2014
Bat Population Monitoring and White Nose Syndrome Surveillance

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TWRA Wildlife Technical Report 14-07

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Wintering Gray bats, Pearsons Cave (Dustin Thames, TWRA)

Acknowledgements

Activities funded by Tennessee Wildlife Resources Agency and a White Nose Syndrome Grant from the U.S. Fish and Wildlife Service.

Additional funding provided by partner organizations that provided assistance with and conducted surveys.

Austin Peay State University
The Nature Conservancy
National Park Service
Southeastern Cave Conservancy, Inc.
Tennessee Dept. of Environment and Conservation
Tennessee Tech University
Tennessee Valley Authority
University of Tennessee
Dept. of Defense - US Army
US Fish and Wildlife Service

Acknowledgements

Volunteers

We thank the many volunteers with caving knowledge and experience who helped identify potential white-nose sites and hibernacula and who assisted with surveys.

Landowners

We thank the many landowners who gave access to their property to conduct surveys of caves in order to better understand bat population distribution and effects of white-nose syndrome on bats.

Executive Summary:

As expected white nose syndrome (WNS) continued to spread across Tennessee. The number of confirmed counties went from 31 in 2013 to 46 in 2014. This means that of the 78 counties having caves 57.7% have been confirmed WNS positive. One county Sumner was identified as suspect for WNS in 2014. The bats submitted for Sumner County tested positive for *Pseudogymnoascus destructans* (*P. destructans*), but positive confirmation could not be made through histopathology. A total of 37 counties were surveyed, of those 20 were not previously known to have WNS. Six of those counties did not show signs of WNS in 2014. A total of 66 caves were surveyed in the 36 counties. One civil war munitions bunker was surveyed in Tipton County.

The 2014 hibernacula survey period also included surveys of Tennessee's three priority 1 gray bat hibernacula. Gray bat numbers were up from 2013. Numbers for the gray bat sites have always been difficult to obtain due to conditions in the caves and complexity of the caves. Surveys of Bellamy cave are hampered by large numbers of bats wintering in the stream section of the cave. At Pearsons cave an area of the cave that is not easily accessed was counted resulting in twice as many bats as has been counted in past years.

White Oak Blowhole which is located in the Great Smoky Mountains National Park in Blount County had a significant decline. Indiana bat numbers declined from 9,076 in 2013 to 1,753 in 2014. Little brown numbers declined from 487 in 2013 to 28 in 2014. White Oak Blowhole is Tennessee's only priority 1 Indiana bat cave. The lowest record Indiana bat numbers for White Oak Blowhole previously was in 1999 when 3,084 were counted.

A full count of other bat species will not be available until after the 2014-2015 hibernacula season. Unfortunately the cold winter of 2013-2014 may have resulted in more direct mortality being observed. Dead bats in caves were more wide spread across the state. Most of the dead bats observed were tri-colored bats *(Perimyotis subflavus).*

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Introduction

Very limited information is available on bat hibernacula and population trends in Tennessee. Only Indiana bat (*Myotis sodalis*) and gray bat (*Myotis grisescens*) hibernacula have been surveyed with any regular frequency. Little brown bat (*Myotis lucifugus*), northern long-eared (*Myotis septentrionalis*), eastern small footed (*Myotis leibii*), big brown (*Eptesicus fuscus*), tri-colored *(Perimyotis subflavus)*, Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) numbers are sporadic at best. After the discovery of white nose syndrome (WNS) caused by *Pseudogymnoascus destructans* (*P. destructans*) (formerly *Geomyces destructans)* in New York, TWRA and partnering Agencies began an extraordinary task to survey caves in Tennessee for hibernating bats. With close to 10,000 caves in the state that task has been difficult. Although there are a large number of caves in the state only a small percentage are likely to contain any significant numbers of hibernating bats. Since 2010 TWRA and partnering agencies (see acknowledgements page for list) have worked to survey new caves with potential hibernating bats, monitor known bat hibernacula populations, and monitor the spread of WNS.

In 2014 the three priority gray bat caves, a sample of WNS confirmed caves, and new caves were surveyed. This year was not a standard Indiana bat cave census year, so only a small sample of Indiana bat caves where surveyed.

The hibernacula surveys and WNS surveillance have helped identify new bat hibernacula and to track hibernacula changes. Each year more is learned about the effects of WNS and continued surveillance will allow TWRA to better understand effects of WNS on Tennessee's bats as well determine future bat population indices trends.

Methods

Caves were surveyed between December 15th and April 1st. Typically teams of 2 to 4 biologists conducted surveys of caves that were either known to have bats or based on available information may have contained enough bats to justify surveying. All surveyors follow the recommended WNS decontamination protocols recommended by U.S. Fish and Wildlife Service.

WNS surveillance followed a tiered approach designed to detect possible WNS infection and to minimize disturbance during surveys.

- **Tier 1 surveys**: a full hibernaculum count, examination of all accessible bats for signs of WNS, and band placement and/or recovery (where appropriate).

- **Tier 2 surveys**: a quick population estimate, examination of all accessible bats for signs of WNS, and band recovery (where appropriate).

- **Tier 3 surveys**: observations made outside of cave entrances to check for unusual winter bat behavior (e.g. daytime activity in the cave entrance).

WNS Status Terms:

Field Signs: A site listed as showing field signs means that at least one bat was observed at the site with what appeared to be a white fungus. The observation may or may not be *Pseudogymnoascus destructans* (P.d.) (formerly *Geomyces destructans),* but could be another fungus or yeast. When a site is listed as having field signs, an observation is made, but samples were not available to be sent off for testing. Field sign positive is also used when a county is already positive and submitting additional samples is not warranted.

Suspect: In order for a site to be listed as suspect a swab from a bat or other surface is submitted to a lab. Analysis of the swab detects the genetic material of *P. destructans*.

Confirmed: In order for a site to be confirmed WNS positive a carcass or tissue sample of a bat must be submitted to a wildlife disease lab for testing. Histopathology identifies hyphae of *P. destructans* have penetrated cells of the bat resulting in lesions. PCR is used to identify the fungus.

Results

As expected white nose syndrome (WNS) continued to spread across Tennessee. The number of confirmed counties went from 31 in 2013 to 46 in 2014 (Figure 1, Figure 2). This means that of

the 78 counties having caves 58.9% have been confirmed WNS positive. One county Sumner was identified as suspect for WNS in 2014. The bats submitted for Sumner County tested positive for *P. destructans*, but positive confirmation could not be made through histopathology. A total of 37 counties (Figure 3) were surveyed of those 20 were not known to have had WNS were surveyed during the 2014 hibernacula season. Six of those counties did not show signs of WNS in 2014.

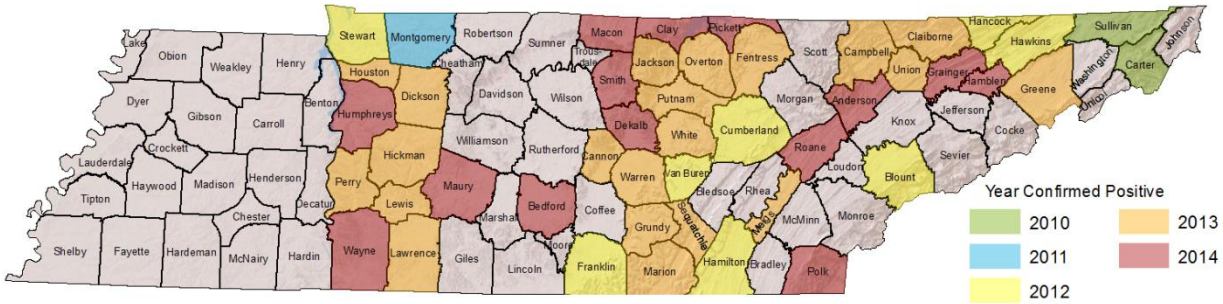

Figure 1. Progress of confirmed white-nose syndrome cases through Tennessee.

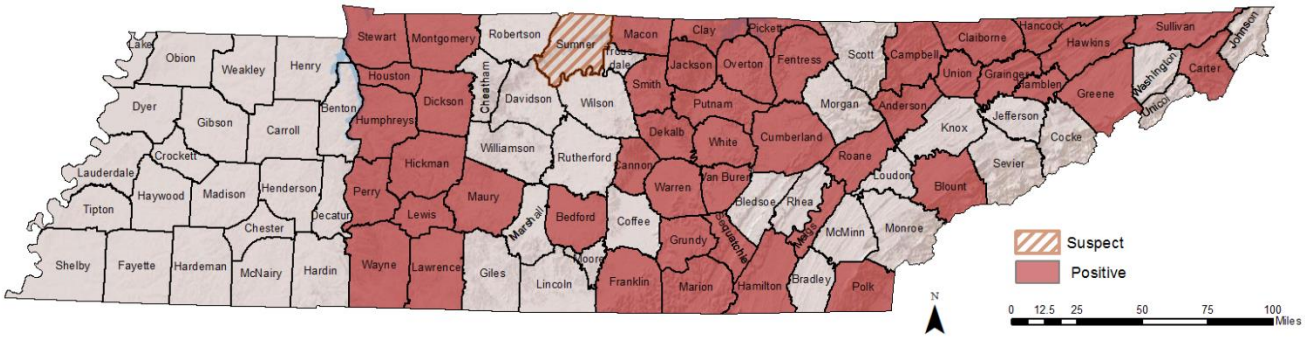

Figure 2. Known confirmed and suspect white-nose syndrome distribution in Tennessee as of April 2014.

Figure 3. Counties surveyed (green) for white-nose syndrome during winter of 2013-2014 in Tennessee.

Population Status

Due to this not being an Indiana bat year only numbers of gray bats could be estimated. Three priority 1 gray bat hibernacula were surveyed in 2014 (Figure 4).

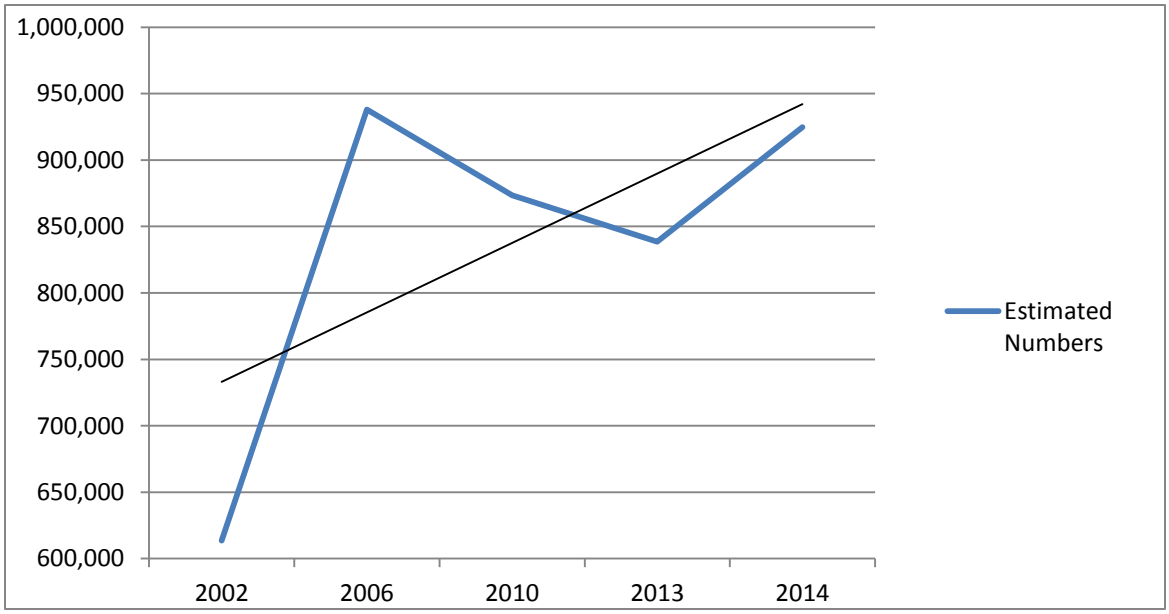

Figure 4. Gray bat hibernacula surveys from 3 priority 1 caves in Tennessee with trend line (2002 to 2014).

* Note: A section of Pearsons Cave not surveyed in several years was surveyed in 2014.

Big browns bat. (Photo Thames, TWRA).

White Nose Syndrome Cave Status

A total of 66 caves were surveyed in the 37 counties. Tipton county was not a cave, but a civil war bunker. Of those caves surveyed 33 caves where WNS status was either unknown or WNS had not been confirmed were surveyed. Of the caves not confirmed WNS positive samples where submitted from 15 caves for testing (Table 1). For additional caves identified as WNS positive in previous years see Flock (2013).

Table 1. Caves status based on bats submitted for WNS testing 2013-2014 WNS.

Cave Name	County	Year	WNS Status
Springhill Saltpeter Cave	Anderson	2014	Confirmed
Ward Cave	Bedford	2014	Confirmed
Leonard Cave	Clay	2014	Confirmed
Cripps Mill Cave	Dekalb	2014	Confirmed
Indian Cave	Grainger	2014	Confirmed
Corner Store Cave	Hamblen	2014	Confirmed
Hurricane Creek Cave	Humphreys	2014	Confirmed
Aunt Beck Simmons Cave	Macon	2014	Confirmed
Rummage Cave	Maury	2014	Confirmed
Big Jordan Cave	Pickett	2014	Confirmed
Gee Cave	Polk	2014	Confirmed
Cave Creek Cave	Roane	2014	Confirmed
Bridgewater Cave	Smith	2014	Confirmed
Mason Cave	Sumner	2014	Suspect
Biffle Cave	Wayne	2014	Confirmed

White Oak Blowhole Rare Example of WNS in Tennessee

As of 2013 White Oak Blowhole Cave located in Blount count in the Great Smoky Mountain National Park has been the only cave to show behavioral and population trends similar to cave in the Northeastern United States. Blount County has a number of smaller known hibernacula there are a number of caves that have not been surveyed for bats. White Oak Blowhole is the only priority 1 Indiana bat hibernacula in Tennessee highest population estimate in 1981 was 12,500. The cave was suspect WNS in 2010 and confirmed WNS positive in 2011. In January through March of 2013 bats were observed by National Park Employees and visitors flying around during cold days (Carr et al. 2014). In 2014, an off census year for Indiana bats, a survey was conducted due to concerns of WNS. The estimate for 2014 (1,753) was the lowest recorded for Indiana bats in the hibernacula (Figure 5).

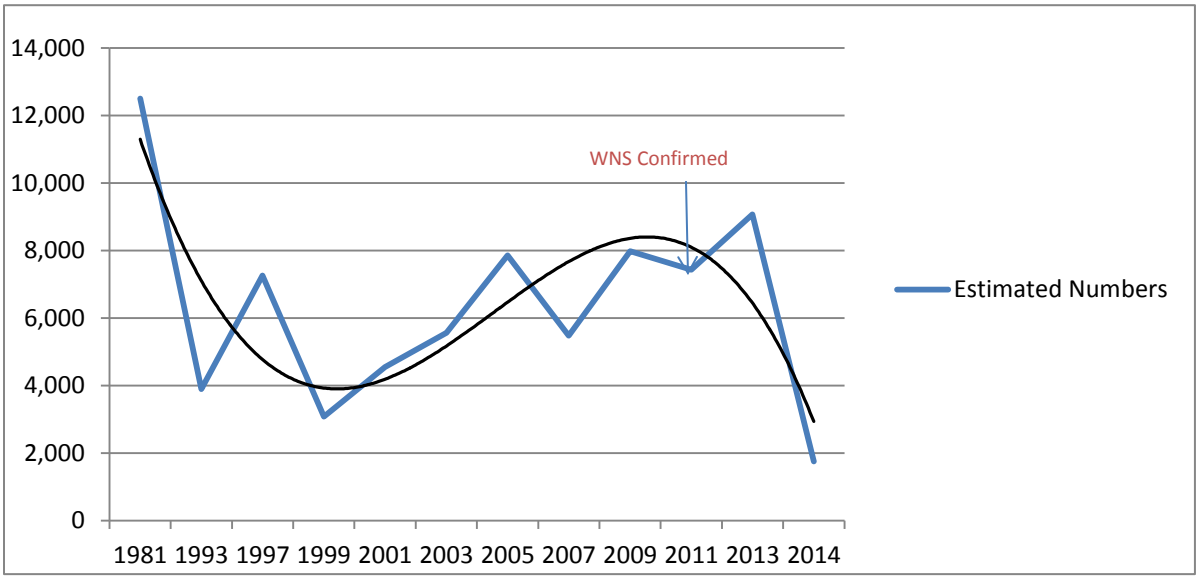

Figure 5. White Oak Blowhole Cave, Blount County, Tennessee, Great Smoky Mountains National park priority 1 Indiana bat hibernacula trends 1981-2014.

Small cluster of Indiana bats with no visible signs of WNS, White Oak Blowhole Cave (Photo Thames, TWRA)

Conclusions

Although it may take a year or two to better determine the full effect of the cold winter of 2013-2014 and WNS, it appears that Indiana bats, tricolored bats, little brown bats, and potentially northern long-eared bats may have been affected the most. With a large portions of the karst region of the State now confirmed as WNS positive efforts will likely begin to shift from surveillance for the disease to long term monitoring of hibernacula and research of key hibernacula to determine when and if bats will recovery from WNS.

Literature Cited

Carr, J.A., R.F. Bernard, and W.H. Stiver. 2014. Unusual bat behavior during winter in Great Smoky Mountains National Park. Southeastern Naturalist 13: N18-N21

Appendix

Survey data from 2014 hibernacula surveys conducted from December 2013 to April 2014. Bat species observed during survey include Rafinesque's big-eared bat (CORA), big brown (EPFU), gray bats (MYGR), eastern small footed (MYLE), little brown bat (MYLU), Indiana bat (MYSO), northern long-eared (MYSE), tri-colored (PESU), and unidentified Myotis sp. (MYsp).

County	Cave Name	Date	CORA	EPFU	MYGR	MYLE	MYLU	MYSE	MYSO	PESU	LANO	MYsp	Surveyors
Anderson	Springhill Saltpeter Cave	1/29/2014		14			354			8			TNC
Bedford	Reese Cave	2/12/2014								22			TNC
Bedford	Ward Cave	3/13/2014		9						219			TNC
Bledsoe	Lowe Gap Cave	3/28/2014								13			TNC
Blount	Gergory Cave	1/24/2014					1	1		1063			NPS
Blount	Scott Cave	2/6/2014	2				29		36	125			NPS
Blount	Kelly Ridge Cave	2/10/2014	204	4			4		585	663			NPS, UT
Blount	White Oak Blowhole	2/24/2014	1				28		1,753	47			NPS, USFWS, TWRA, UT
Blount	Saltpeter	2/7/2014		2					1	59			NPS
Campbell	New Mammoth Cave	1/27/2014		5		7	315	35	70	204		2	TNC, TWRA
Carter	Grindstaff Cave	3/25/2014		7						4			TNC, TWRA
Carter	Renfro Cave	3/26/2014		2						6			TNC, TWRA
Clay	Leonard Cave	3/27/2014	2							66			TNC
Cumberland	Run to the Mill Cave	12/1/2013						2	50	30			TNC
Cumberland	Grassy Cove Saltpeter	2/20/2014		4		1	92		2	63			TWRA, USFWS, UT
Decatur	Baugus Cave	2/12/2014								6			TWRA
Dekalb	Cripps Mill Cave	2/8/2014		4			12	4	2	248		4	TNC, TWRA
Fentress	East Fork Saltpeter Cave	1/14/2014		1			178	20	105	434			TNC, TWRA, UT
Fentress	Wolf River Cave	1/17/2014					1024	14	1097	173		2	TNC, TWRA, USFWS
Franklin	Carlton Cave	2/19/2014		1			2			210		2	TWRA, TNC

County	Cave Name	Date	CORA	EPFU	MYGR	MYLE	MYLU	MYSE	MYSO	PESU	LANO	MYsp	Surveyors
Franklin	Keith Cave	2/20/2014								113			TNC, TWRA
Franklin	Signature Cave	2/20/2014							25	23			TWRA
Grainger	Indian Cave	3/25/2014		4	1					38			TNC, TWRA
Hamblen	Saltpeter Cave	2/26/2014								8			TNC
Hamblen	Corner Store Cave	2/26/2014		4			1			40			TNC
Hawkins	Pearsons Cave	1/28/2014			190,260								TNC, TWRA, UT, USFWS
Humphreys	Hurricane Creek Cave	2/20/2014		19			1			63			TWRA
Jackson	North Spivey Cave	1/16/2014		7			6	8		116		1	TNC, TWRA
Loudon	Blankenship Cave	2/21/2014								20			TWRA, TVA
Macon	Aunt Beck Simmons Cave	3/24/2014		1			4	1		81		1	TNC
Marion	Whiteside Cave	2/3/2014		1						1342			TNC, TWRA
Maury	Cheeks Bend Cave #2	2/14/2014		1									TNC
Maury	Cheeks Bend Cave #1	2/14/2014								10			TNC
Maury	Rummage Cave	2/14/2014								39			TNC
Meigs	Eve's Cave	1/30/2014		2			2	3		116			TWRA, TVA
Meigs	Blythe Ferry Cave	1/30/2014								19			TWRA, TVA
Montgomery	Coleman Cave	2/1/2014		3			2			9			TNC, USFWS
Montgomery	Bellamy Cave	2/4/2014		4	310,090		2			8			TWRA, TNC
Montgomery	Cooper Creek Cave	2/18/2014		8						24	1		TWRA, UT, DOD
Moore	Silvertooth Cave	2/12/2014		2						25			TNC
Perry	Alexander Cave	3/12/2014			7					28			TNC
Perry	Jaybird Cave	3/12/2014			1		46		14	561			TNC, TWRA
Pickett	Big Jordan Cave	3/3/2014		3			71	3	53	234			TNC
Polk	Gee Cave	3/17/2014								15			TWRA, USFWS
Putnam	Johnson Cave	2/7/2014	117	2			6	3		96			TNC, TWRA, TECH
Roane	Marble Bluff Cave	1/24/2014		1				3		172			TVA
Roane	Cave Creek Cave	2/27/2014		5				1		26			TNC

County	Cave Name	Date	CORA	EPFU	MYGR	MYLE	MYLU	MYSE	MYSO	PESU	LANO	MYsp	Surveyors
Robertson	Bradley Hill Caverns	3/4/2014								19			TNC
Robertson	Worsham Springs Cave	3/10/2014								43			TNC
Smith	Bridgewater Cave	2/21/2014			2		15			38			TNC
Stewart	Tobaccoport Saltpeter Cave	2/5/2014		18	26		50		105	12		5	TNC, TWRA, TVA
Sullivan	Morrell/Worleys Cave	2/25/2014		2	1		1			20			TNC, TWRA
Sumner	Mason Cave	3/14/2014		6						182		1	TNC
Tipton	Civil War Bunker	2/12/2014	1	3						6			TWRA
Union	Jolley Saltpeter Cave	2/26/2014					460	1		23			TWRA
Van Buren	Measles Gulf Cave	2/7/2014	130	6				1		9			TNC, TWRA, TECH
Van Buren	Cagle Saltpeter Cave	2/19/2014	1	1	15	1	2			62		4	TWRA, USFWS, TDEC
Van Buren	Camps Gulf Cave	2/19/2014		4			1		9	47		7	TWRA, USFWS, TDEC
Van Buren	Foxhole Cave	3/5/2014					19		6	56			TWRA, USFWS
Warren	Hubbards Cave	1/20/2014			238,365				88	10			TWRA, TNC
Washington	Windged Deer Saltpeter Cave	2/20/2014								1			TVA, TWRA
Wayne	Biffle Cave	2/13/2014		3			19	16	15	552		1	TNC
White	Great Expectations Cave	1/31/2014	217	2			1	1		92		2	TNC, TWRA, TVA
White	Lost Creek Cave	1/31/2014			1		1		51	62		2	TNC, TWRA, TVA, USFWS
White	Rose Cave	2/5/2014		1						41			TWRA
White	Great Big Bottom Cave	3/2/2014					3			244			TNC, TWRA
Wilson	Gallatin Steam Plant Cave	3/5/2014			2					27			TNC