Preliminary Summary of 2015 Northern Long-eared Bat Research in Minnesota

**Morgan Swingen[1], Richard Baker[2], Timothy Catton[3],
Kari Kirschbaum[4], Gerda Nordquist[5], Brian Dirks[6], Ron Moen[1,7]**

September 2015

Author Information:
[1] Center for Water and the Environment, Natural Resources Research Institute, University of Minnesota Duluth, Duluth, MN
[2] Division of Ecological and Water Resources, Minnesota Department of Natural Resources, St. Paul, MN
[3] Superior National Forest, USDA – Forest Service, Ely, MN
[4] Chippewa National Forest, USDA – Forest Service, Cass Lake, MN
[5] Minnesota Biological Survey, Minnesota Department of Natural Resources, St. Paul, MN
[6] Camp Ripley Environmental Office, Minnesota Department of Natural Resources, Little Falls, MN
[7] Biology Department, Swenson College of Science and Engineering, University of Minnesota Duluth, Duluth, MN

Summary

Bat populations in the eastern United States have been decimated by White-nose Syndrome (WNS), a disease caused by the fungus *Pseudogymnoascus destructans* that leads to increased winter activity and extremely high mortality rates of hibernating bats. In April 2015, the U.S. Fish and Wildlife Service listed the northern long-eared bat (*Myotis septentrionalis*; MYSE or NLEB) as "threatened" under the federal Endangered Species Act, largely due to the impact of WNS. Since WNS will likely spread to Minnesota within the next 5 years, obtaining knowledge about northern long-eared bat habitat use and distribution before a population decline occurs will be critical information for reducing mortality in maternal roosts following the appearance of WNS. A collaborative project designed to obtain this knowledge was funded by the Environmental and Natural Resources Trust Fund beginning in 2015.

A total of 206 bats of six species were captured during 39 nights of mist-netting in June and July 2015. Twenty-four adult female MYSE were fitted with radio-transmitters, and tracked daily to their roosts. This effort led to the identification of 73 total roost locations, 71 of which were in trees and 2 of which were in structures. Roosts were located in at least 17 species of trees, and were most often in trees showing evidence of decline or decay. Emergence surveys of MYSE roost trees recorded an average of 21.5 bats emerging, with a maximum of 79 bats observed emerging from one tree.

Data presented in this report are preliminary and subject to revision.

On the cover: Female northern long-eared bat with radio-transmitter, photo credit to Superior National Forest.

Table of Contents

List of Figures

List of Tables

Introduction

Bats are a critical component of Minnesota's ecosystems. A single bat may eat 1,000 insects per hour, and the state's half million bats provide many millions of dollars in pest control each year. Seven species of bats are residents of Minnesota: little brown bats (*Myotis lucifugus*), northern long-eared bats (*Myotis septentrionalis*), big brown bats (*Eptesicus fuscus*), tricolored bats (*Perimyotis subflavus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), and hoary bats (*Lasiurus cinereus*). Four Minnesota bat species (northern long-eared bat, tricolored bat, little brown bat, and big brown bat) hibernate in caves during the winter, and disperse widely across the state in spring, summer, and fall (Fig. 1). Very little is known about the summer habitat use of these species. These four cave-hibernating bats are all Species of Special Concern in Minnesota.

Figure 1. Map of Minnesota showing: 1) forested portion of the state that is the focus of this project (shaded); 2) locations of acoustic bat surveys as of 2008 (dots); 3) range of northern long-eared bat in North America (inset); 4) Minnesota's cave-hibernating bat species. Illustrations by Don Luce, courtesy of the James Ford Bell Museum of Natural History.
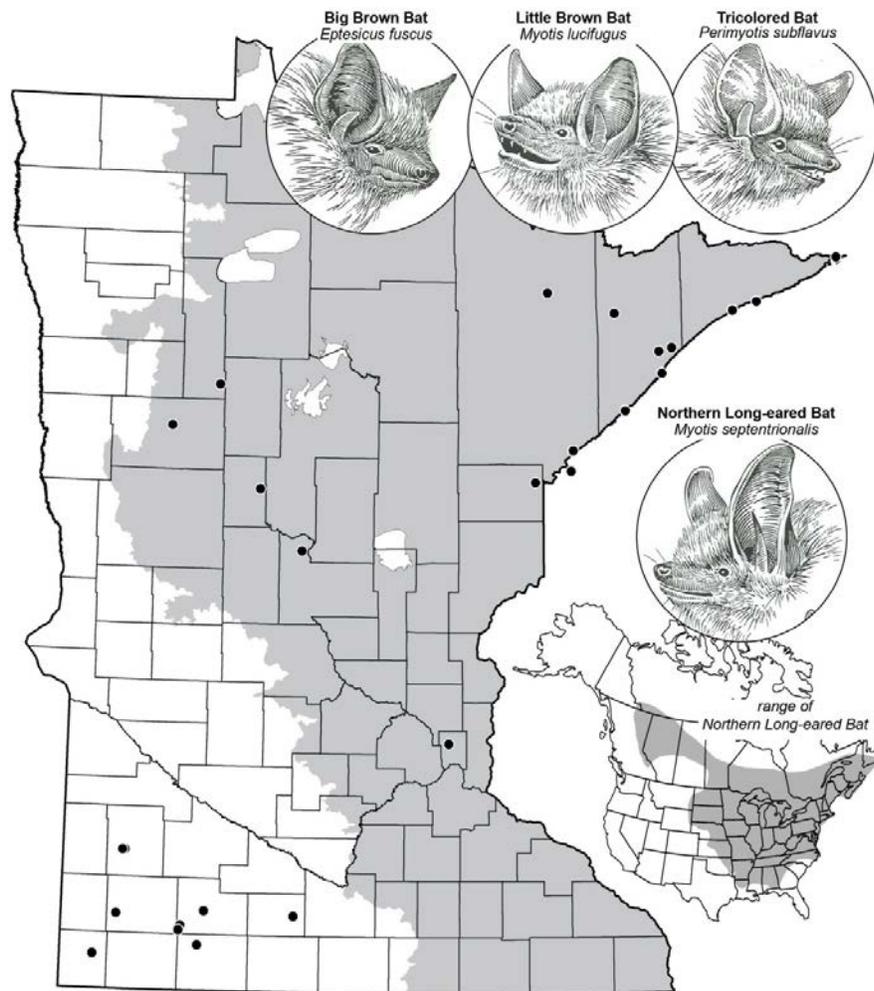
The U.S. Fish and Wildlife Service listed the northern long-eared bat as "Threatened" under the federal Endangered Species Act in April 2015, largely due to the impact of white-nose syndrome on bat populations. White-Nose Syndrome (WNS) is caused by the fungus *Pseudogymnoascus destructans* (Pd) that leads to increased winter activity and extremely high mortality rates of cave-hibernating bats. WNS has been moving through bat populations in the eastern states and provinces, with range expansions of WNS occurring every year. Pd was detected in Minnesota in 2012, but bat mortalities due to WNS have not yet been observed in the state.

Because maintaining reproductive success is critical to the viability of Minnesota's bat populations, obtaining knowledge about maternity roosts before a population decline occurs is critical for future efforts to reduce negative impacts of forest management and provide high quality habitat to support recovery of bat populations following the appearance of WNS in Minnesota. Even if mortality rates can be reduced, there is still likely to be a drastic reduction in bat populations. Implementing management strategies that minimize mortality will clearly be of over-riding importance when WNS starts affecting Minnesota bats.

In 2015, the Minnesota legislature approved $1.25 million in Environment and Natural Resources Trust Fund (ENRTF) funding for the project *Endangered Bats, White-Nose Syndrome, and Forest Habitat,* the goal of which is to collect data on the distribution and habitat use of the northern long-eared bat in Minnesota. This project is being conducted by the Minnesota Department of Natural Resources (MNDNR), the University of Minnesota Duluth – Natural Resources Research Institute (NRRI), and the USDA-Forest Service (USFS).

Despite limited start-up funding, fieldwork during the summer of 2015 succeeded in obtaining a variety of data. We also fine tuned methodologies for the more extensive field seasons of 2016 and 2017.

Mist-Netting

Mist-nets were set up along potential bat travel corridors (e.g. forest roads) at each site (Fig. 2). Nets were placed perpendicular to travel corridors, with three or four nets set at least 100 feet apart at each site. Netting began at sunset and continued for 3.5-5 hours, with net checks conducted every 10-15 minutes. Captured bats were identified to species, and photographs were taken of diagnostic features if needed. Captured bats were marked with numbered wing bands, with males banded on the right forelimb and females on the left forelimb as per established protocol. Wing punches and swabs were taken from some of the captured *Myotis* bats and sent to the USFS lab in Rhinelander, WI for microbiome and genetic analysis. Hair clippings from some of the bats given transmitters were also sent to the University of Wisconsin – LaCrosse for analysis of mercury levels.

We conducted mist-netting of bats in four general locations in Minnesota. Crews from the MNDNR were based at Camp Ripley Training Center (CRTC) near Little Falls, MN, and in the vicinity of Red Lake Wildlife Management Area/Beltrami Island State Forest (RLWMA/BISF) in Lake of the Woods and Roseau counties. A USFS crew captured bats on Superior National Forest (SNF) and Chippewa National Forest (CNF; Figure 3). Mist-netting occurred on 39 total nights, with bats captured on 36 nights (Table 1).

Figure 2. Mist net set up in Superior National Forest. Mist nets are made of very fine mesh strung between two poles, and can be raised and lowered to remove captured bats. Photo Credit: Superior National Forest.

Table 1. Allocation of mist-netting effort between 4 locations in Minnesota during the summer of 2015.

Location	Nights with Captures	Nights without Captures	Total Nights
Chippewa National Forest	7	0	7
Camp Ripley Training Center	12	2	14
RLWMA/BISF	7	1	8
Superior National Forest	10	0	10
Total	**36**	**3**	**39**

Captures

We captured individuals of six of the seven bat species native to Minnesota, totaling 206 bats (Table 2, Fig. 3). Tri-colored bats (*Perimyotis subflavus*) were not captured this summer, which is not surprising as they occur at low densities in Minnesota and are at the edge of their known geographic range. Most captures were northern long-eared bats (*Myotis septentrionalis;* MYSE; also known as "NLEB") and little brown bats (*Myotis lucifugus*; MYLU). Big brown bats (*Eptesicus fuscus*; EPFU), eastern red bats (*Lasiurus borealis*; LABO), hoary bats (*Lasiurus cinereus*; LACI), and silver-haired bats (*Lasionycteris noctivagans*; LANO) were also captured. More male bats than female bats were captured of MYSE, MYLU, and EPFU. Sex ratios were especially male biased in Superior National Forest (Table 2, Fig. 4), perhaps due to the early seasonal timing of a portion of the netting activities.
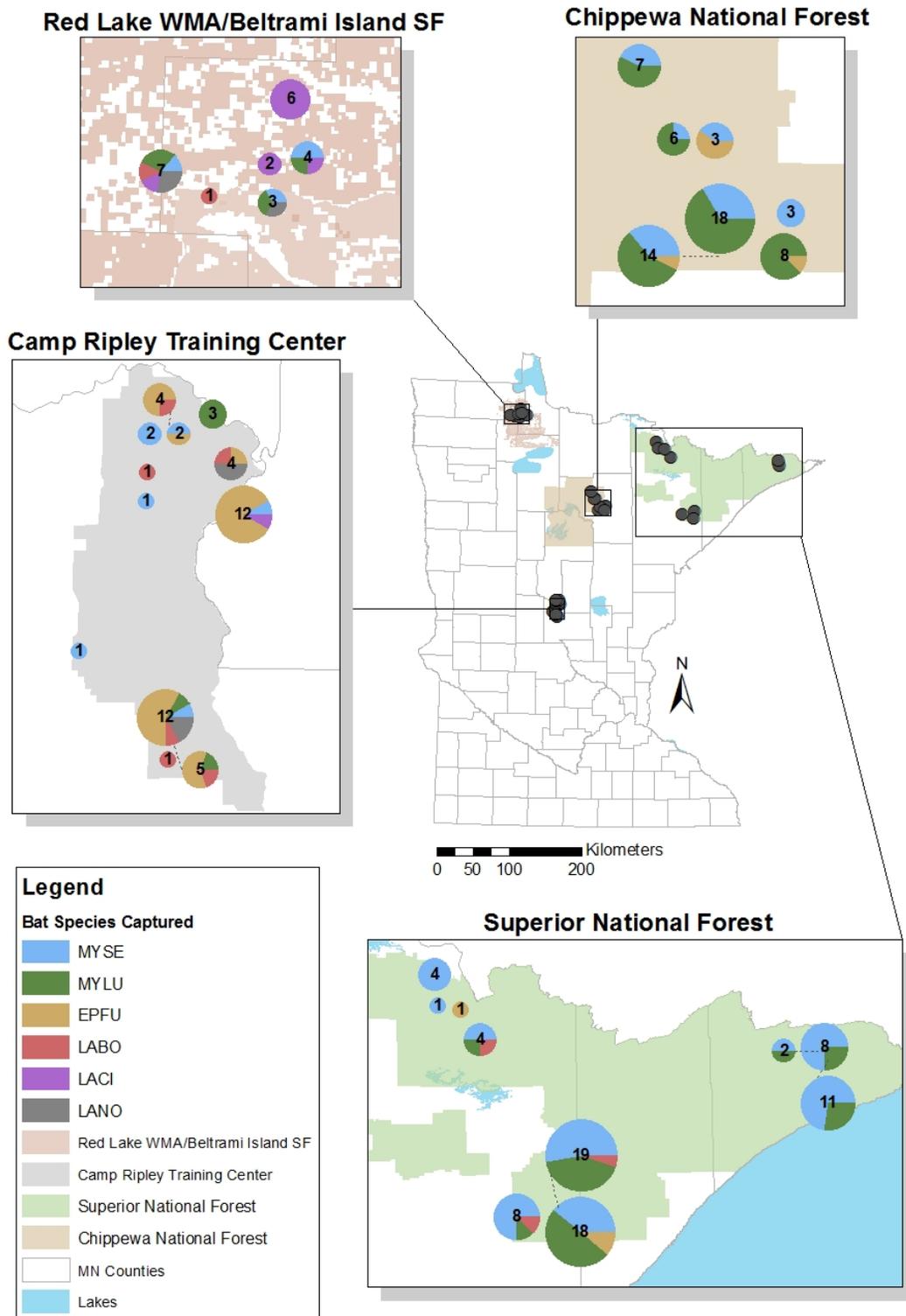
Figure 3. Map showing locations of mist-netting sites throughout Minnesota. The pie charts at each location show the total number of individual bats captured with a breakdown by species. The size of each pie chart is proportional to the total number of bats captured.

Table 2. Total individual bats captured by species, sex, and location during summer 2015. F = Female, M = Male.

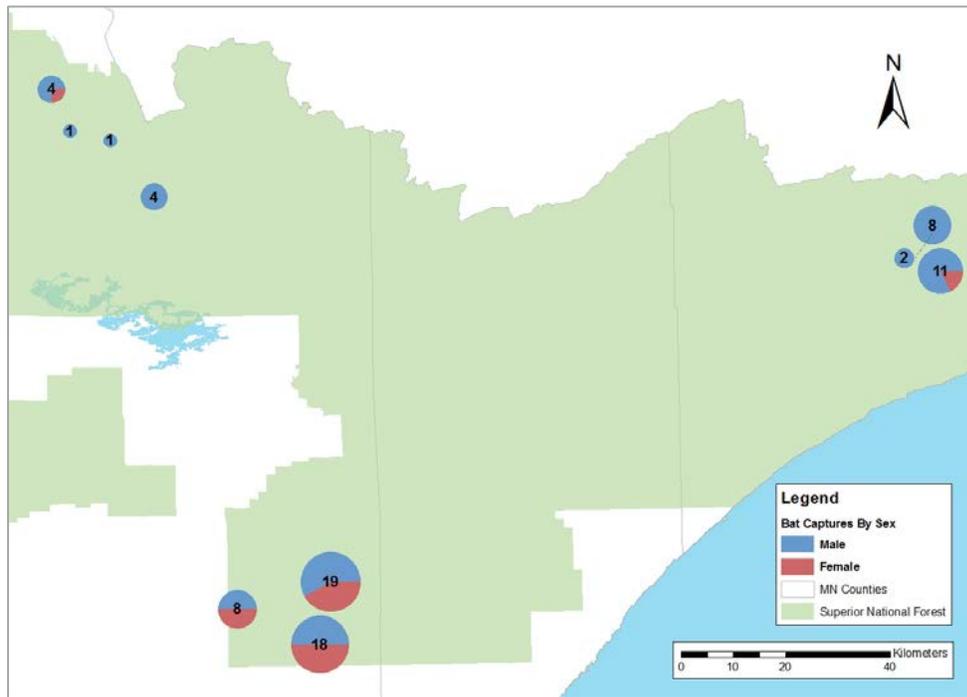| Location	MYSE		MYLU		EPFU		LABO		LACI		LANO		Total
	F	M	F	M	F	M	F	M	F	M	F	M	
SNF	15	30	8	17	0	3	1	2	0	0	0	0	76
CNF	12	8	11	23	1	4	0	0	0	0	0	0	59
CRTC	5	2	1	4	11	14	3	3	1	0	4	0	48
RLWMA/BISF	4	0	0	4	0	0	2	0	10	0	1	2	23
Subtotal	36	40	20	48	12	21	6	5	11	0	5	2	
Grand Total	**76**		**68**		**33**		**11**		**11**		**7**		**206**

Figure 4. Map showing ratio of male to female bats captured at locations on Superior National Forest during summer 2015. The size of each pie chart corresponds to the total number of bats captured at that location.

Seventeen of the 206 bats captured were classified as juvenile bats (young of the year). Juveniles of four bat species were captured: MYSE, MYLU, EPFU, and LABO. The first capture of a juvenile bat was an EPFU captured on June 22nd, and juveniles continued to be captured until the last night of netting on July 16th (MYSE & LABO). The first juvenile *Myotis* was a MYLU captured on June 24th. Seven of the 76 MYSE captured were classified as juveniles (Table 3). Pregnant bats were captured as early as June 8th (MYSE & EPFU), and as late as July 16th (MYLU).

Table 3. MYSE individuals captured by week and reproductive class during the summer of 2015. Adult females listed as "other" were classified as either non-reproductive or unknown.

Reproductive Status	Week of							Grand Total
	6/1	6/8	6/15	6/22	6/29	7/6	7/13	
Adult Female								
Pregnant	0	2	11	4	0	0	0	**17**
Lactating	0	0	0	0	0	0	7	**7**
Post-lactating	0	0	0	0	0	0	1	**1**
Other	2	1	3	1	0	0	2	**9**
Adult Male	13	6	5	3	2	0	6	**35**
Juvenile Female	0	0	0	0	0	0	2	**2**
Juvenile Male	0	0	0	0	0	0	5	**5**
Total MYSE Captured	**15**	**9**	**19**	**8**	**2**	**0**	**23**	**76**

We attached Holohil LB-2X radio-transmitters using surgical adhesive to selected adult female bats, primarily those that were pregnant or lactating (Fig. 5). We limited the number of bats to which we attached transmitters to no more than three each night, since a project goal was to identify as many maternity colonies as possible, and it was likely some of the bats caught in the same location on the same night were from the same maternity colony. Twenty-five transmitters were deployed: 24 on female MYSE and 1 on a female MYLU (Table 4).

Figure 5. Northern long-eared bat (*Myotis septentrionalis*) with radio-transmitter attached. Photo credit: Superior National Forest.

Table 4. Radio-transmitters deployed by species and location during 2015. All transmitters were deployed on adult female bats.

	MYSE	MYLU	Total
Superior National Forest	6	1	**7**
Chippewa National Forest	9	0	**9**
Camp Ripley Training Center	5	0	**5**
RLWMA/BISF	4	0	**4**
Total	**24**	**1**	**25**

Radio telemetry

Bats equipped with radio-transmitters were tracked daily to their roosts until the transmitter fell off or the signal was lost. Individual bats were tracked for 6.4 days on average (range:1-11 days). The total number of telemetry days (one bat located on one day) for MYSE was 153, with 100 telemetry days for pregnant or lactating females. Tracking efforts identified 73 total unique roost locations for female MYSE, 71 of which were located in trees (Table 5). In most cases, identity of the presumed roost tree was confirmed by observing bats exit from the tree during emergence surveys. Two MYSE roosts and the single MYLU roost were located in private buildings.

Table 5. Number of MYSE roost trees identified by species during the summer of 2015. Some trees could not be identified to species due to advanced decay.

Scientific Name	Common Name	# of Roosts Identified				Total
		SNF	CNF	CRTC	RLWMA /BISF	
Acer rubrum	Red maple	4	4	7	0	**15**
Acer saccharum	Sugar maple	0	8	0	0	**8**
Betula papyrifera	Paper birch	0	1	0	0	**1**
Fraxinus pennsylvanica	Green ash	0	0	1	0	**1**
Fraxinus nigra	Black ash	1	0	0	0	**1**
Larix laricina	Tamarack	0	0	0	1	**1**
Picea glauca	White spruce	0	0	0	3	**3**
Picea sp.	Spruce (unspecified)	1	0	0	0	**1**
Pinus banksiana	Jack pine	1	0	0	3	**4**
Pinus strobus	White pine	1	0	0	0	**1**
Populus grandidentata	Big-tooth aspen	0	1	0	0	**1**
Populus sp.	Aspen (unspecified)	1	0	0	0	**1**
Populus tremuloides	Trembling aspen	10	5	1	11	**27**
Quercus alba	White oak	0	0	1	0	**1**
Quercus rubra	Northern red oak	0	0	1	0	**1**
Thuja occidentalis	Northern white cedar	1	0	0	0	**1**
Tilia americana	Basswood	0	1	0	0	**1**
Unknown	Unknown	1	1	0	0	**2**
Total		**21**	**21**	**11**	**18**	**71**

Roost trees were classified into decay classes on a scale of 1-9, based on the Indiana Bat Monitoring Protocol (U.S. Fish and Wildlife Service 2015). Most roosts were in trees of declining health with some broken branches or dying limbs (decay class 2), however roosts were located in trees in a range of decay classes (Fig. 6).
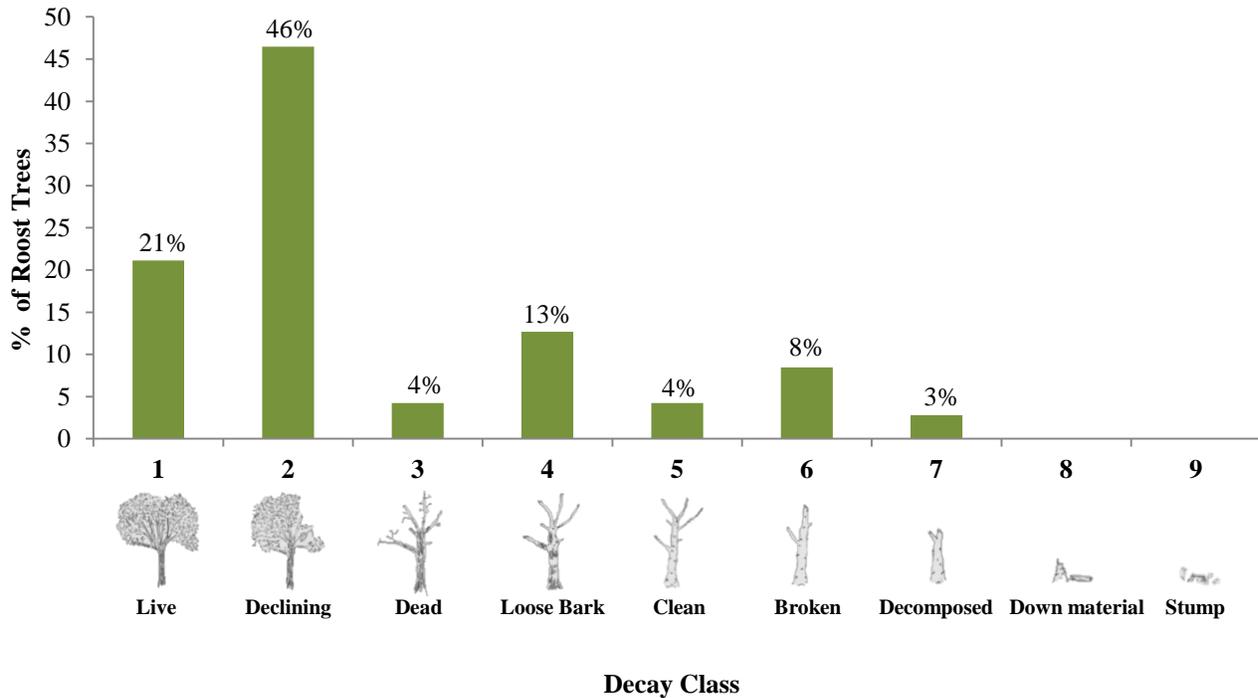

Figure 6. Number of roost trees identified by decay class. The graphics overlaid on the chart are from the survey guidelines provided by the U.S. Fish and Wildlife Service.

Transmittered MYSE traveled 873 m on average from the capture location to their first roost (range: 64 – 2812 m), and an average of 235 m between consecutive roosts. An average of 3.2 roosts were identified per transmittered MYSE (range: 0-6), resulting in 0.7 new roosts/day/transmitter when normalized for the number of days the transmitter remained attached. This number is less than 1 because transmittered bats sometimes used the same roost tree for more than one day.

Emergence Surveys

Emergence counts were conducted at identified roost trees each night from 30 minutes before sunset to one hour after sunset or until it was too dark to see emerging bats. Observers recorded the number of bats seen emerging from the tree, the exit point, and the timing of emergence. We attempted to survey as many roost trees as possible, but personnel constraints did not allow for every active roost to be surveyed every night. We conducted an average of 3 emergence counts per transmitter (range: 1-8).

We conducted 76 emergence surveys on 51 MYSE roost trees, and observed bats exiting from the trees during 53 of those surveys. The number of bats observed emerging from a tree ranged from 1-79, with an average of 21.5 and median of 12 (Figure 7). The number of bats counted during each survey was the minimum number of bats emerging as visibility was sometimes limited by ambient light and vegetation density.
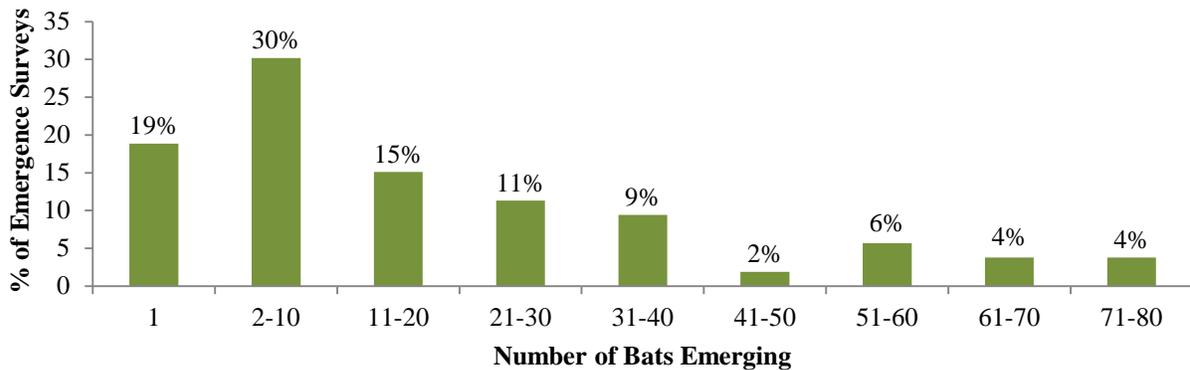

Figure 7. Summary of the number of bats observed during emergence surveys at MYSE roost trees summer 2015.

Acoustic Sampling

Acoustic detectors were deployed at each mist-netting site (except for 1 site on SNF) to collect calls of bats that were utilizing those flight corridors where netting activities were occurring. When possible, personnel also used Anabat acoustic detectors during emergence surveys to record bats as they exited. On SNF and CNF, we recorded 2219 acoustic files during 52 emergence surveys. These files have not yet been analyzed, but specific results will be included in future reports. Acoustic data from CRTC and the RLWMA/BISF area will also be included in future reports.

Field Work in Late Summer and Fall 2015

Passive acoustic detectors will be deployed across the forested region of Minnesota to create a distribution map for MYSE and focus future mist-netting efforts. We purchased 25 full-spectrum Song Meter SM3BAT acoustic detectors from Wildlife Acoustics Inc. in July with ENRTF funds. After receiving all of the required components and building protective housings, we started deploying detectors in late August. As of 31 Aug 2015 we have deployed 10 of the new SM3BAT detectors.

During the remainder of the 2015 field season we will be finishing the roost tree characterization, deploying passive acoustic detectors, and collecting and summarizing project data. Crews are returning to roost trees to collect detailed measurements on the roost trees and the surrounding forest. We will compile and summarize all of the 2015 project data in future reports. As possible, data from this project will be submitted to the Bat Population Database maintained by the U.S. Geological Survey.

Literature Cited

U.S. Fish and Wildlife Service. 2015. 2015 Range-wide Indiana bat summer survey guidelines. 44 pp. Available at: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html. Accessed 14 April 2015.

Appendix A. Personnel List (Alphabetical By Last Name)

NRRI
Jesse Alston, Sarah Baker, Jacob Bollinger, Kris Hennig, Brian Houck, Ron Moen, Anne Patterson, Cord Reno, Morgan Swingen

Superior National Forest
Tara Anderson, Chris Beal, Helen Becker, Scott Brennan, Susan Catton, Tim Catton, Aurelia Denasha, Dave Grossheusch, Melissa Grover, Sarah Malick-Wahls, Peg Robertsen, Dan Ryan

Minnesota Department of Natural Resources
Richard Baker, Johanna Birchem, Joshua Birchem, Bob Dunlap, Andrew Herberg, Kyle Johnson, Scott Laudenslager, Adam Maleski, Gretchen Mehmel, Gerda Nordquist, Brandon Schad, Christi Spak, Steve Stucker, Charles Tucker

Camp Ripley Training Center
Jay Brezinka, John Brezinka, Nancy Dietz, Brian Dirks, Bill Faber, Tyler Mick, Zachary Reynolds, Brian Sanoski, Range Control Staff

Borealis Ecological Services
Joel Flory

Chippewa National Forest
Kari Kirschbaum, Todd Tisler, Scott Warsen

Appendix B. Deliverables

This report meets the deliverable requirements for Northern Long-Eared Bat Project (MN DNR SWIFT #94028), Summer Habitat Use by Bats in Managed Minnesota Forests (NCASI Award EW-EWG-2135), Study of Northern Long-eared Bat Habitat Requirements (Blandin Foundation Grant G-2015-04836), and Survey of Minnesota's Wildlife and Habitat Resources and Information Management (MNDNR SWG Grant No. F14AF01118).

This report meets a portion of the requirements for the annual update to the Camp Ripley Training Center Integrated Natural Resources Management Plan (2003).