Final Performance Report

State: North Carolina **Grant Number:** E-17

Period Covered: October 1, 2015 – September 30, 2016

Grant Title: White-nose Syndrome Grant to States

Project Title: White-nose Syndrome Surveillance & Bat Monitoring in North Carolina

Objectives:

1. **WNS Surveillance and Hibernacula Population Monitoring:** Conduct 20 winter and early spring hibernacula surveys and WNS surveillance, including purchase of decontamination supplies, data entry into NCWRC database, and shipping bat samples to SCWDS for WNS testing. These data will contribute to the Data and Technical Information Management, Disease Surveillance, Disease Management, and Conservation and Recovery elements of the National WNS Plan.
2. **Long-term Summer Population Monitoring:** Conduct summer monitoring of bat populations and community structure, including conducting counts at 15 summer roosts and mist-netting 25 sites with long-term datasets. These data will contribute to the Data and Technical Information Management and Conservation and Recovery elements of the National WNS Plan.
3. **Travel to WNS Meetings:** Funding for expenses associated with attending the Annual WNS Workshop and regional meetings (e.g., NCBWG, SBDN) focused on bats and WNS. Attendance at these meetings will contribute to all seven elements of the National WNS plan.

A. Activity

We conducted a broad range of activities in western North Carolina under this grant, meeting all objectives. Work was done by current staff and some funds were used to support temporary technician assistance. We conducted surveillance for WNS, winter bat hibernacula monitoring surveys, mist-netting surveys, and monitoring of several summer roosts. In addition to these field-oriented efforts, we managed the bat and WNS databases, summarized data, assisted with several WNS research studies, and coordinated with a multitude of partners on WNS related issues.

White-nose Syndrome Surveillance

White-nose syndrome was first detected in North Carolina in February 2011 in a bat from Avery County. Since that time, biologists with the N.C. Wildlife Resources Commission and the U.S. Fish and Wildlife Service have confirmed the disease in 5 bat species in 8 counties in western

North Carolina (Avery, Buncombe, Haywood, Jackson, McDowell, Rutherford, Transylvania, Yancey), with an additional 3 counties considered suspect for WNS (Swain, Cherokee, Stanly; Figure 1.)

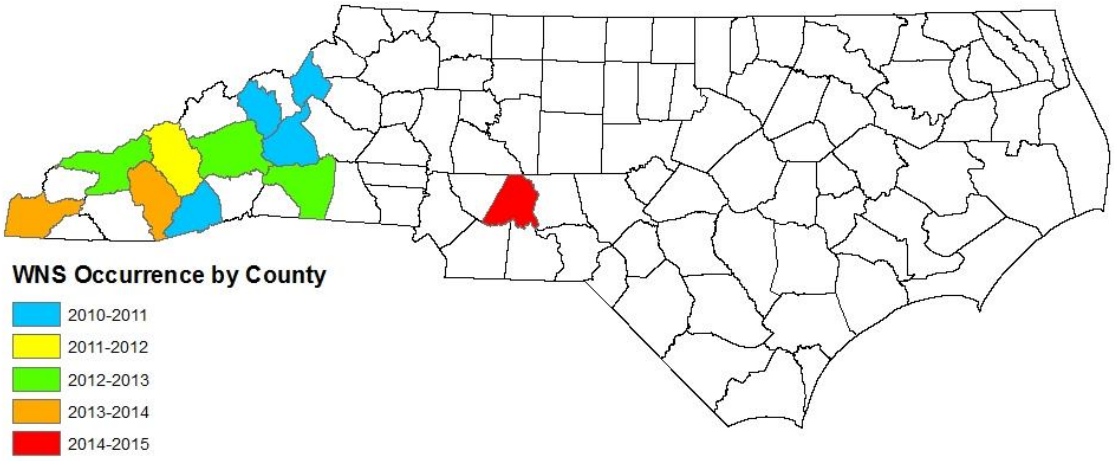

Figure 1. Map WNS occurrence in NC counties by year.

In accordance with the protocols outlined in the North Carolina White-nose Syndrome Surveillance and Response Plan (NCWRC 2013), bats and swabs from bats and hibernacula substrate were sent for WNS testing at the Southeastern Cooperative Wildlife Disease Study (SCWDS) in Athens, Georgia (Table 1). In 2014, we extended our surveillance efforts to the Piedmont region, and although in 2015 one swab was positive for *Pd* from a Stanly County mine, subsequent samples tested negative in 2016 (Table 1).

Table 1. Samples sent to SCWDS for WNS testing from 1 October 2014 - 30 September 2015. Species codes are as follows: EPFU = *Eptesicus fuscus*; PESU = *Perimyotis subflavus*; TABR = *Tadarida brasiliensis;* NYHU = *Nycticeus humeralis;* MYLE = *Myotis leibii*. Note that the County/Site ID is unique to this table and does not match up with sites with the same ID in other tables.

Collection Date	County/Site ID #	Site Type	Sample Type	Species (# of samples)	WNS Status
10/19/2016	Cleveland-1	Bridge	Bat	EPFU	Negative
1/28/2016	Cabarrus -1	Mine	Bat and substrate swabs	PESU (6)	Negative
1/26/2016	Stanly-1	Mine	Bat and substrate swabs	PESU (10)	Negative

Winter Bat Hibernacula Monitoring

NCWRC staff conducted bat hibernacula surveys at 11 caves and mines in 7 counties in winter 2016 in western North Carolina (Table 2). The total number of bats counted was 455 with Virginia big-eared bats accounting for 56% of the total (252 individuals). The second most abundant species was the tri-colored bat with 20% of the total (90 individuals), which is a decrease from previous years (Figure 2). Counts of little brown and northern long-eared bats continue to be low as compared to pre-WNS counts. Additionally, we purchased the necessary gear and supplies for the winter cave surveys and associated decontamination procedures.

Table 2. Bat hibernacula surveyed in winter 2016 for bats, WNS site status, and the number of each species observed. A site is WNS positive (+) if the site is confirmed or suspect for WNS; ND = WNS not detected. Species codes are as follows: CORA = *Corynorhinus rafinesquii rafinesquii*; COTO-VI = *Corynorhinus townsendii virginianus*; EPFU = *Eptesicus fuscus*; MYLE = *Myotis leibii*; MYLU = *Myotis lucifugus*; MYSE = *Myotis septentrionalis*; PESU = *Perimyotis subflavus*; *Myotis* spp. = a bat in the *Myotis* genus but not identified to species. Note that the County/Site ID is unique to this table and does not match up with sites with the same ID in other tables.

County-Site ID	Survey Date	Property Owner	WNS Status	CORA	COTO-VI	EPFU	MYLE	MYLU	MYSE	MYSO	Myotis spp.	PESU	Total
Haywood-1	1/28/2016	Private	+				17	1				25	43
Macon-1	2/11/2016	USFS	+									14	14
Transylvania-1	2/11/2016	USFS	ND										0
Cherokee-1	2/9/2016	USFS	+					4				16	20
Cherokee-2	2/9/2016	USFS	+				1	63				14	78
McDowell-1	2/25/2016	Private	+									7	7
Avery-1	1/26/2016	NCWRC	+			8						3	11
Avery-2	2/1/2016	NC Parks	+		239							1	240
Avery-3	2/1/2016	NPS	+		13		1				1	6	21
Avery-4	2/4/2016	NC Parks	+		1								1
Yancey-1	2/16/2016	Private	+			2	13	1				4	20
			Species Totals:	**0**	**253**	**10**	**32**	**69**	**0**	**0**	**1**	**90**	**455**

When the data from hibernacula surveyed in winter 2016 are combined with past data at these same long-term monitoring sites, the trends that emerge indicate that WNS is having a significant negative effect on several cave hibernating bat species in western North Carolina. An analysis of trends was conducted with a total of 21 bat hibernacula, for which we had pre and post WNS data. Six of the seven species documented at this set of sites show a decline in the number of hibernating bats observed post-WNS as compared to the pre-WNS average. However, the Rafinesque's big-eared bat and the Virginia big-eared bat are not known to suffer from WNS. Declines are seen in the 5 remaining species when data are combined across all 21 sites (Figure 2). However, when only the sites that have been confirmed with WNS for three or more years are included (n=11), the declines in the number of hibernating bats is close to 100% for little brown bats, tri-colored bats, and northern long-eared bats, with big brown bats around a 40% decline, and eastern small-footed bats close to a 70% decline.

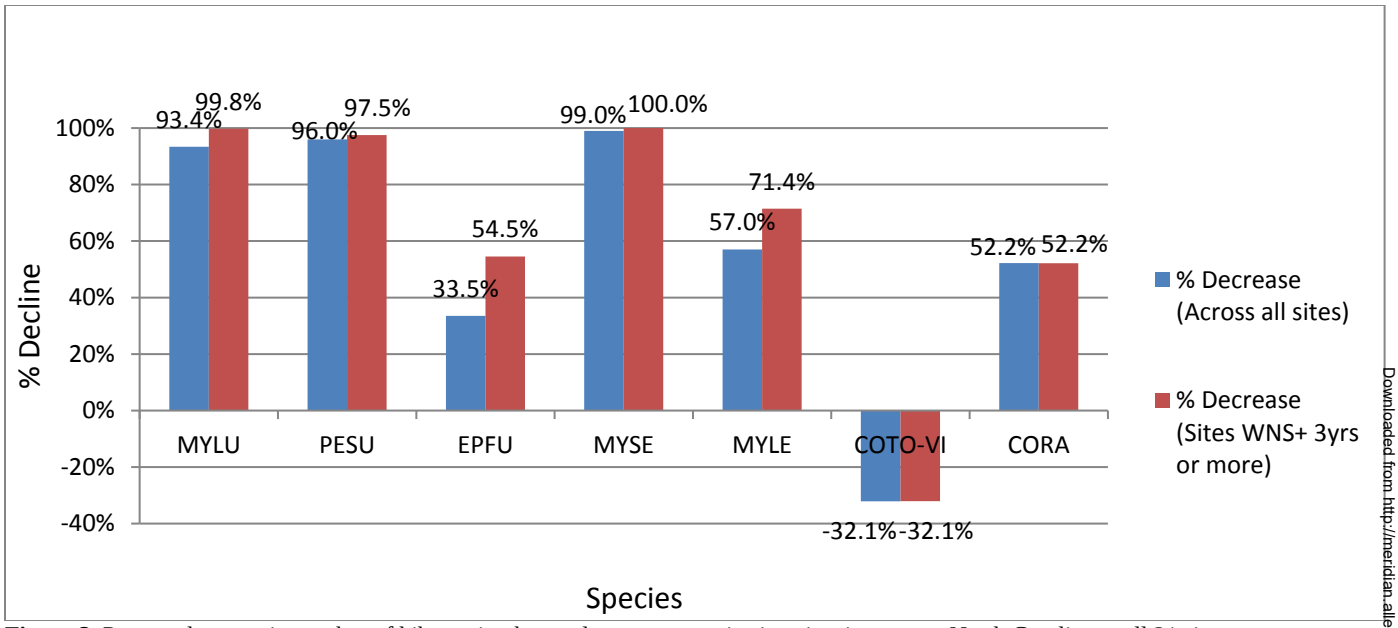

Figure 2. Percent decrease in number of hibernating bats at long-term monitoring sites in western North Carolina at all 21 sites monitored and at a subset of those that have had WNS for 2 or more years (n=11). Species codes are as follows: CORA = *Corynorhinus rafinesquii rafinesquii*; COTO-VI = *Corynorhinus townsendii virginianus*; EPFU = *Eptesicus fuscus*; MYLE = *Myotis leibii*; MYLU = *Myotis lucifugus*; MYSE = *Myotis septentrionalis*; PESU = *Perimyotis subflavus*.

Summer Mist-netting

In summer 2016, NCWRC staff and partnering agencies conducted mist-netting to collect demographic information on bat populations at designated long-term monitoring sites in the western region of North Carolina and added eight new sites in the Coastal Plain and Piedmont regions of the state. We purchased the necessary gear and supplies for the summer mist-netting surveys and associated decontamination procedures. A total of 27 surveys were conducted in 16 counties. These surveys resulted in the capture of 11 bat species and a total of 293 bats. The big brown bat and the eastern red bat were the most common species captured, at 110 (38%) and 121 (41%), respectively (Table 3). The eastern small-footed bat was the third most commonly captured bat with 21 captures (7%). The average captures of this species per net hour has increased 30% post-WNS (2012 and after) compared to pre-WNS surveys (before 2011, Figure 3). This is contradictory to winter survey data; however, this bat is primarily encountered in one hibernacula yet is somewhat frequently caught in mistnetting surveys, so the winter data may only represent a small proportion of the population.

Table 3. Mist-netting sites surveyed in summer 2016 in western North Carolina as part of a long-term bat monitoring effort. Some sites were netted multiple times over the two years. Species codes are as follows: CORA = *Corynorhinus rafinesquii rafinesquii*; EPFU = *Eptesicus fuscus*; LABO = *Lasiurus borealis*; LACI = *Lasiurus cinereus*; MYGR =

Myotis grisescens; MYLE = *Myotis leibii*; MYLU = *Myotis lucifugus*; MYSE = *Myotis septentrionalis*; MYSO = *Myotis sodalis*; PESU = *Perimyotis subflavus*; *Myotis* spp. = a bat in the *Myotis* genus but not identified to species.

Site Name	Survey Date	County	Property Owner	CORA	EPFU	LANO	LABO	LACI	MYGR	MYLE	MYLU	MYSE	MYSO	MYAU	PESU	NYHU	TOTAL
Croatan Mitigation Bank	5/15/2016	Craven	NCDOT		2		11							2			15
Goose Creek State Park	5/16/2016	Beaufort	State Park		6		2								1		9
Merchants Millpond-Group Campground Road	5/17/2016	Gates	State Park				1										1
Merchants Millpond-Group Campground Road	5/18/2016	Gates	State Park	1			5					1					7
Merchants Millpond-Fire Road	5/19/2016	Gates	State Park		1		5							5			11
Pee Dee NWR-GTR Road	5/22/2016	Anson	USFWS				9								1		10
Pee Dee NWR-Griffin Road	5/23/2016	Anson	USFWS				10									1	11
Pee Dee NWR-End of Griffin Road	5/24/2016	Anson	USFWS				5										5
Pee Dee NWR-Cemetary Road	5/25/2016	Richmond	USFWS				13				1					1	15
Shuler Creek	5/31/2016	Cherokee	USFS		1	7	7										15
John's Branch/FS 81C	6/1/2016	Graham	USFS		2		2										4
Cold Knob/FS 479H	6/13/2016	Buncombe	USFS		8	1	12										21
Davidson River/Pisgah Education Center	6/16/2016	Transylvania	NCWRC		1	2	4			5					2		14
Pigeon River/Twelve Mile	6/20/2016	Haywood	USFS		1		3										4
A-0009 - Site N - FS 404	6/21/2016	Graham	USFS		20		1	1							1		23
Nantahala River Bike Path	6/22/2016	Macon	USFS							1					1		2
North Shoals Creek/FS 408	6/28/2016	Cherokee	USFS		9							1					10
Alarka Laurel 1	6/30/2016	Swain	USFS		3		13	2							1		19
Upper Curtis Creek Road	7/5/2016	McDowell	USFS		5		2			3							10
Linville River at Pineola	7/7/2016	Avery	State Park		2					1	1				1		5
Upper Neals Creek	7/11/2016	Yancey	USFS		3												3
Upper Neals Creek	7/12/2016	Yancey	USFS		5					3							8
Victor Road Cemetary	7/13/2016	McDowell	NPS		1		2			4							7
North Harper Creek	7/14/2016	Avery	USFS		3		3			1							7
Atkins River	7/15/2016	Watauga	Private		2												2
Ray's Branch	7/20/2016	Macon	USFS		17		4			1							22
FR 496/ FR210 Junction	8/1/2016	Burke	USFS		15		2			1							18
Nantahala Dam Road	8/8/2016	Macon	USFS		3		5			1	1						10
Hurricane Creek	8/15/2016	Haywood	USFS	5													5
			Totals	**6**	**110**	**10**	**121**	**3**	**0**	**21**	**3**	**2**	**0**	**7**	**8**	**2**	**293**

A preliminary analysis of long-term mist-net monitoring data shows similar trends for several species to winter hibernacula counts (Figure 3). The steep declines in the number of bats captured per hour for little brown and northern long-eared bats (91% and 81%, respectively) resemble declines in winter data across all 21 monitored hibernacula (93% and 99%, respectively). Big brown bat mist-net captures decreased 17%, which is somewhat comparable to the 32% decrease seen in hibernacula counts for this species. Tri-colored bat captures have decreased by 61% since the arrival of WNS, yet winter counts of this species are down 96% at all monitored hibernacula. One northern long-eared bat was captured on the Coastal Plain in Gates County, which was the first record of this species at Merchant's Millpond State Park. Additionally, a little brown bat was caught in Richmond County in the Piedmont Region, which

is a new county record for this species.

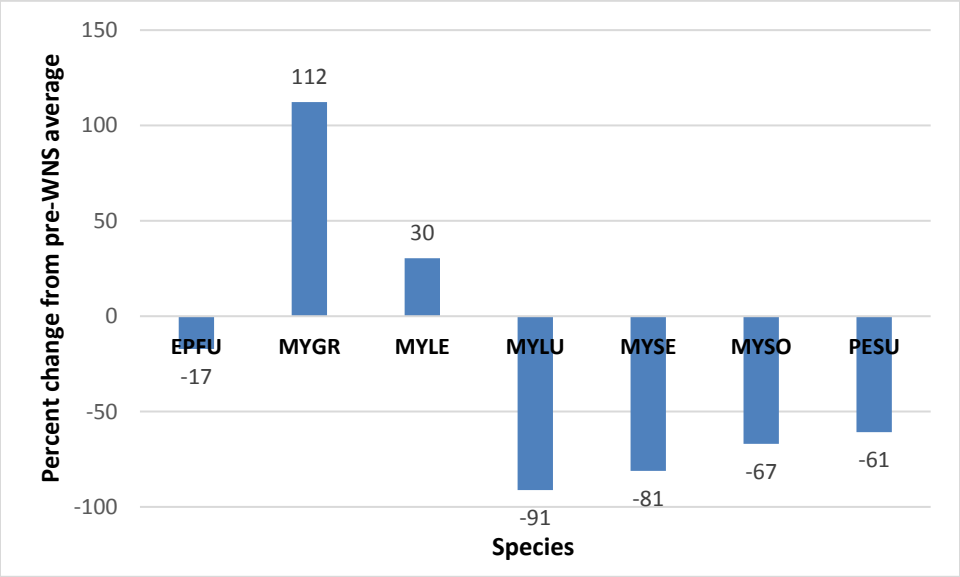

Figure 3. The percent change in the mean number of bats captured per net hour in mist-netting surveys at long-term monitoring sites in western North Carolina post-WNS (2012+) compared to pre-WNS (2011 or before). Species codes are as follows: EPFU = *Eptesicus fuscus*; MYGR = *Myotis grisescens*; MYLE = *Myotis leibii*; MYLU = *Myotis lucifugus*; MYSE = *Myotis septentrionalis*; MYSO = *Myotis sodalis*;PESU = *Perimyotis subflavus*.

Summer Bat Roost Surveys

Ten locations in western North Carolina were surveyed, most of them multiple times, for bat presence in summer 2016 (Table 4). Nine roosts are long-term monitoring sites and an additional roost was discovered and monitored in Buncombe County. These roosts include bridges, concrete and pipe based structures, and bat houses. Some surveys were conducted by performing a day-time count of roosting bats, while others were conducted through an emergence count at dusk, but the method is consistent at individual sites. Over this time span, 40 surveys were conducted and yielded 7 species for a total of 4,482 bats observed (Table 4). The most notable observation was the presence of roosting gray bats in Buncombe County, which was the first record of its kind in the state.

Table 4. Summer bat roosts monitored in western North Carolina as part of a long-term monitoring effort. The survey dates, property ownership, and number of each species observed are shown. Species codes are as follows: CORA = *Corynorhinus rafinesquii rafinesquii*; COTO-VI = *Corynorhinus townsendii virginianus*; EPFU = *Eptesicus fuscus*; MYLE = *Myotis leibii*; MYLU = *Myotis lucifugus*; MYSE = *Myotis septentrionalis*; MYSO = *Myotis septentrionalis*; MYGR = *Myotis grisescens*; PESU = *Perimyotis subflavus*; TABR = *Tadarida brasiliensis*. Note that the County/Site ID is unique to this table and does not match up with sites with the same ID in other tables.

Site Name	Survey Date	County	Property Owner	CORA	COTO-VI	EPFU	MYLE	MYLU	MYSE	MYSO	MYGR	PESU	TABR	Total
Jackson-1	5/11/2016	Jackson	Private/NCWRC											0
Swain-1	5/4/2016	Swain	NCDOT			26	3							29
Swain-1	6/7/2016	Swain	NCDOT			1	4							5
Swain-1	7/27/2016	Swain	NCDOT				4							4

Swain-1	8/22/2016	Swain	NCDOT			2	3						5
Haywood-1	4/25/2016	Haywood	USFS	19									19
Haywood-1	8/15/2016	Haywood	USFS	20									20
Watauga-1	2/4/2016	Watauga	NPS (BRP)										0
Watauga-1	7/7/2016	Watauga	NPS (BRP)		2		10						12
Watauga-2	8/11/2016	Watauga	Private		343								343
Haywood-2	6/29/2016	Haywood	NCDOT										0
Macon-1	7/28/2016	Macon	NCDOT										0
Swain-2	5/4/2016	Swain	NCDOT			21							21
Swain-2	6/7/2016	Swain	NCDOT			34							35
Swain-2	7/27/2016	Swain	NCDOT			128	1						129
Swain-2	8/22/2016	Swain	NCDOT			37			2				39
Graham-1	5/4/2016	Graham	NCDOT				1						1
Graham-1	6/1/2016	Graham	NCDOT				8						8
Graham-1	7/27/2016	Graham	NCDOT				23						23
Graham-1	8/22/2016	Graham	NCDOT				16						16
Buncombe-1	5/9/2016	Buncombe	NPS (BRP)			240							240
Buncombe-1	7/18/2016	Buncombe	NPS (BRP)			173							173
Buncombe-1	7/19/2016	Buncombe	NPS (BRP)			200					10		210
Buncombe-1	7/25/2016	Buncombe	NPS (BRP)			200					8		208
Buncombe-1	7/26/2016	Buncombe	NPS (BRP)			235					29	1	265
Buncombe-1	8/1/2016	Buncombe	NPS (BRP)			305					4		309
Buncombe-1	8/9/2016	Buncombe	NPS (BRP)			38							38
Buncombe-1	8/10/2016	Buncombe	NPS (BRP)			41					1	3	45
Buncombe-1	8/17/2016	Buncombe	NPS (BRP)			175					8	8	191
Buncombe-1	8/23/2016	Buncombe	NPS (BRP)			288					2	3	293
Buncombe-1	8/25/2016	Buncombe	NPS (BRP)			363					26	1	390
Buncombe-1	8/29/2016	Buncombe	NPS (BRP)			357					5	2	364
Buncombe-1	8/31/2016	Buncombe	NPS (BRP)			103					68		171
Buncombe-1	9/7/2016	Buncombe	NPS (BRP)			151					31	1	183
Buncombe-1	9/13/2016	Buncombe	NPS (BRP)			172					8	1	181
Buncombe-1	9/23/2016	Buncombe	NPS (BRP)			183					3		186
Buncombe-1	10/1/2016	Buncombe	NPS (BRP)			80					5		85
Buncombe-1	10/6/2016	Buncombe	NPS (BRP)			111					15		126
Buncombe-1	10/13/2016	Buncombe	NPS (BRP)			54					3		57
Buncombe-1	10/19/2016	Buncombe	NPS (BRP)			55					3		58
			Species Totals:	**39**	**345**	**3773**	**73**	**0**	**2**	**0**	**229**	**1** **20**	**4482**

Travel to WNS Meetings

NCWRC staff participated in and presented WNS-related work at the Annual NC Bat Working Group meeting in Gastonia, NC in December 2015 and at the WNS Workshop in Denver, CO in June 2016 on this grant.

B. Target Dates for Achievement and Accomplishment

On schedule

C. Significant Deviations

None.

D. Remarks

E. Recommendations

F. Estimated Cost

$44,514.72 federal dollars spent. (October 1, 2015 – September 30, 2016)

G. References

North Carolina Wildlife Resources Commission. 2013. North Carolina's White-nose Syndrome Surveillance and Response Plan. Raleigh, North Carolina.

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