	VanBuren	3/17/2011	PESU	Yes	<1%
Cooper Creek	Montgomery	2/9/2011	MYSE, MYLU, PESU	Yes	12%
Dunbar	Montgomery	2/24/2011	NA	No	0%
East Fork SLP	Fentress	3/16/2011	MYLU	Yes	<1%
Grindstaff	Carter	2/24/2011	MYLU, PESU, MYsp	Yes	approx 45%
White Oak Blowhole	Blount	3/27/2011	MYSO, MYLU	Yes	<1%
Worley (Morrill's)	Sullivan	2/24/2011	PESU	Yes	42%

Previously Infected Sites

In the winter of 2009-2010, six caves in Tennessee were either confirmed or suspect WNS sites (Table 2). The status of those caves during the 2010-2011 survey is listed below.

East Fork Saltpeter Cave, Fentress County

This cave has been considered a suspect WNS site since the early fall of 2010 when one *M. septentrionalis* tested PCR positive for *G. destructans*. This year's survey showed no increased sign of WNS and no mortality. However one female *M. lucifugus* with trace amounts of a white substance on the elbow, wrist, and forearm, was euthanized and sent to USGS National Wildlife Health Center (NWHC) in Madison, Wisconsin for testing and came back PCR positive for *G. destructans* (Appendix A).

Camps Gulf Cave, Van Buren County

Camps Gulf Cave was classified as a suspect cave in 2010 after two *P. subflavus* tested PCR positive for *G. destructans* (Appendix A). Evidence of WNS was minimal during the 2010-2011 survey. However a single *P. subflavus* was euthanized and sent to the NWHC for testing. This bat did not test PCR positive for *G. destructans*. A report of the test results is in Appendix A of this document.

White Oak Blowhole Cave, Blount County

This cave was classified as suspect in 2010. The 2010-2011 survey found approximately four bats with visible fungal growth. One *M. lucifugus* was euthanized and sent to the NWHC for testing. Although the lab did find a fungus on this bat, it did not test positive for *G. destructans*. A report of the test results is in Appendix A of this document.

Dunbar Cave, Montgomery County

This cave was considered a WNS suspect site after a single *M. septentrionalis* tested PCR positive in 2010. This year's survey showed no signs of the *G. destructans* fungus; all bat numbers and roosting locations seemed to be consistent with those of previous years (D. Withers pers. comm.). A large flood event did occur in Dunbar Cave in May of 2010. It is not known how this may have affected bat behavior, but a significant amount of mud and sediment was left behind by this event.

Worley Cave, Sullivan County

This cave tested positive for *G. destructans* and showed histological evidence of WNS on *P. subflavus* in the winter of 2010. The 2010-2011 survey showed an increase in the number of bats and a large progression of WNS throughout the cave (Sterling Daniels, pers. comm.) Approximately 42% of the bats showed signs of WNS. Evidence of mortality at this cave was low with only two dead-hanging *P. subflavus* noted.

Grindstaff Cave, Carter County

Grindstaff Cave tested positive for *G. destructans* and showed histological evidence of WNS on *P. subflavus* and *M. septentrionalis* in late winter of 2010. This year's survey showed a general progression of the infection with a large number of bats showing signs of fungal infection. There was an increase in the number of dead bats found in this cave compared to the count from the 2009-2010 survey.

Twenty-one dead-hanging *P. subflavus* were noted, but no carcasses were found on the cave floor. The surveyors counted a total of 101 bats (dead and alive). Of those, 17 showed definite signs of WNS and 25 were not accessible for determination. If the 25 inaccessible bats are not considered, 31% of the bats in this cave were WNS positive during the 2010 – 2011 survey. A significant decrease in the number of *Myotis* species was also observed by the 2011 survey crew. One hundred seventy-five *Myotis septentrionalis* were counted in 2010 while only four were present during this year's survey (Cory Holliday, pers. comm.)

Newly Infected Sites

Cooper Creek Cave

Bats in Cooper Creek Cave showed significant signs of WNS with approximately 12% of the total population exhibiting visible fungal growth. The fungus was found on three of the five species in the cave, *Myotis septentrionalis*, *M. lucifugus*, and *Perimyotis subflavus*. The fungus was not found on the two *M. grisescens*, or on any of the seventeen *Eptesicus fuscus* found in the cave. Four dead bats were found hanging very close to the cave entrance, and no bat carcasses were found on the cave floor. A total of five bats were submitted for WNS testing to the USGS NWHC in Madison, Wisconsin. Two of the five were dead bats (one *M. septentrionalis* and one *P. subflavus*) found near the cave entrance. The remaining bats, one *M. septentrionalis*, one *M. lucifugus*, and one *P. subflavus* were all found in the normal roost areas in the cave and were euthanized. Four of the five bats submitted tested PCR positive for *G. destructans*, and three of those tested positive (histological confirmation) for white-nose syndrome. Further test details can be found in the NWHC report in Appendix A of this document.

Bellamy Cave

A tier 1 survey of the *M. grisescens* hibernacula at Bellamy Cave was conducted in March of 2010; no signs of WNS were detected during this survey. A tier 2 survey was conducted this season, and although the majority of *M. grisescens* observed still appeared healthy, there was a significant drop in the overall number of bats compared to the 2010 count, and many of the bats present were active (i.e., not in deep torpor).

A single *M. lucifugus* did show signs of a fungus on the snout. Because this did not represent a newly infected species or a new county occurrence, the bat was not submitted for testing. Several pictures of the suspect bat were taken. Bellamy cave is located approximately 1.7 miles (straight-line distance) from Cooper Creek Cave (confirmed WNS positive in 2011). Given the close proximity to a known WNS positive site and the discovery of fungal growth on the single *M. lucifugus*, it was decided by Tennessee state officials to classify Bellamy cave as suspect for *G. destructans*.

Biennial Indiana Bat Census

Sixteen of the sixty-one caves surveyed during the 2010-2011 season were part of the established biennial, tier 1 *M. sodalis* surveillance. In addition to the expected Indiana bat caves surveyed, Signature Cave in Franklin County contained a previously unknown group of Indiana bats; bringing the total number of tier 1 *M. sodalis* surveys to seventeen. A summary of the 2011 *M. sodalis* counts is listed in Table 4 below.

Tier 2 surveys were performed at two known *M. sodalis* caves during the 2010-2011 season. Approximately two hundred thirty-five *M. sodalis* were counted at East Fork Saltpeter Cave while *M. sodalis* were noted as present at Rose Cave.

Table 4. 2011 *M. sodalis* Tier 1 Cave survey results

2011 <i>M. sodalis</i> Tier 1 Cave Survey Results			
Cave Name	County	Survey Date	Observed # of MYSO
Alexander	Perry	3/11/2011	6
Bull	Blount	2/5/2011	2491
Cagle SLP	VanBuren	3/4/2011	19
Camps Gulf	VanBuren	3/17/2011	14
Cornstarch	Fentress	2/17/2011	293
Kelly Ridge	Blount	2/6/2011	1137
Little Jack Creek	Fentress	2/17/2011	5
New Mammoth	Campbell	2/22/2011	12
Rainbow	Blount	2/5/2011	11
Rice	VanBuren	3/4/2011	17
Saltpeter	Blount	2/26/2011	10
Scott Gap	Blount	2/26/2011	12
Signature	Franklin	02/17/11	18
Tobaccoport SLP	Stewart	2/10/2011	3
White Oak Blow hole	Blount	3/27/2011	7495
Wolf River	Fentress	3/18/2011	875
Zarathustras	Fentress	3/23/2011	53
TOTAL			12471

Banding and Band Recovery

The encroachment of WNS into Tennessee has prompted an increase in the bat banding efforts taking place throughout the state. During the 2010-2011 hibernacula surveillance banding took place at eleven caves with a total of 475 bats of eight species banded (Table 5). All bats banded were apparently healthy and did not exhibit signs of WNS. By far the highest percentage of bats banded took place at Little Bat Cave and Measles Gulf Cave where 53% and 37% (respectively) of the big-eared bats observed were banded.

Band recoveries occurred at nine caves. Some band information was recorded at all these caves with the exception of Kelly Ridge Cave where the three banded bats were unable to be retrieved. Some bands were also observed but not retrieved at Wolf River Cave, East Fork SLP Cave, and Cornstarch Cave. Individual banding and band recovery information for each of these caves can be found in Appendix B.

Table 5. 2011 Banding and band recovery data.

2011 Banding and Band Recovery						
Cave Name	County	Survey Date	# bands recovered	# new bats banded	Species	Surveyors
Bull	Blount	02/05/11	3	0	MYSO, MYLU	NPS
Caney Hollow	Franklin	3/15/2011	1	0	MYGR	AAFB
Cornstarch	Fentress	2/17/2011	11	44	MYSO, MYLU	TNC, USFW
Dunbar	Montgomery	02/24/11	0	6	PESU, MYSE	TDEC, APSU
East Fork SLP	Fentress	3/16/2011	6	50	MYSO, MYLU, PESU	TNC, USFWS, USGS
Johnson	Putnum	3/25/2011	0	3	CORA	TNC, TCS
Kelly Ridge	Blount	2/6/2011	3	0	MYSO, MYLU	NPS
Little Bat	Warren	03/02/11	8	58	CORA	TNC, AAFB
New Mammoth	Campbell	2/22/2011	0	17	MYSO, MYLU, MYSE, MYLE	TNC, TWRA
Measles Gulf	VanBuren	3/1/2011	8	73	CORA	TNC, AAFB
Oaks	Union	3/1/2011	0	1	MYGR	TWRA
Red Bud	Fentress	02/17/11	0	21	MYLU, PESU	TNC, USFWS
Rose	VanBuren	2/24/2011	1	51	MYSO, MYGR	TWRA
Signature	Franklin	02/17/11	0	34	MYLU, PESU, MYSO, EPFU	TWRA, AAFB
Tobaccoport SLP	Stewart	3/17/2011	0	27	MYLU, PESU, MYGR	TNC
Whiteside	Marion	3/2/2011	14	81	PESU	TWRA
Wolf River	Fentress	3/18/2011	66	0	MYSO, MYLU	TNC, USFW, TWRA

Census Results by Species

Survey and monitoring of bats in Tennessee is frequently linked to resources and funding associated with endangered species. This leads to a relatively robust body of knowledge about rare bats but leaves many questions about the more common species. The encroachment of WNS into Tennessee and its potential impact on several species of bats, both endangered and common, emphasizes the importance of gaining baseline population information on all bat species. With this in mind, Tier 1 and 2 surveys conducted during the 2010-2011 season attempted to capture census data on all species found during cave visits. Nine bat species were recorded during these surveys with a total of 23,459 bats reported. A complete list of species estimates can be found in Table 6 below.

Table 6. 2011 Species Counts by Cave. * 1 dead-hanging, **20 dead-hanging, p= present.

2011 Hibernacula Survey Species Counts																
Cave Name	County	Tier	Survey Date	Species:	MYSO	MYLU	MYGR	MYSE	MYLE	MYsp	CORA	PESU	EPFU	LANO	Unknown	TOTAL
Alexander	Perry	1	3/11/2011		6		6					13				25
Bat Cave Sumner Co	Sumner	1	3/31/2011									17				17
Bellamy	Montgomery	2	3/10/2011			1	P	3				87				91
Bone	VanBuren	3	1/23/11, 2/3/11	NA												0
Bridge Creek	Putnum	1	3/24/2011									2				2
Bridgewater	Smith	1	2/15/2011			6				16		16				38
Bius Farm Cave	Claiborne	1	3/31/2011									2				2
Bull	Blount	1	2/5/2011		2491	352		10			4	229	2			3088
Buzzard's	Jackson	1	3/17/2011									1	1			2
Cagle SLP	VanBuren	1	3/4/2011		19	3						48				70
Camps Gulf	VanBuren	1	3/17/2011		14	21		1			4	229	2			271
Caney Hollow	Franklin	1	3/15/2011				54					133				187
Carlton	Franklin	2	02/17/11												200	200
Cooper Creek	Montgomery	1	2/9/2011			129	2	36				218	17			402
Cornstarch	Fentress	1	2/17/2011		293	509		1			1	31				835
Cumberland River	Jackson	1	3/17/2011				22					3				25
Devil Step Hollow	Cumberland	3	02/10/11	NA												0
Draper	Jackson	1	3/17/2011													0
Dudd-Hail	Jackson	1	3/15/2011			1	6					18	3			28
Duke's River #1	Jackson	1	3/17/2011													0
Dunbar	Montgomery	1	2/24/2011					5				75				80
Durham	Sumner	1	3/31/2011							1		32				33
East Fork SLP	Fentress	2	3/16/2011		235	273					1	254				763
Flynn's Creek	Jackson	1	3/15/2011													0
Grassy Cove SLP	Cumberland	3	2/11/2011	NA												0
Great Expectations	White	2	2/16/2011					2			1	300				303
Gregory's	Blount															0
Grindstaff	Carter		2/24/2011			4*				1		85**	16			17
Hardin	Davidson															0
Herron	Rutherford	2	3/17/2011									23				23
Hubbard's	Warren	2	3/2/2011	NA												0

Table 6 (continued). 2011 Species Counts by Cave.

2011 Hibernacula Survey Species Counts																
Cave Name	County	Tier	Survey Date	Species:	MYSO	MYLU	MYGR	MYSE	MYLE	MYsp	CORA	PESU	EPFU	LANO	Unknown	TOTAL
Indian	White	1	3/3/2011				1					42	6			49
Indian Grave Point	Dekalb	2	2/4/2011			1		1		1		38				41
Johnson	Putnum	1	3/25/2011						1		115	97	1			214
Keith	Franklin	1	4/1/2011									225				225
Kelly Ridge	Blount	1	2/6/2011		1137	454					198	69				1858
Little Bat	Warren	1	3/2/2011								110					110
Little Jack Creek	Fentress	1	2/17/2011		5							3				8
Lost Creek	White	2	2/16/2011									350	10	1	30	361
Marble Bluff	Roane	3	3/17/2011					1				87				88
Measles Gulf	White	1	3/1/2011								190	5	2			197
Meredith	Campbell		3/22/2011									14	2			16
New Mammoth	Campbell	1	2/22/2011		12	532		25	11	25		222	2			829
Norris Dam Cave	Campbell	1	2/23/2011									32				32
Oaks	Union	1	3/1/2011				1					49	4			54
Old Squire's SLP	Smith	1	2/15/2011									5				5
Pearson	Hawkins	2	02/23/11	NA												0
Rainbow	Blount	1	2/5/2011		11	51						77				139
Red Bud	Fentress	1	2/17/2011			12						54				66
Rice	VanBuren	1	3/4/2011		17		1					143	1			162
Rose	VanBuren	2	02/24/11		P	700						13	2			715
Salt peter	Blount	1	2/26/2011		10	11						133	1			155
Scott Gap	Blount	1	2/26/2011		12	148		5				64				229
Signature	Franklin	1	02/17/11		18	1						14	1			34
Tobaccoport SLP	Stewart	1	2/10/2011		3	246	97	4		14		44	24			432
White Oak Blowhole	Blount	1	3/27/2011		7495	574		71				148				8288
Whiteside	Marion	1	03/07/11									535				535
Windlass	Cumberland	3	2/10/2011	NA												0
Wolf River	Fentress	1	3/18/2011		875	734	5	1				148				1763
Worley (Morril's)	Sullivan	1	2/24/2011			1						258	5			264
Zarathustras	Fentress	1	3/23/2011		53	3					1	31				88

Works Cited

Lamb, J.W. and G.R. Wyckoff, Eds. 2010. *Cooperative White-nose Syndrome Monitoring and Surveillance Plan for Tennessee*.

Samoray, Steve. 2010. 2010 Survey of Gray Bat Hibernacula in Tennessee. Prepared for the TN Chapter of The Nature Conservancy.

U.S. Fish and Wildlife Service. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.

Appendix A - NWHC WNS Test Results by Cave (East Fork SLP)



NATIONAL WILDLIFE HEALTH CENTER
 6006 Schroeder Road
 Madison, Wisconsin 53711-6223
 608-270-2400 (FAX 608-270-2415)

DIAGNOSTIC SERVICES CASE UPDATE

CASE: 23482 EPIZOO:

4/7/2011

Legal INV NUM:

FINDINGS TO DATE

Submitter:

David Peiren
 USFWS Ecological Services/Cookeville TN
 TN Ecological Services Field Office
 446 Neal Street
 Cookeville, TN 38501

Date Submitted: 3/18/2011

Specimen description/identification/Location:

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER'S ID	COUNTY	STATE
001	Bat, Little Brown	CARCASS		E. Fork Sallpeter Ca	Fentress	TN

Summary of Physical Characteristics

ACC	SEX	AGE	WEIGHT	BODY CONDITION	POSTMORTEM STATE
001	Male	Adult	6.87 gm	Good	Good

Comment:

4/7/11 A single little brown bat was euthanized inside East Forks Sallpeter Cave on 3/16/11 with suspicious white material on the forearm. *G. destructans* DNA had been detected on a bat submitted in March 2010 so this animal was collected for further diagnostic evaluation this year.

This adult male was in good body condition with abundant subcutaneous fat. There was no obvious UV fluorescence detected on wing membranes at necropsy. Histologically, there was no evidence of white-nose syndrome (WNS) on the ear, wing and muzzle tissues examined; only one area on the wing had an inflammatory crust with associated fungal hyphae. However, the *Geomyces destructans* PCR was POSITIVE. Fungal culture results are still pending.

This bat is considered suspect positive for WNS because of the positive Gd PCR result. We would be happy to evaluate additional suspicious bats collected from this location in the future as we currently advise to consider this site contaminated with *G. destructans* based on laboratory results from both March 2010 and 2011. AEB

Anne E. Ballmann

If you have questions regarding this case, contact:

Anne E. Ballmann, DVM, Ph.D.
 Wildlife Disease Specialist

Phone: 608-270-2445 E-Mail: aballmann@usgs.gov

Diagnostic findings may not be used for publication without the pathologist's knowledge and consent.

Appendix A (continued) - NWHC WNS Test Results by Cave (Camps Gulf)



NATIONAL WILDLIFE HEALTH CENTER

6006 Schroeder Road
 Madison, Wisconsin 53711-6223
 608-270-2400 (FAX 608-270-2415)

DIAGNOSTIC SERVICES CASE UPDATE

CASE: 22984 EPIZOO: 2010-047

4/8/2010

FINDINGS TO DATE

Submitter:

George Wyckoff
 Aerospace Testing Alliance Conservation
 1103 Avenue
 Arnold Air Force Base, TN 37389

Date Submitted: 3/25/2010

Specimen description/identification/Location:

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER'S ID	COUNTY	STATE
001	Bat, Eastern Pipistrelle (Tri-colored)	CARCASS			Van Buren	TN
002	Bat, Eastern Pipistrelle (Tri-colored)	CARCASS			Van Buren	TN
003	Bat, Indiana	SLIDES(>1)			Van Buren	TN

Comment:

3/28/10: Two tricolor bat carcasses (1 female, 1 male partially scavenged) and fungal tape samples collected from an Indiana bat with signs suspicious of white-nose syndrome (WNS) were submitted for diagnostic evaluation to NWHC on 3/25/10. Light microscopy evaluation of the fungal tape strips from the Indiana bat could not detect any evidence of *Geomyces destructans* or any other identifiable fungal elements. Debris seen on the wing and muzzle in the photo of this animal appears similar to the substrate observed on the wall where the bat was roosting.

The female bat (Acc. 001) was in good body condition (5.82 g, forearm 32.11 mm). PCR results of wing tissues from the 2 tricolor bats tested weakly positive for *G. destructans*, the causative agent of skin lesions in WNS-affected bats. Histology, however, could not confirm the presence of WNS in these bats. Additional testing is being pursued to help clarify these findings and we hope to have some results next week. At this time, these bats are suspected to have come into contact with *G. destructans* and WNS may develop at this location in the future. Implementation of stringent decontamination of personnel and equipment entering this site is advised as is increased monitoring of nearby hibernacula for signs of WNS. Please don't hesitate to contact me if you have any questions. AEB

4/8/10: Sequencing of PCR products has confirmed the identification of *G. destructans* on the 2 tricolored bats submitted for WNS evaluation. So while these individuals had not yet developed the fungal skin infection of WNS at the time of collection, they were carrying the *G. destructans* fungus and may have only recently been exposed to the fungus. As always, please contact me if you have any questions.

If you have questions regarding this case, contact:

Signature on File

Anne E. Ballmann, DVM, Ph.D.
 Wildlife Disease Specialist

Phone: 608-270-2445 E-Mail: aballmann@usgs.gov

Diagnostic findings may not be used for publication without the pathologist's knowledge and consent.

PRINTED April 08, 2010

Appendix A (continued) - NWHC WNS Test Results by Cave (Camps Gulf)



NATIONAL WILDLIFE HEALTH CENTER
 6006 Schroeder Road
 Madison, Wisconsin 53711-6223
 608-270-2400 (FAX 608-270-2415)

DIAGNOSTIC SERVICES CASE UPDATE

CASE: 23481 EPIZOO:

4/7/2011

Legal INV NUM:

FINDINGS TO DATE

Submitter:

David Pelren
 USFWS Ecological Services/Cookeville TN
 TN Ecological Services Field Office
 446 Neal Street
 Cookeville, TN 38501

Date Submitted: 3/18/2011

Specimen description/identification/Location:

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER'S ID	COUNTY	STATE
001	Bat, Eastern Pipistrelle (Tri-colored)	CARCASS		Camps Gulf Cave	Van Buren	TN

Summary of Physical Characteristics

ACC	SEX	AGE	WEIGHT	BODY CONDITION	POSTMORTEM STATE
001	Female	Adult	5.84 gm	Good	Good

Comment:

4/7/11 A single tri-colored bat was euthanized inside Camps Gulf Cave on 3/17/11 with suspicious white material on the right arm near the wrist. This may be related to wall substrate, however, because of detection of *G. destructans* DNA from a bat submitted in March 2010, this animal was collected for further diagnostic evaluation.

This adult female was in good body condition with abundant subcutaneous fat. There was no obvious UV fluorescence detected on wing membranes at necropsy. Histologically, there was no evidence of white-nose syndrome (WNS) on the ear, wing and muzzle tissues examined. In addition, the *Geomyces destructans* PCR was negative. Fungal culture results are still pending.

Currently, there is no evidence that this specimen had WNS or that it was harboring the causative fungus, *G. destructans*. We would be happy to evaluate additional suspicious bats collected from this location in the future as we currently advise to consider this site contaminated with *G. destructans* based on laboratory results from March 2010. AEB

Anne E. Ballmann

If you have questions regarding this case, contact:

Anne E. Ballmann, DVM, Ph.D.
 Wildlife Disease Specialist

Phone: 608-270-2445 E-Mail: aballmann@usgs.gov

Diagnostic findings may not be used for publication without the pathologist's knowledge and consent.

PRINTED: April 07, 2011

Appendix A (continued) - NWHC WNS Test Results by Cave (Cooper Creek)



NATIONAL WILDLIFE HEALTH CENTER

6006 Schroeder Road
 Madison, Wisconsin 53711-6223
 608-270-2400 (FAX 608-270-2415)

DIAGNOSTIC SERVICES CASE UPDATE

CASE: 23444 EPIZOO:

3/3/2011

Legal INV NUM:

FINDINGS TO DATE

Submitter:

Cory Holiday
 Nature Conservancy/Galnesboro
 862 Fort Blount Ferry Rd
 Galnesboro, TN 38562

Date Submitted: 2/11/2011

Specimen description/identification/Location:

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER'S ID	COUNTY	STATE
001	Bat, Little Brown	CARCASS	MYLU1		Montgomery	TN
002	Bat, Northern Long-eared	CARCASS	MYSE1		Montgomery	TN
003	Bat, Northern Long-eared	CARCASS	MYSE2		Montgomery	TN
004	Bat, Eastern Pipistrelle (Tri-colored)	CARCASS	PESU		Montgomery	TN
005	Bat, Eastern Pipistrelle (Tri-colored)	CARCASS	PESU2		Montgomery	TN

Summary of Physical Characteristics

ACC	SEX	AGE	WEIGHT	BODY CONDITION	POSTMORTEM STATE
001			7.32kg		
002	Female	Unknown	5.83kg	Fair	Good
003	Male	Subadult (adolescent)	5.11kg	Emaciated	Poor
004	Male	Subadult (adolescent)	4.28kg	Fair	Good
005			3.15kg		

Comment:

3/3/11: PCR analysis identified a genetic signature of *Geomyces destructans* in association with skin samples from four of four bats tested (Accs 001-004). Follow-up histopathology analysis confirmed fungal infection with cupping erosion consistent with white-nose syndrome in three of four bats (Acc 001, 002, 004). Accession 003 was too autolyzed for diagnostic interpretation. JLB

Anne E. Ballmann

If you have questions regarding this case, contact:

Anne E. Ballmann, DVM, Ph.D.
 Wildlife Disease Specialist

Phone: 608-270-2445 E-Mail: aballmann@usgs.gov

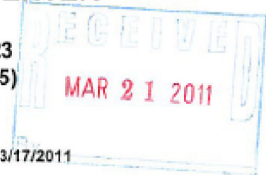
Diagnostic findings may not be used for publication without the pathologist's knowledge and consent.

Appendix A (continued) - NWHC WNS Test Results by Cave (White Oak Blowhole)



NATIONAL WILDLIFE HEALTH CENTER

6006 Schroeder Road
 Madison, Wisconsin 53711-6223
 608-270-2400 (FAX 608-270-2415)



DIAGNOSTIC SERVICES CASE REPORT

Final Report

3/17/2011

CASE: 23466

EPIZOO:

Legal INV#:

Declassified

Submitter:

David Pelren
 USFWS Ecological Services/Cookeville TN
 TN Ecological Services Field Office
 446 Neal Street
 Cookeville, TN 38501

Date Submitted: 3/2/2011

Specimen description/identification/Location: *WOB*

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER'S ID	COUNTY	STATE
001	Bat, Little Brown	CARCASS			Bicant	TN

DIAGNOSIS

Negative for White-nose Syndrome

Comment:

3/17/2011

This adult female Little Brown bat was in good body condition. Although a fungus was present in the microscopic sections of the ears and wing membrane, this was not White-nose Syndrome (WNS), and the *Geomyces destructans* PCR was negative.

We occasionally see fungal hyphae on the surface of bat skin. This may be a more typical dermatophyte (like ringworm in dogs and cats), and not the invasive fungus that causes WNS.

Carol U. Meteyer DIPL.ACVP
 Staff Diagnostic Pathologist

If you have questions regarding this case, contact:

Anne E. Ballmann DVM, Ph.D.
 Wildlife Disease Specialist

Phone: 608-270-2445 E-Mail: aballmann@usgs.gov

Diagnostic findings may not be used for publication without the pathologist's knowledge and consent.

Copies To:

DR. JEREMY COLEMAN
 USFWS New York Field Office/Cortland NY, 3817 Luker Road, Cortland, NY 13045

ROGER APPLGATE
 Tennessee Wildlife Resources Agency- Region 2, PO Box 40747, Ellington Agricultural Center, Nashville, TN 37204

MIKE ARMSTRONG
 USFWS Endangered Species/Frankfort KY, JC Watts Federal Bldg., Suite 265, Frankfort, KY 40601

Appendix B - Banding and Band Recovery Data Sheets by Cave (Caney Hollow)

2011 Tennessee Bat Hibernacula Banding Data					
USFWS Region 4	Survey date: 3/15/11	Sheet 1 of 1			
Cave name: <u>Caney Hollow Cave</u>					
County: <u>Franklin</u>					
Ownership: <u>Private</u>					
Extent (circle): <u>Tier 1 Tier 2 External</u>			Additional Data on		
Data Recorder: <u>George Wyckoff</u>			inside (circle)		
Surveyors: <u>John Lamb</u>			Yes No		

New Bands					
Species (code)	Sex	Text	Number	Forearm (L/R)	WNS (+/-)
MYGR	F	AAFB TN	5265	L	-
MYGR	M	AAFB TN	5266	R	-
MYGR	M	AAFB TN	5267	R	-
MYGR	M	AAFB TN	5268	R	-
MYGR	F	AAFB TN	5269	L	-
MYGR	F	AAFB TN	5270	L	-
MYGR	F	AAFB TN	5271	L	-
MYGR	F	AAFB TN	5272	L	-
MYGR	F	AAFB TN	5273	L	-
MYGR	M	AAFB TN	5274	R	-
MYGR	M	AAFB TN	5275	R	-
MYGR	F	AAFB TN	5276	L	-
MYGR	M	AAFB TN	5277	R	-
MYGR	M	AAFB TN	5278	R	-
MYGR	F	AAFB TN	5279	L	-
MYGR	F	AAFB TN	5280	L	-
MYGR	M	AAFB TN	5281	R	-
MYGR	F	AAFB TN	5282	L	-
MYGR	M	AAFB TN	5283	R	-
MYGR	F	AAFB TN	5284	L	-
MYGR	F	AAFB TN	5285	L	-
MYGR	M	AAFB TN	5286	R	-
MYGR	M	AAFB TN	5287	R	-
MYGR	M	AAFB TN	5288	R	-
MYGR	M	AAFB TN	5289	R	-
MYGR	M	AAFB TN	5290	R	-
MYGR	M	AAFB TN	5291	R	-
MYGR	F	AAFB TN	5292	L	-

New Bands Continued					
Species (code)	Sex	Text	Number	Forearm (L/R)	WNS (+/-)
MYGR	M	AAFB TN	5293		-
MYGR	M	AAFB TN	5294		-
MYGR	M	AAFB TN	5295		-
MYGR	M	AAFB TN	5296		-
MYGR	M	AAFB TN	5297		-
MYGR	M	AAFB TN	5298		-
MYGR	F	AAFB TN	5299		-
MYGR	M	AAFB TN	5300		-
MYGR	F	AAFB TN	5301		-
MYGR	M	AAFB TN	5302		-
MYGR	M	AAFB TN	5303		-
MYGR	M	AAFB TN	5304		-
MYGR	F	AAFB TN	5305		-
MYGR	M	AAFB TN	5306		-
MYGR	F	AAFB TN	5307		-
MYGR	F	AAFB TN	5308		-
MYGR	F	AAFB TN	5309		-
MYGR	F	AAFB TN	5310		-
MYGR	F	AAFB TN	5311		-
MYGR	F	AAFB TN	5312		-
MYGR	F	AAFB TN	5313		-
		Band Recoveries			
MYGR	F	AAFB TN	4102	L	-

Appendix B (continued) - Banding and Band Recovery Data Sheets by Cave (Cornstarch)

2011 Tennessee Bat Hibernacula Banding Data					
USFWS Region 4		Survey date: 2.17.11		Sheet 1 of 1	
Cave name: Cornstarch Cave					
County: Fentress					
Ownership: TN Division of Forestry				Additional Data on	
Extent (circle): Tier 1 Tier 2 External				inside (circle)	
Data Recorder: Steve Samoray				Yes No	
Surveyors: Cory Holliday, Dave Pelren					
New Bands					
Species (code)	Sex	Text	Number	Forearm (L/R)	WNS (+/-)
MYSO	M	TNC	290	R	-
MYSO	M	TNC	301	R	-
MYSO	F	TNC	302	L	-
MYSO	M	TNC	303	R	-
MYLU	F	TNC	304	L	-
MYSO	F	TNC	305	L	-
MYSO	M	TNC	306	R	-
MYSO	F	TNC	307	L	-
MYSO	F	TNC	308	L	-
MYSO	M	TNC	309	R	-
MYSO	F	TNC	310	L	-
MYSO	M	TNC	311	R	-
MYSO	M	TNC	312	R	-
MYSO	F	TNC	313	L	-
MYSO	F	TNC	314	L	-
MYSO	M	TNC	315	R	-
MYSO	F	TNC	316	L	-
MYSO	M	TNC	317	R	-
MYSO	F	TNC	318	L	-
MYSO	F	TNC	319	L	-
MYSO	M	TNC	320	R	-
MYSO	F	TNC	321	L	-
MYSO	M	TNC	322	R	-
MYSO	F	TNC	323	L	-
MYSO	F	TNC	324	L	-
MYLU	M	TNC	325	R	-
MYLU	M	TNC	326	R	-
MYLU	M	TNC	327	R	-

New Bands Continued					
Species (code)	Sex	Text	Number	Forearm (L/R)	WNS (+/-)
MYLU	M	TNC	328	R	-
MYLU	M	TNC	329	R	-
MYLU	M	TNC	330	R	-
MYLU	F	TNC	331	L	-
MYLU	F	TNC	332	L	-
MYLU	M	TNC	333	R	-
MYLU	M	TNC	334	R	-
MYLU	M	TNC	335	R	-
MYLU	M	TNC	336	R	-
MYLU	M	TNC	337	R	-
MYLU	F	TNC	338	L	-
MYLU	M	TNC	339	R	-
MYLU	M	TNC	340	R	-
MYLU	M	TNC	341	R	-
MYLU	M	TNC	342	R	-
MYLU	F	TNC	343	L	-
Band Recoveries					
MYSO	M	KYFW	A15328	R	-
MYSO	F	TNTECHU	775	L	-
MYSO	F	TNTECHU	762	L	-
MYSO	F	TNTECHU	708	L	-
MYSO	F	TNTECHU	703	L	-
MYSO	F	TNTECHU	713	L	-
MYSO	F	TNTECHU	741	L	-
MYSO	F	TNTECHU	701	L	-
MYSO	F	TNTECHU	749	L	-
MYSO	F	TNTECHU	765	L	-
MYSO	F	TNTECHU	710	L	-

Appendix B (continued) - Banding and Band Recovery Data Sheets by Cave (Little Bat Cave)

2011 Tennessee Bat Hibernacula Banding Data					
USFWS Region 4		Survey date: 3/2/11		Sheet 1 of 1	
Cave name: Little Bat Cave					
County: Warren					
Ownership: TNC				Additional Data on	
Extent(circle): Tier 1 Tier 2 External				inside(circle)	
Data Recorder: Steve Samoray				Yes No	
Surveyors: Cory Holliday, John Lamb					
New Bands					
Species (code)	Sex	Text	Number	Forearm (L/R)	WNS (+/-)
CORA	M	TNC	0451	R	-
CORA	F	TNC	0452	L	-
CORA	F	TNC	0453	L	-
CORA	F	TNC	0454	L	-
CORA	M	TNC	0455	R	-
CORA	M	TNC	0456	R	-
CORA	F	TNC	0457	L	-
CORA	M	TNC	0458	R	-
CORA	M	TNC	0459	R	-
CORA	M	TNC	0460	R	-
CORA	F	TNC	0461	L	-
CORA	F	TNC	0462	L	-
CORA	M	TNC	0463	R	-
CORA	M	TNC	0464	R	-
CORA	F	TNC	0465	L	-
CORA	M	TNC	0466	R	-
CORA	M	TNC	0467	R	-
CORA	F	TNC	0468	L	-
CORA	M	TNC	0469	R	-
CORA	F	TNC	0470	L	-
CORA	F	TNC	0471	L	-
CORA	F	TNC	0472	L	-
CORA	M	TNC	0473	R	-
CORA	F	TNC	0474	L	-
CORA	M	TNC	0475	R	-
CORA	F	TNC	0476	L	-
CORA	M	TNC	0477	R	-
CORA	F	TNC	0478	L	-

New Bands Continued					
Species (code)	Sex	Text	Number	Forearm (L/R)	WNS (+/-)
CORA	F	TNC	0479	L	-
CORA	F	TNC	0480	L	-
CORA	F	TNC	0481	L	-
CORA	F	TNC	0482	L	-
CORA	F	TNC	0483	L	-
CORA	F	TNC	0484	L	-
CORA	F	TNC	0485	L	-
CORA	F	TNC	0486	L	-
CORA	F	TNC	0487	L	-
CORA	F	TNC	0488	L	-
CORA	F	TNC	0489	L	-
CORA	F	TNC	0490	L	-
CORA	F	TNC	0491	L	-
CORA	F	TNC	0492	L	-
CORA	F	TNC	0493	L	-
CORA	F	TNC	0494	L	-
CORA	F	TNC	0495	L	-
CORA	F	TNC	0496	L	-
CORA	F	TNC	0497	L	-
CORA	F	TNC	0498	L	-
CORA	F	TNC	0499	L	-
CORA	F	TNC	0500	L	-
CORA	M	TNC	0401	R	-
CORA	F	TNC	0402	L	-
CORA	F	TNC	0403	L	-
CORA	F	TNC	0404	L	-
CORA	F	TNC	0405	L	-
CORA	F	TNC	0406	L	-
CORA	F	TNC	0407	L	-
		Band Recoveries			
CORA	M	TNC	0106	L	-
CORA	M	TNC	0104	L	-
CORA	M	TNC	0102	L	-
CORA	F	TNC	0109	L	-
CORA	F	TNC	0113	L	-
CORA	F	TNC	0103	L	-
CORA	F	TNC	0108	L	-
CORA	F	TNC	0105	L	-

