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BUREAU OF WILDLIFE MANAGEMENT
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COOPERATING AGENCIES: U.S. Fish and Wildlife Service, Division of Federal Aid; Department of Conservation and Natural Resources, Bureau of State Parks; Pennsylvania Natural Heritage Program, Bucknell University and The Nature Conservancy.

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WORK LOCATION: Statewide

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ABSTRACT This report covers spring and fall trapping at entrances to hibernacula during 2016, internal surveys of hibernacula conducted from January 2016 through March 2016. The disease called White-nose syndrome (WNS) has been a focus of investigation for staff across this time and for the past several years. Currently, the Pennsylvania Game Commission considers all significant hibernacula to be infected across the state and the priority of searching for sites to verify disease has ceased since 2012. Our focus has switched to locating, monitoring, protecting, and investigating the survivors that do exist. Following the winter 2016 surveys in Pennsylvania, 73 sites have WNS mortality confirmed and 83 of these have comparable survey effort both before and after WNS. Inter-specific differences in mortality and an overall decline of 98.8% for all cave bats species combined. Members from the genus *Myotis* and genus *Perimyotis* are noted to be relocating to colder sites (38-40°F) where these species have never been observed prior (i.e. site 17-002) as well as shifting within sites to colder areas proximate to opening (i.e. site 14-009-M). During winter 2016 internal surveys, 35 different hibernacula were visited, and 178.1 person hours were spent finding and counting bats. Thirty-three of the 35 sites contained bats. Of the sites surveyed, 12 were used by at least 1 individual classified as a special concern species (Indiana, small-footed, and northern long-eared). However, only 1 site contained ≥ 4 species of bats (in contrast with 4 in 2015) and only 2 sites contained ≥ 100 bats (compared to 3 in 2015). The 37 interior surveys accounted for 6 species and 1,514 total bats. These included 599 little brown bats (*Myotis lucifugus*) at 22 sites, 90 tri-colored bats (*Perimyotis subflavus*) at 26 sites, 755 big

brown bats (*Eptesicus fuscus*) at 22 sites, 4 northern long-eared bats (*Myotis septentrionalis*) at 3 sites, 12 Indiana bats (*Myotis sodalis*) at 2 sites, and 45 small-footed bats (*Myotis leibii*) at 10 sites. During spring and fall 2016, 9 surveys were performed at 2 hibernacula using harp traps resulting in the capture of 174 bats including 158 little brown bats, 8 big brown bats, 1 northern long-eared bat, 1 tri-colored bat, 4 eastern small-footed bats, and 2 Indiana bats. One site (07-018M) known to contain Indiana bats prior to WNS has confirmed swarm captures of live Indiana bats in 2016, and one site (40-007-M) known to contain northern long-eared bats prior to WNS continues to provide swarm captures in 2016. Site 40-007-M has had WNS for 6 seasons and is the largest remaining hibernacula known following WNS infection, and comprised 55% of the total bats captured at hibernacula trapping. Twenty Indiana bat hibernation sites are currently recognized within the state. These include 9 limestone mines, 6 limestone caves, 1 clay mine, 3 anthracite coal mines, and 1 railroad tunnel. One limestone mine (07-018M) is currently designated by the U.S. Fish and Wildlife Service as a Priority 2 Indiana bat hibernaculum; 3 are Priority 3 sites, and the remaining 16 sites are all Priority 4. White-nose Syndrome is confirmed in 73 sites across 27 counties in Pennsylvania, including 18 of the 20 known sites that contain Indiana bats. Extant populations of Indiana bats are confirmed at only 3 of the 20 known hibernacula via harp trapping and 2 secondarily confirmed via internal surveys (third is not accessible to humans). In addition, the Pennsylvania Game Commission relegalized the need for an updated prioritization plan to properly determine with hibernacula need internal surveys. Along with partners the Pennsylvania Game Commission completed this plan and will begin implementation in winter 2017.

OBJECTIVES

1. To inventory and examine any new site that has the potential to contain hibernating bats and to locate survivors of white-nose syndrome (WNS).
2. To assess the distribution of caves and mines used by bats, and to survey and monitor bat populations in these hibernacula.
3. To protect all hibernacula harboring special concern species, 4 or more species, and large bat populations.
4. To prioritize and survey sites for WNS using the most current guidelines as defined in the Pennsylvania Hibernacula Prioritization and Management Plan (2016).
5. To conduct research investigating the causative agent, transmission, detection, survival, and potential techniques to fight the spread and mortality associated with WNS.
6. To analyze the demographic and population changes that may occur as a result of WNS; specifically, to examine any attributes of survivors that provide clues to why individuals are surviving and how to improve management for the survivors.

INTRODUCTION

There are over 2,000 recognized caves and over 4,000 mine openings in Pennsylvania.

For decades, our management objective have been to search for new sites when possible and to monitor, no less than once every 5 years, those caves or mine openings that are classified as special concern hibernacula. To be considered a special concern hibernaculum, criteria included at least 1 of the following, either currently or historically: presence of a state or federally listed bat species, 4 or more species of bats, $\geq 1,000$ bats historically or ≥ 25 total bats (excluding numbers of big brown bats) currently, or an exceptional population of a special concern species. This plan, however, despite having broad application in Pennsylvania, has never been systematically evaluated, and therefore Pennsylvania Game Commission has focused management efforts at only a few dozen hibernacula, a small fraction of the state's total number of potential hibernacula. Therefore, the need for such an evaluation of these criteria had become pressing, especially since the recent invasion of an emerging infectious disease of hibernating bats, White-nose Syndrome (WNS), which has dramatically changed hibernating bat colonies and affected their use of these hibernacula (Table 1). In 2016, the Pennsylvania Game Commission re-evaluated data from the agency's long-term program of bat monitoring to determine the criteria for determining special concern hibernacula both before and after the onset of WNS in the state (Sewell et al 2016). This evaluation indicated that some criteria and thresholds were redundant and others – especially since the onset of WNS – are exceedingly restrictive. In addition, some species now requiring heightened conservation attention are largely ignored under the old criteria and does not provide clear guidance to managers on resource allocation. This new methodology uses 2 evaluation criteria (high species richness and important populations of any hibernating species) and establishes several tiers of conservation priority (including: Critical Hibernacula, Special Concern Hibernacula, and Potential Recovery Hibernacula). Table 2 shows previous criteria and quantitative thresholds for identification of Special Concern Hibernacula in Pennsylvania, with the number meeting this threshold in pre-WNS period (2002–2006) and the WNS-prevalent period (2012–2016).

White-nose syndrome has quickly become the most devastating wildlife disease ever documented to impact Pennsylvania's native fauna. The North American epicenter lies just outside Albany, New York, where it was first photographed in Howe's Cave in February 2006 (Blehert et al. 2009). Following its assumed introduction to Pennsylvania during the 2007-2008 hibernating season, WNS has spread across all of Pennsylvania. The fungus *Pseudogymnoascus* [= *Geomyces*] *destructans* has been confirmed to be the causative agent of WNS (Lorch et al. 2011) and the disease is formally diagnosed in the laboratory by confirming the presence of characteristic skin lesions where *P. destructans* actively invades and digests live cells within the wing membrane or other areas of exposed skin with minimal hair (Meteyer et al. 2009). Currently, ultraviolet (UV) light provides a method to identify and collect small biopsy punches of lesions for further histological confirmation of disease, but in a non-lethal manner (Turner et al. 2014). A common characteristic among WNS bats is an emaciated condition; with dehydration (Cryan et al. 2010) and increased arousals (Reeder et al. 2012) being 2 biological systems demonstrated to be altered in infected bats. Unpublished data suggests that survivors are getting less infection annually and they are compensating for the increased arousals by increasing the storage of energy in fall. However, with the very low reproductive rate of bats, the high mortality of adults, and other factors, the long-term existence of these species within Pennsylvania will depend greatly on whether or not the juveniles born to these survivors will be passed a trait offering protection from the disease.

METHODS

Two techniques were used to assess the status of cave-roosting bats: 1) visual inspection of caves and mines for hibernating bats from December through March and 2) sampling of bats “swarming” at cave or mine entrances using harp traps or mist nets (Tuttle 1974) during spring (April to May) or fall (August to November). For each visit to a cave, tunnel or mine, a bat hibernaculum survey form was completed. All data was transferred to a Pennsylvania Game Commission bat hibernacula database.

Interior or visual surveys occurred late in the hibernation season to minimize stress to infected individuals low on fat reserves and to overlap the timing of this survey with warmer weather periods, should any disturbance result in the emergence from hibernation. Sites chosen for WNS surveys in 2016 were prioritized by multiple characteristics including: research requests and needs, species presence and abundance within hibernacula, proximity to an affected area, the need to determine WNS distribution. The newly-developed Prioritization and Management Plan will be implemented in future years to determine the site selection of winter internal surveys.

In the past, to confirm a site as being WNS-positive, a collection of 2-3 live specimens would be euthanized and shipped, refrigerated, overnight to the U.S. Geological Survey (USGS) laboratory. The first several sites in Pennsylvania were all confirmed via this method, but once Pennsylvania was confirmed and the symptoms were seen routinely in affected areas, the decision was made to call sites confirmed if 2 clinical signs (visible fungus, roost shift, dehydration, flying bats, etc) were seen and mortality was noted.

RESULTS

Table 1 is an overview of the status of hibernating bats commonly found in Pennsylvania, including their hibernacula use and population trends, both pre-WNS and in a WNS-prevalent environment. In addition to the federally-endangered Indiana bat and newly-listed (2015) federally-threatened northern long-eared bat, Pennsylvania’s special concern species include the state-threatened eastern small-footed bat.

During winter 2016 internal surveys, Pennsylvania Game Commission employees, other state employees, and volunteers visited 37 different hibernacula and spent 178.1 hours finding and counting bats during internal surveys (Table 3). Thirty three of the 35 sites contained bats. Of the 2 that had no bats, 1 site was never surveyed previously. Of those sites surveyed, 12 sites were used by at least 1 individual classified as a special concern species (Indiana, northern long-eared, or eastern small-footed). Only 1 site contained ≥ 4 species of bats and only 2 sites contained ≥ 100 bats. The 37 interior surveys accounted for 6 species and 1,514 total bats. These included 599 little brown bats (*Myotis lucifugus*) at 22 sites, 90 tri-colored bats (*Perimyotis subflavus*) at 26 sites, 755 big brown bats (*Eptesicus fuscus*) at 22 sites, 4 northern long-eared bats (*Myotis septentrionalis*) at 3 sites, 12 Indiana bats (*Myotis sodalis*) at 2 sites, and 45 small-footed bats (*Myotis leibii*) at 10 sites.

Twenty Indiana bat hibernation sites are currently recognized within the state. These include 9 limestone mines, 1 clay mine, 3 anthracite coalmines, 1 railroad tunnel, and 6 limestone

caves. The USFWS Indiana bat recovery plan categorizes Indiana bat hibernacula into 4 categories - Priority 1: >10,000 Indiana bats current or historic; Priority 2, >1,000-10,000 current or historic bats; Priority 3, 50-1,000 current or historic bats; and Priority 4, <50 bats current or historic (USFWS 2007). Of the 19 sites, 1 limestone mine is a Priority 2 Indiana bat hibernaculum, 4 are Priority 3 hibernacula, and the remaining 15 are all Priority 4. The high count of Indiana bats for the Priority 2 mine after the site was gated in 1986 is 765, with the Priority 3 and 4 sites ranging from 1 to 139 Indiana bats.

In 2016, extant populations of the endangered Indiana bat were confirmed at 2 sites previously documented with populations of Indiana bats, 1 via an internal survey and the other by both an internal survey and fall swarm trapping. Within 6 years of WNS being first confirmed in Pennsylvania (2009), it has been documented in 18 of the 20 known sites harboring the federally-listed species. Of these 18 sites, 16 sites have been surveyed internally following at least 1 year of confirmed WNS mortality. At these 16 sites, only 3 sites are confirmed to still have Indiana bats following WNS mortality.

During spring and fall 2016, 9 surveys were performed at 2 hibernacula using harp traps placed at or near the entrance resulting in the capture of 174 bats including 158 little brown bats, 8 big brown bats, 1 northern long-eared bat, 1 tri-colored bat (formerly eastern pipistrelle), 4 eastern small-footed bats, and 2 Indiana bats. One site (07-018M) known to contain Indiana bats prior to WNS has confirmed swarm captures of live Indiana bats in 2016, whereas 1 site (40-007-M) known to contain northern long-eared bats prior to WNS continues to provide swarm captures in 2016. Site 40-007-M has had WNS for 6 seasons and is the largest remaining hibernacula known following WNS infection, and comprised 55% of the total bats captured at hibernacula trapping.

As of this reporting period, surveys for WNS in Pennsylvania have resulted in 73 confirmed sites in 25 counties (Table 5), with 18 of the 20 Indiana bat sites confirmed. Of the 2 unconfirmed sites, landowner access has been denied at 1 and the other is a coal mine where no internal surveys can be performed. Survey efforts at the latter have not yielded a single bat since WNS was confirmed in local sites. The counties that remain without being confirmed result mostly from lack of survey effort. Many of these have few documented hibernacula or contain such small, warm sites that typically less than a dozen bats may inhabit. With reports of daytime flying bats in winter received from the public, along with formally confirmed counties, it is presumed at this time that every site has been contaminated by the causative agent of WNS.

Following 2016 surveys, we analyzed the mortality by species at 83 sites (Fig. 1) with comparable survey effort both before and following WNS introduction. Following the 2016 surveys in Pennsylvania, the total bat mortality for all species combined was 71.6%. Differential survival is noted, with big browns and small-footed bats displaying declines of 24.0% and -17.8%, respectively, when compared to the averaged counts for these species from all prior surveys before WNS ($n = 417$ surveys). Mortality for the other 4 species is more severe, with little brown bats declining 99.6%, northern long-eared bats declining 99.1%, Indiana bats declining 95.4%, and tri-colored bats declining 93.7%. The variation in counts of small-footed bats and big brown bats are notorious for being small sample sizes with high variation that are highly correlated to average temperature of the winter, with very cold winters having the highest

counts. Hence, we took the conservative approach of averaging all surveys before WNS to yield the most accurate changes in these populations that could be ascertained, but still caution reading too much into the declines for these 2 species.

In addition, temperature and humidity monitoring continued at 9 sites across Pennsylvania. Sites were selected based on: their continued or increased use by various bat species, colder temperatures that have been shown to be preferred by hibernating bats in a WNS-prevalent landscape (Johnson et al. 2016), or is the location of planned future WNS-related research where baseline data is needed. In 1 example, site 07-008-M, a mine in close proximity to a Priority 2 Indiana bat hibernacula, a second entrance (a previously-closed shaft ending in breakdown on a steep slope) was opened in April 2015. This mine previously had internal temperatures of 50-52⁰F and less than 12 bats since it was first discovered to be WNS-positive in 2012. However, in less than 1 year since the opening of the second entrance, the internal temperatures had dropped to 40-44⁰F throughout. It is hoped that this enhancement will be beneficial to bats in the coming years.

DISCUSSION

The Pennsylvania Hibernacula Prioritization and Management Plan (prioritization plan) developed by the Pennsylvania Game Commission and partners in 2016 includes multiple enhancements to the existing prioritization plan implemented by Pennsylvania Game Commission since hibernacula surveys began in 1985. Enhancements included providing more explicit criteria and thresholds for inclusion as a ‘special concern’ hibernacula, reducing unnecessary complexity to the existing plan, being more inclusive of all species needing conservation attention, being more adaptable to a changing conservation landscape, and providing more useful guidance to managers for the efficient allocation of conservation resources, research, and monitoring efforts.

However, additional basic research on bat hibernation ecology and cave ecology is needed to fully understand bat behavior in a WNS-prevalent landscape. For instance, it is unclear to what extent the number and diversity of bats captured outside of hibernacula vary with trapping date, and whether the timing of fall swarms and spring emergences may have changed since the onset of WNS in the state. Research into such topics could help clarify the best times and strategies for fall or spring trapping at the entrances to inaccessible hibernacula. Similarly, investigations of how sampling effort (number of hours and number of netting nights) during spring or fall trapping affects species detection would be beneficial. Similarly, the study of how results from trapping compare to results from interior surveys is needed to better compare data collected with the different techniques and ensure even treatment of all hibernacula in the prioritization process. Even for accessible hibernacula, bat detection rates vary for most species across the hibernation season (Ingersoll et al. 2013). This suggests a need to standardize survey timing and improve understanding of optimal timing of surveys. Another important question relates to modification of hibernacula entrance areas. While it is clear that changes to the entrance structure and vegetation can affect interior environmental conditions, clarification of the direct relationship between them would enable more targeted interventions and greater certainty that the modification would improve interior microclimates for hibernating bats. Finally, surveys to locate populations of rare troglobites, woodrats, and other rare cave-associated fauna would be beneficial. Consideration of the management needs of these species alongside those of bat species could facilitate broader community-level conservation within cave and mine environments.

Despite these needs for further research, to our knowledge, Pennsylvania is the only state with such a detailed prioritization and management plan for hibernacula. This new plan and resulting list of priority hibernacula has the potential to lead management efforts, serve as a durable strategy to guide hibernacula management, and to provide a valuable tool to reinforce the overall goal of supporting the continued persistence of hibernating bat populations in Pennsylvania.

Also, 2016 internal surveys showed that site 42-032-M, a tunnel which had been significantly improved via gating and pouring of concrete floors, continues to have low mid-winter temperatures (33-46⁰F) and now contains stable numbers of 4 bat species, including big browns, little browns, small-footed, and tricolored bats. This may be due to the site's consistently low temperatures post-WNS exposure. In addition, site 26-001-M was revealed to house 2 hibernating Indiana bats during its 26 February survey. This is significant because this is the only documented use by Indiana bats since 2007 (pre-WNS) at this site. In 2008, this site underwent significant habitat improvements including the creation of a cold-air dam at the entrance via the piling of soil and rocks at the entrance to stop cold air from escaping, and the subsequent gating of this entrance.

RECOMMENDATIONS

1. Continue to survey bat hibernacula, concentrating on previously un-surveyed mines and caves. The emphasis should be on those sites with environmental conditions conducive to habitation by the federally-endangered Indiana bat, federally-threatened northern long-eared bat, and the state-threatened eastern small-footed bat. Most new surveys will focus on abandoned manmade structures, such as mines and tunnels.

2. Continue to update the winter bat hibernacula survey database. Maintain separate databases (or distinct fields in a single database) for mist netting and trapping at or near hibernacula entrances, and for bat surveys in summer habitat that are at least 0.5 km away from the entrance to known hibernacula.

3. Implement the new hibernacula prioritization plan as described in Sewell et al. 2016 and evaluate its effectiveness in coming years.

4. Continue to revise survey and reporting protocol for bat-sampling permits issued through the Pennsylvania Game Commission.

5. Sites with WNS survivors should be monitored to determine if the same individuals are returning in subsequent years, to see if these survivors are still getting infected each winter, and to see if any demographic changes have occurred as a result of WNS (i.e. sex ratio, body mass).

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Table 1. Hibernating bat species of Pennsylvania, with hibernacula use and population trends. Hibernacula use: C = cave, M = mine, T = tunnel, R = rock crevices exterior to caves and mines, B = buildings. Data are from the Draft Hibernacula Management Plan, Pennsylvania Game Commission Annual Report 71401-05, Turner et al. (2011), Thogmartin et al. (2012), Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission (2015), Ingersoll et al. (2016), B. J. Sewall, G. G. Turner, and C. M. Butchkoski, unpublished, and G. G. Turner and M. R. Scafini, pers. obs.

Species	Hibernacula types used	Federal conservation status	PA estimated pre-WNS population	Recent pre-WNS population trends within PA	WNS-prevalent population trends
Indiana myotis	C, M, T	Endangered	rare	Slight increase	Severe decline
northern long-eared myotis	C, M, T, R, B	Threatened	rare	Steady decline	Severe decline
little brown myotis	C, M, T, R	Petitioned	common	Stable	Severe decline
eastern small-footed myotis	C, M, T, R	None	rare	Stable	Decline
tri-colored bat	C, M, T	Petitioned	common	Stable	Severe decline
big brown bat	C, M, T, B	None	common	Slight decline	Decline

Table 2. Previous criteria and quantitative thresholds for identification of Special Concern Hibernacula in Pennsylvania, with number meeting this threshold in pre-WNS period (2002–2006) and the WNS-prevalent period (2012–2016).

Criteria for the determination of Special Concern Hibernacula	Thresholds for the determination of Special Concern Hibernacula	Number of hibernacula			
		Pre-WNS period		WNS prevalent period	
		Meeting threshold	Meeting Single threshold only	Meeting threshold	Meeting Single threshold only
Large total number of	A total of ≥ 1000 bats	22	3	0	0
High species richness of	≥ 4 bat species	34	9	19	11
Presence of a federally	Indiana myotis	15	0	5	1
Exceptional population of a special concern species	≥ 3 eastern small-footed myotis, or ≥ 10 northern myotis	30	9	10	3
Number of hibernacula meeting any threshold or meeting only one threshold in each period	—	48	21	23	15

Table 3. Date, type of hibernacula, person hours, and bat species observed during 2016 winter surveys.

Site Code ^a	Date	Type	Person Hours	Species						Total	
				Indiana	Small Footed	Little Brown	N. Long Eared	Big Brown	Tri Colored	Bats	Species
14-032-M	16-Dec-15	RR	2	0	3	3	0	50	4	60	4
14-009-M	8-Jan-16	LC	4	0	1	229	0	2	1	233	4
07-008-M	15-Jan-16	LM	3	0	0	2	0	4	1	7	3
44-002	24-Jan-16	LC	20	0	0	1	0	0	3	4	2
31-049	25-Jan-16	LC	0.5	0	0	0	0	0	1	1	1
31-048-M	25-Jan-16	LC	2.75	0	0	2	0	0	2	4	2
44-032-M	28-Jan-16	RR	5.42	0	15	2	0	107	7	132	4
44-009-M	01-Feb-16	LC	3	0	2	17	0	7	8	34	5
44-009	02-Feb-16	LC	1.75	0	0	3	0	0	1	4	2
07-001-M	02-Feb-16	LC	1.5	0	0	1	0	5	2	8	3
44-009	03-Feb-16	LC	0.8	0	0	0	0	1	1	2	2
44-015-M	03-Feb-16	LM	0.7	0	0	0	0	3	0	3	1
44-004-M	03-Feb-16	LC	0.8	0	0	0	0	7	1	8	2
44-016-M	03-Feb-16	LM	2	0	0	1	0	7	1	9	3
44-009-M	04-Feb-16	LC	6	0	2	1	0	0	3	6	5
37-006-M	08-Feb-16	LM	6	0	0	27	0	86	1	114	3
04-001-M	09-Feb-16	LM	2.6	0	0	5	0	1	3	9	3
44-009-M	11-Feb-16	LC	10.5	0	10	23	0	12	1	49	4
07-016-M	17-Feb-16	LC	2	0	3	0	0	4	2	9	3
07-015-M	17-Feb-16	LC	2.6	0	1	0	2	8	8	19	4
11-001	19-Feb-16	RR	2.3	0	0	0	0	81	0	81	1
07-006-M	22-Feb-16	LC	4.9	0	0	5	0	0	7	12	2
56-016	23-Feb-16	LM	2	0	0	0	0	0	0	0	0
26-035	23-Feb-16	LC	12.25	0	0	0	0	0	1	1	1
56-004-M	23-Feb-16	LM	4.3	0	4	1	0	248	4	257	4
26-008-M	25-Feb-16	LC	8	0	0	3	0	0	11	14	2
26-001-M	26-Feb-16	LM	25.6	2	4	6	1	98	8	121	6
44-027-M	29-Feb-16	LM	2.25	0	0	0	0	0	1	1	1
44-026	29-Feb-16	LM	0.65	0	0	0	0	0	0	3	2
56-017	02-Mar-16	RR	3.7	0	0	2	0	17	0	19	2
09-003	04-Mar-16	LC	0.3	0	0	0	0	0	0	0	0
09-004	04-Mar-16	OS	6	0	0	0	1	0	0	1	1
09-002	04-Mar-16	LC	3.6	0	0	0	0	2	0	2	1
07-018	08-Mar-16	LM	12	10	0	60	0	0	0	70	2
65-006	22-Mar-16	LC	2.9	0	0	2	0	1	7	10	3
14-009-M	23-Mar-16	LC	9.3	0	0	203	0	4	0	207	2
		Total	178.1	12	12	45	599	4	755	90	

^a First pair of numbers refers to county, second is the hibernaculum of record for the county, and the "M" indicates the hibernaculum is periodically monitored.

Table 4. Mist net and harp trap bat surveys at the entrances of hibernacula during 2016.

Site Code ^a	Date	Site Type	Trap Hours	Species						Total	
				Little Brown	Long-Eared	Small-Footed	Indiana	Big Brown	Tri-Colored	Bats	Species
07-018-M	06-Apr-16	LM	4.0	6	0	0	0	0	0	6	1
07-018-M	13-Apr-16	LM	4.0	8	0	1	0	0	0	9	2
07-018-M	27-Sep-16	LM	4.8	38	0	0	1	1	1	41	4
07-018-M	05-Oct-16	LM	4.5	22	0	0	1	0	0	23	2
40-007-M	07-Apr-16	CM	4.0	4	1	1	0	4	0	10	4
40-007-M	14-Apr-16	CM	4.2	4	0	1	0	2	0	7	3
40-007-M	20-Apr-16	CM	4.5	6	0	1	0	0	0	7	2
40-007-M	26-Sept-16	CM	3.5	46	0	0	0	1	0	47	2
40-007-M	04-Oct-16	CM	5	24	0	0	0	0	0	24	1
Totals			38.5	158	1	4	2	8	1	174	

^a Site code same as referred to in previous table.

Table 5. Site code, county, site type, date confirmed, and method of confirmation for 73 white-nose syndrome (WNS) sites in Pennsylvania by end of 2016. Initial county level confirmation by laboratory analysis diagnosing WNS with subsequent county confirmation by field techniques documenting clinical signs of WNS was a protocol established in 2010 by the National Wildlife Health Center. Prior to this date, 2 or more clinical signs resulted in confirmation.

Site Code	County	Site Type	Date Confirmed	Confirmation Type
41-002	Lycoming	Cave	26-Jan-10	Field
41-003	Lycoming	Cave	26-Jan-10	Field
13-002	Carbon	Mine	26-Jan-10	Field
13-003	Carbon	Mine	21-Jan-10	Field
44-009-M	Mifflin	Cave	06-Feb-09	Field
44-011-M	Mifflin	Cave	04-Mar-09	Field
35-002-M	Lackawanna	Mine	02-Feb-09	Laboratory
44-006	Mifflin	Cave	16-Mar-09	Field
14-001-M	Centre	Cave	01-Apr-09	Laboratory
14-009-M	Centre	Cave	25-Mar-09	Laboratory
027-M	Mifflin	Mine	29-Jan-09	Laboratory
40-007 N/T ^a	Luzerne	Mine	12-Feb-09	Field
35-002 N/T ^a	Lackawanna	Mine	02-Feb-09	Field
44-008-M	Mifflin	Cave	01-Apr-09	Field
09-001-M	Bucks	Mine	16-Dec-09	Laboratory
31-002	Huntingdon	Cave	27-Jan-10	Laboratory
41-001	Lycoming	Cave	26-Jan-10	Field
45-001	Monroe	Cave	21-Jan-10	Field
40-14 N/T ^a	Luzerne	Mine	21-Jan-10	Field
40-004 N/T ^a	Luzerne	Mine	10-Jan-10	Field
07-016	Blair	Cave	09-Feb-10	Field
07-015	Blair	Cave	09-Feb-10	Field
49-001	Northumberland	Mine	16-Feb-10	Field
59-001	Tioga	Mine	23-Feb-10	Laboratory
44-012	Mifflin	Cave	20-Mar-10	Field
07-018-M	Blair	Mine	01-Apr-10	Laboratory
26-027-M	Fayette	Mine	19-Apr-10	Laboratory
26-009	Fayette	Cave	19-Apr-10	Laboratory
37-008-M	Lawrence	Mine	10-Apr-10	Laboratory
37-004-M	Lawrence	Mine	21-Dec-10	Field
31-007	Huntingdon	Cave	27-Dec-10	Field
31-006	Huntingdon	Cave	27-Dec-10	Field
26-002M	Fayette	Cave	18-Jan-11	Laboratory
37-005M	Lawrence	Mine	31-Jan-10	Field

Table 5. cont.

Site Code	County	Site Type	Date Confirmed	Confirmation Type
59-002	Tioga	Mine	22-Mar-11	Laboratory
59-003	Tioga	Mine	22-Mar-11	Laboratory
65-004	Westmoreland	Cave	18-Mar-11	Laboratory
31-001M	Huntingdon	Cave	21-Mar-10	Laboratory
03-008M	Butler and Armstrong	Mine	17-Mar-11	Field
29-004	Fulton	Cave	30-Mar-11	Laboratory
56-012M	Somerset	Tunnel	29-Mar-11	Laboratory
14-032-M	Centre	Tunnel	26-Jan-12	Field
03-001-M	Armstrong	Mine	06-Feb-12	Field
04-001-M	Beaver	Mine	06-Feb-12	Laboratory
10-004	Butler	Mine	10-Feb-12	Field
56-015	Somerset	Cave	17-Feb-12	Field
18-008-M	Clinton	Mine	07-Mar-12	Field
62-002	Warren	Cave	07-Mar-12	Laboratory
07-008-M	Blair	Mine	09-Mar-12	Field
07-004	Blair	Cave	09-Mar-12	Field
07-049	Blair	Cave	09-Mar-12	Field
07-005-M	Blair	Cave	09-Mar-12	Field
26-001-M	Fayette	Mine	11-Mar-12	Field
17-001	Clearfield	Mine	13-Mar-12	Laboratory
37-010-M	Lawrence	Mine	15-Mar-12	Field
65-005-M	Westmoreland	Cave	19-Mar-12	Field
05-005	Bedford	Cave	21-Mar-12	Laboratory
56-004-M	Somerset	Mine	07-Feb-13	Field, UV positive
41-006-M	Lycoming	Cave	12-Feb-13	Field, UV positive
67-003-M	York	Mine	20-Feb-13	Field, UV positive
37-006-M	Lawrence	Mine	5-Mar-13	Field, UV positive
21-006	Cumberland	Cave	15-Mar-13	Field, UV positive
17-002	Clearfield	Tunnel	28-Jan-14	Field, UV positive
61-003	Venango	Tunnel	18-Dec-14	Field
56-005	Somerset	Mine	29-Jan-15	Field
44-017-M	Mifflin	Cave	20-Feb-15	Field
31-048-M	Huntingdon	Cave	25-Jan-16	Field
04-001-M	Beaver	Mine	9-Feb-16	Field
26-008-M	Fayette	Cave	24-Mar-16	Field
56-017	Somerset	Tunnel	2-Mar-16	Field
65-006	Westmoreland	Cave	22-Mar-16	Field

Table 5. cont.

Site Code	County	Site Type	Date Confirmed	Confirmation Type
07-008-M	Blair	Mine	3-Feb-16	Field
03-007	Armstrong	Mine	2-Mar-17	Field

^a N/T refers to site that is only surveyed by entrance netting or trapping.

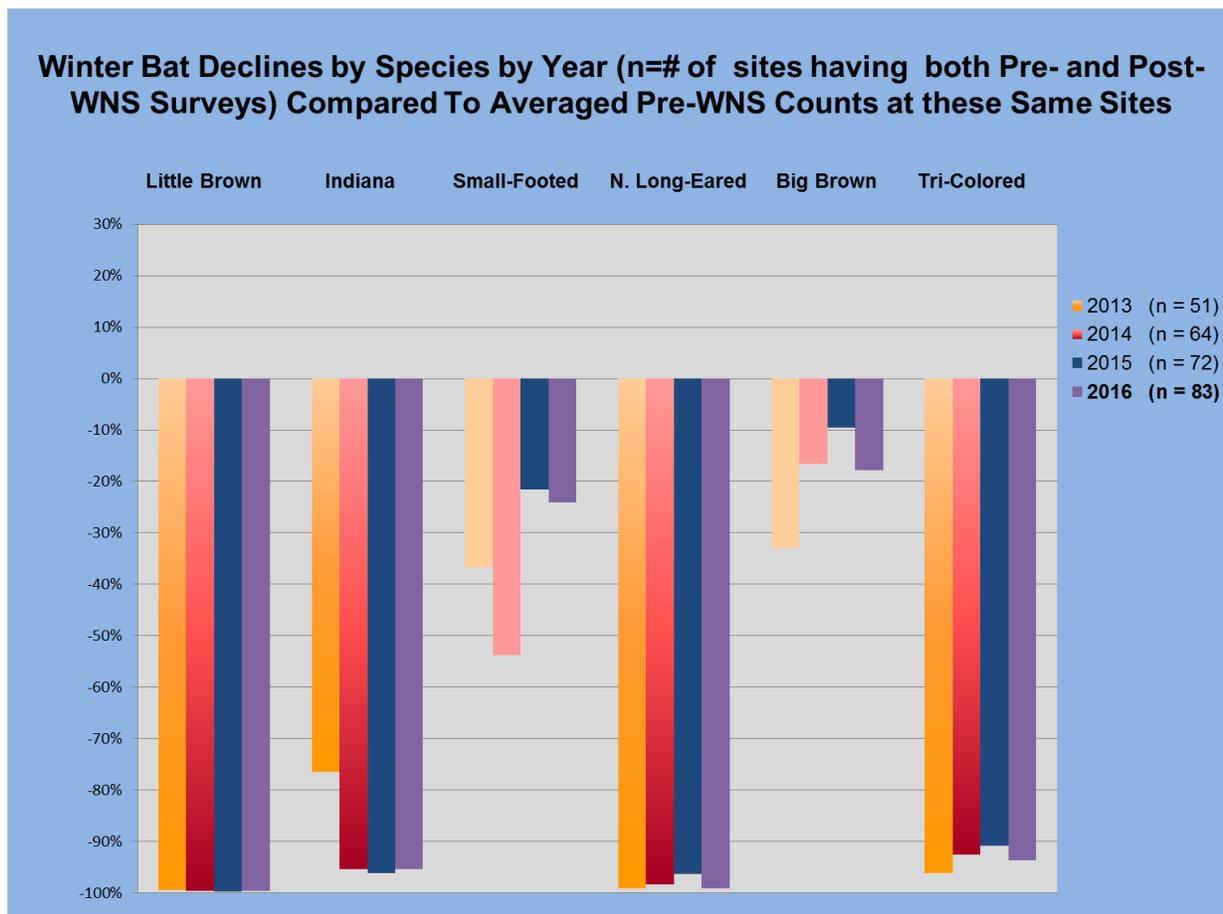


Figure 1. Cumulative declines of 6 cave hibernating bat species using the most recent survey per site, with each site having at least 2 years of disease-induced mortality and multiple surveys prior to site contamination. Post disease surveys are compared to the average of 417 total pre-white-nose syndrome surveys conducted at 72 of these hibernacula in 2015, 64 in 2014, and 51 in 2013.