
COMMONWEALTH of VIRGINIA

Results of Bat Surveys at Bull Run Mountain Natural Area Preserve During 2016



Prepared for:
Bull Run Mountain Conservancy
17405 Beverley Mill Drive
Broad Run, Virginia 20137

Virginia Department of Conservation and Recreation
Division of Natural Heritage
Natural Heritage Technical Report 17-04
January 2017



Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

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FINAL REPORT

Natural Heritage Technical Report 17-04

January 2017

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Appendix 2: Locations of mist net sites during 2016 bat surveys at Bull Run Mountain Natural Area Preserve, Virginia

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Special thanks to my field technician Erin Thady whose hard work and diligence in the field were most appreciated, and responsible for the success of this project. Thanks go to the wonderful staff of the Bull Run Mountain Conservancy (Michael Kieffer, Anna Ritter, and Wynn Tucker) for their assistance in the field with setup and running mist nets and bat detectors. BRMC also provided lodging, and logistical assistance, and assisted with landowner contacts as needed. Thanks to DNH Regional Steward Mike Lott, and Operations Steward, Geoff Austin for their assistance with transportation to the top of the mountain and set up and operation of mist nets, and especially for clearing trees along the road allowing access to High Point. Thanks to VOF personnel for their logistical assistance, and especially Robert Stuart for his field assistance and help clearing trees along the access trails to High Point. Thanks to David Boyd and Gary Fleming for their assistance with figures, and background information on the study area.

Introduction

In 2015, The Bull Run Mountain Conservancy raised funding to initiate a contract with the Virginia Department of Conservation and Recreation, Division of Natural Heritage (DCR-DNH) to conduct an inventory and assessment of bat populations at the Bull Run Mountain Natural Area Preserve (BRMNAP). This report represents a summary of efforts and findings based on field surveys, and evaluation of collected data from BRMNAP during 2016.

Growing concerns over the fate of bat populations in eastern North America due to the impacts of White Nose Syndrome (WNS), and other factors, prompted our surveys for bats during this project period. While our primary objective was to provide an inventory of bats occurring at BRMNAP, the recent federal listing of one species, Northern long-eared bat (*Myotis septentrionalis*), added focus to the potential for this rare species occurrence within the preserve. The Northern long-eared bat, Little brown bat (*Myotis lucifugus*), and Tri-colored bat (*Perimyotis subflavus*) have drastically declined in Virginia, and have been listed as endangered by The Virginia Department of Game and Inland Fisheries. Both the Little brown bat and Tri-colored bat have been considered for federal listing as well. Information on the Virginia Department of Game and Inland Fisheries (VDGIF) adoption of the federal list of endangered species (including *M. septentrionalis*), and the addition of *Myotis lucifugus* and *Perimyotis subflavus* to the state list as State Endangered can be found at the following website:

<https://www3.dgif.virginia.gov/web/comment-2015-03/proposed-language/4VAC15-20-130.pdf>

STUDY AREA

The study area is located in northern Virginia, approximately 56 km (35 mi) west of Washington, D.C., encompassing portions of Fauquier, Prince William, and Loudoun Counties (Fig. 1). This area is situated in the western, or inner, part of the Piedmont Plateau physiographic province (Fenneman 1938) and consists of a complex of sharp ridges with narrow, intervening valleys. This highland complex extends north from New Baltimore (Fauquier County) for approximately 24 km (15 m) to Aldie (Loudoun County), varying from about 1.5 to 3.5 km (0.9 to 2.2 mi) wide and rising conspicuously above the surrounding terrain.

Fleming (2002) provides a more extensive synopsis of the study area including physiography, hydrology, climate, geology, soils, vegetation, and land use history.

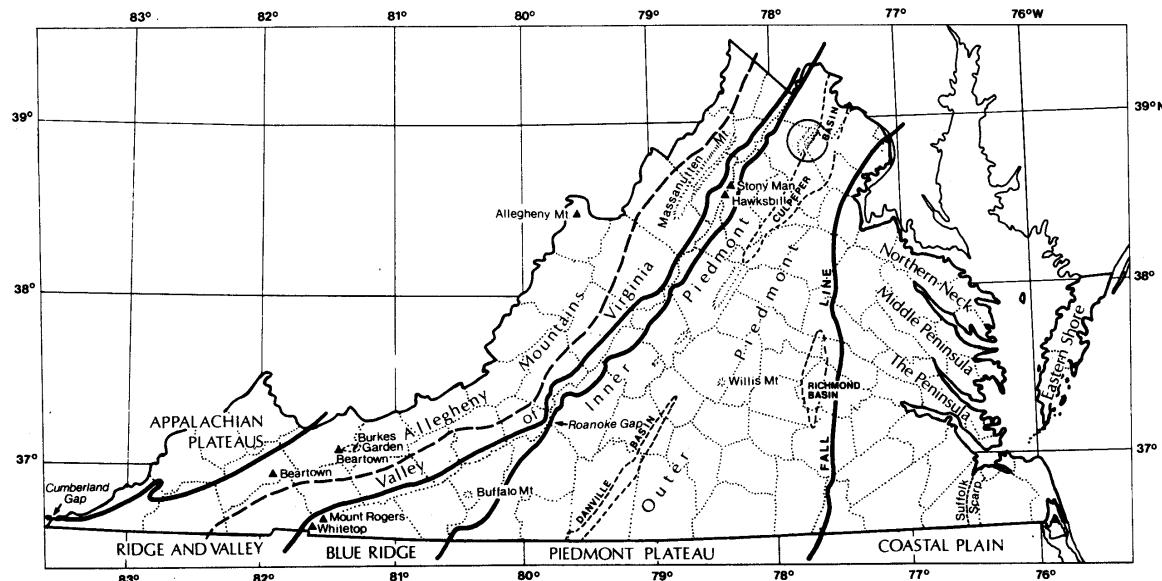


Figure 1. Location of Bull Run Mountain Natural Area Preserve in Virginia

DCR-DNH is the state agency responsible by statutory authority under the Virginia Natural Area Preserves Act (Section 10.1-209 through 217, *Code of Virginia*) for inventory, database maintenance, protection, and management of Virginia's Natural Heritage Resources. These resources are defined as the habitats of rare, threatened, or endangered plant and animal species, rare or state significant communities, and other natural features. See Appendix 1 for an explanation of the abbreviations used to describe global and state rarity ranks of Natural Heritage Resources mentioned within this report. The Division's work represents the first comprehensive attempt to identify the Commonwealth's most significant natural areas through ongoing scientific biological survey. Data gathered during this state-wide survey are assembled and managed using a sophisticated database management system, Biotics 5, in which information on ecosystems and species, their biology, habitats, locations, conservation status, and management needs is continually updated and refined. The Division is part of an international network of biological inventories known as natural heritage programs or conservation data centers, operating in all 50 U.S. states, Canada, Latin America and the Caribbean. This network of natural heritage programs uses standardized inventory methodologies and the Biotics data management system, an advanced geographic information systems-based software tool for managing biodiversity information developed and maintained by NatureServe (www.natureserve.org).

Materials and Methods

Acoustic Sampling

Acoustic sampling was conducted using Pettersson D500x Full Spectrum direct recording detector units (Figure 2). Each unit was housed inside a plastic weather resistant box that held the detector, power source, and all connectors. All units were deployed with D500x external microphones, and were set using a 20 foot extension cable attached to a collapsible 10 foot steel pole to raise the microphone off the ground, and placed to minimize obstruction, and maximize call quality. Figure 3 shows a typical deployment for acoustic surveys at BRMNAP during 2016. Detector units were primarily powered by internally housed “C” cell batteries, but occasionally were powered by an external, rechargeable 6 volt battery.



Figure 2. Typical components of the D500x acoustic detector system.



Figure 3. A typical deployment of the D500x detector system (photo C.S. Hobson)

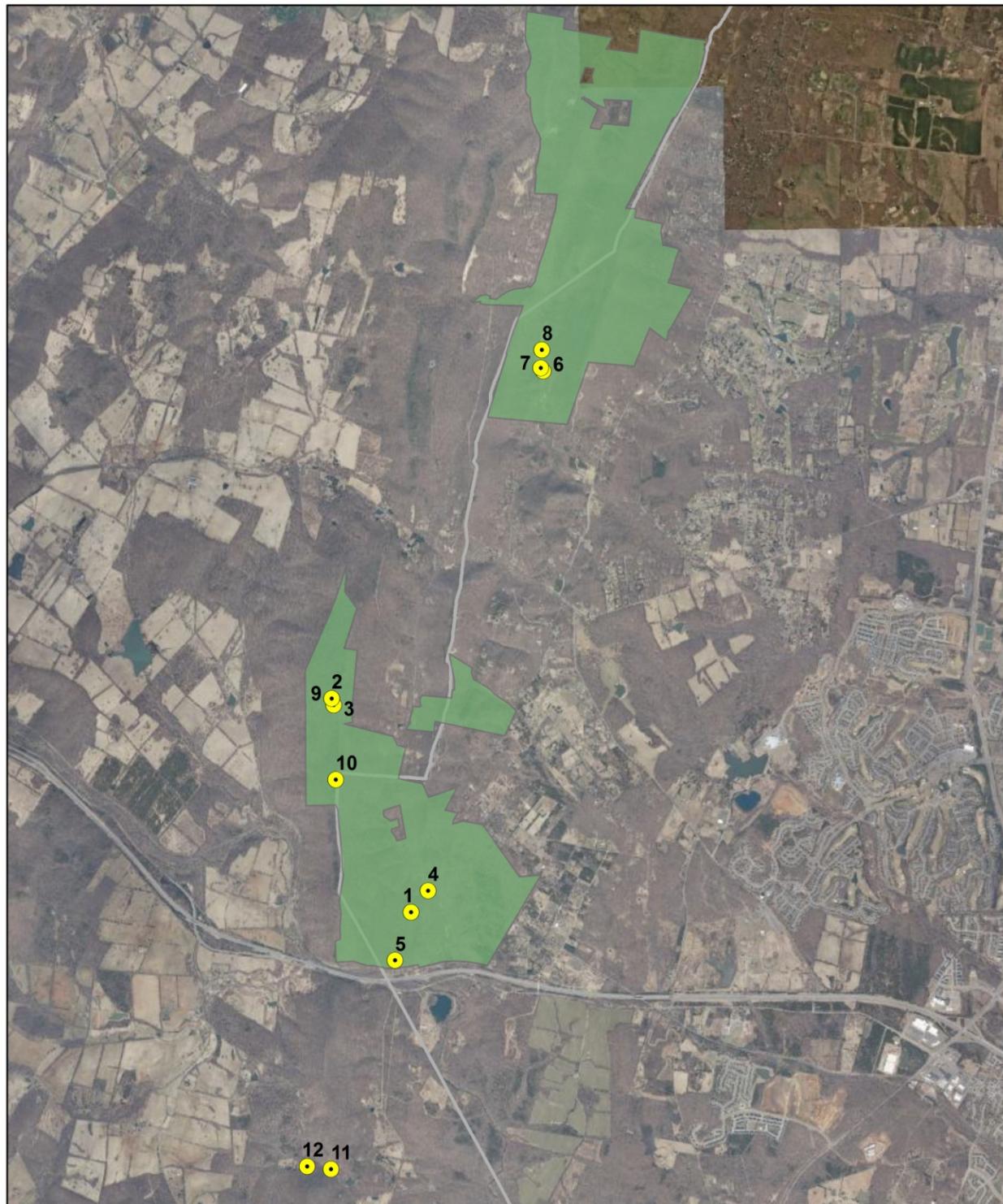
An effort was made to only operate detectors during favorable weather conditions to minimize damage to the machine, and its components, and to increase the likelihood of obtaining good recordings with minimal interference from high wind, or heavy precipitation. Detectors were pulled from the field prior to periods of expected inclement or extreme weather. On many occasions, detectors were used at sites where mist netting was also utilized to document bats.

Most sampling was conducted by placing a detector at a site for 1-2 nights with settings enabling initiation, and termination of nightly recording sessions during the sampling period. Sampling was typically initiated circa one half hour before sunset, and terminated circa 0500 hours. There were 12 individual sampling periods during which recordings were attempted. For the purposes of analysis and discussion, only the sampling periods where successful recordings were made were included. The locations of these sites can be seen in Figure 4. One site, High Point was sampled on two occasions. Table 1 shows sites sampled with dates, number of nights sampled, and latitude/longitude.

All recorded files were processed through the Sonobat D500x attributer, and subsequently scrubbed (medium filter setting) to remove most non bat calls from the data to be analyzed. Each file was attributed with information on settings utilized during recording, as well as time, date, and information on habitat, site conditions, collector, and other parameters as appropriate. Analysis of all attributed bat call files was done using Sonobat Software Version 3.2.2 with the Northeastern Classifier. A summary text

file for each sampling period was produced by Sonobat, and subsequently placed into an excel file. Individual sampling period summary files (Excel tables) can be seen in Appendix 3.

Prior to, and subsequent to analysis by Sonobat, a majority of the calls were also vetted by the author using visual examination of the full spectrum recording signature. Vetting calls also included audio examination of calls in “Real Time” and “Time Expansion” mode, to determine if calls were search phase, approach phase, social, or feeding buzz vocalizations. Because Sonobat 3.2.2 does not eliminate approach/inspection phase, social, and feeding buzz vocalizations prior to analysis, this was a crucial step in attempting to verify species identity, particularly when questionable identifications were made during auto-classification. The vetting process allowed for further analysis, and acceptance/rejection of the identification made by the software. Representations of call sequences recorded for species are shown in the Species Accounts section of this report.



Legend

- 2016 Detector Locations
- Bull Run Mountains NAP



Figure 4. Locations of D500x detectors deployed during 2016 DCR-DNH bat surveys at Bull Run Mountain Natural Area Preserve, Virginia (numbers as shown in Table x)

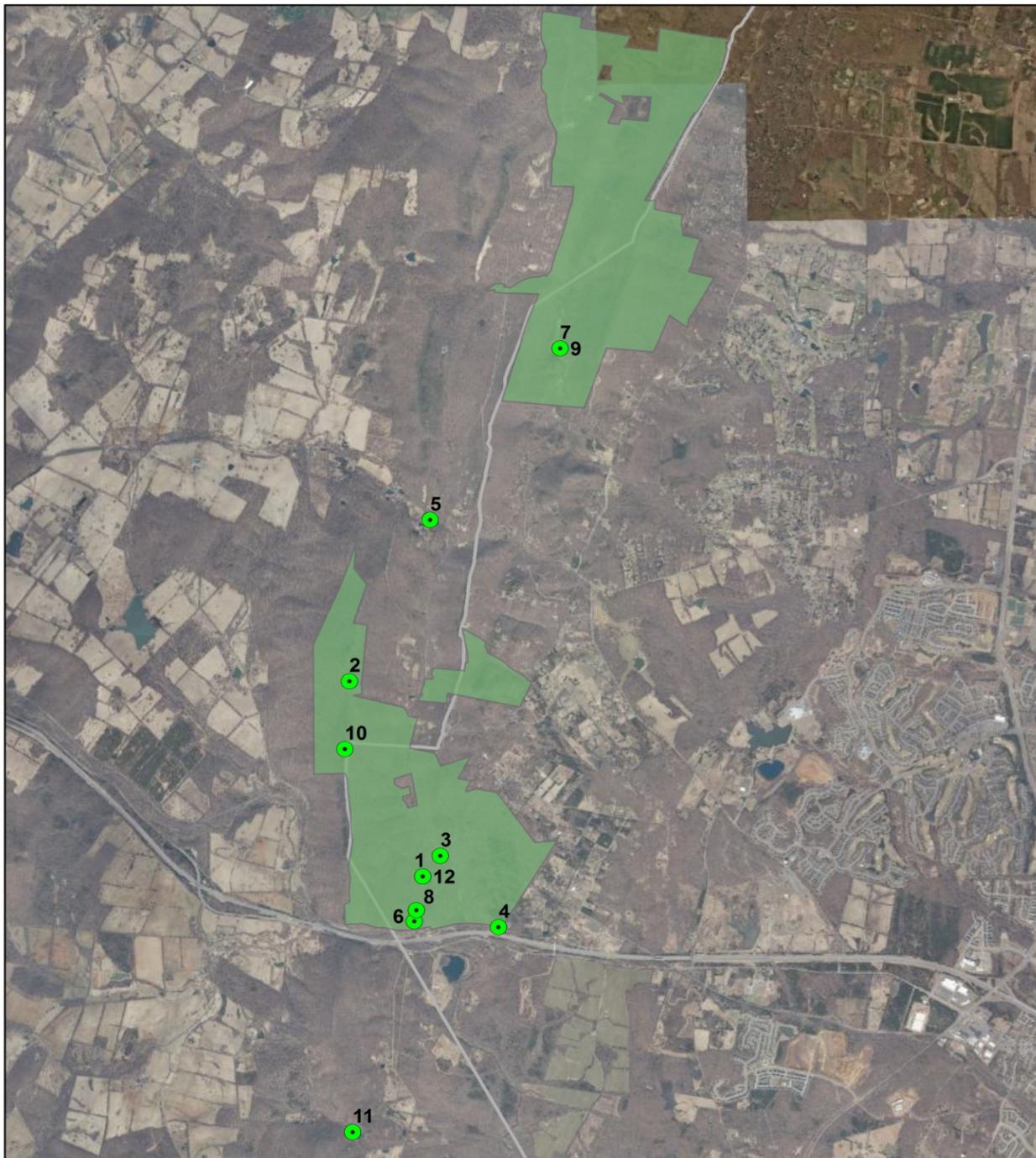
Table 1. Acoustic monitoring sites with dates sampled, nights sampled, and latitude and longitude for sites surveyed during 2016 at Bull Run Mountain Natural Area Preserve, Virginia

Site #	Site name	latitude	longitude	# detector nights	date sampled
1	lower ridge trail	38.83028	-77.70694	2	8-9 June 16
2	High pt summit	38.850833	-77.71611	1	9-Jun-16
3	High pt summit South	38.8502	-77.7159	1	9-Jun-16
4	Catletts Br. Trail	38.8323	-77.7048	1	22-Jun-16
5	Cemetery	38.8257	-77.709	2	21-22 July 16
6	Jackson hollow clearing	38.8817	-77.6895	1	4-Aug-16
7	Jackson hollow dam	38.882	-77.6898	1	4-Aug-16
8	Jackson Hollow upstream	38.8837	-77.6896	1	4-Aug-16
9	High pt summit	38.850833	-77.71611	1	11-Aug-16
10	High pt trail South	38.84306	77.71583	1	11-Aug-16
11	Arl. Outdoor Lab kiosk	38.8059	-77.7173	1	30-Aug-16
12	Arl. Outdoor Lab meadow	38.8062	-77.7202	1	30-Aug-16
				14	Totals

Mist Netting

Mist nets were used to capture bats along streams, roads, and trails. Nets were erected into the canopy whenever possible using the “Triple High Forest Filter Mist Net System” from Bat Conservation and Management, Inc. (<http://www.batmanagement.com/Ordering/3h/3h.html>). Up to three nets were used to reach the top of the pole structure if necessary. Occasionally, single-high, or double-high set ups were used depending on local flyway and canopy conditions. Nets varied from 6 m to 18 m in length depending on the width of the sampling site. Mist nets and associated equipment were sanitized frequently during this project period to minimize the potential for contamination and spread of White Nose Syndrome when using these resources at other sites. All of the nets used during the project were from Avinet, Inc., and consisted of 70 denier polyester. Figure 5 shows the locations of mist netting sites during 2016 surveys.

Captured bats were identified to species, weighed, sexed, measured for right forearm length, and examined for overall condition. Age was determined and recorded as juvenile or adult, and sexual condition was assessed and recorded for females (lactating, post lactating, non-reproductive), and for males (testes distended, non-reproductive). Time of capture was recorded for each bat, and height of capture was recorded if possible. One bat (*Myotis septentrionalis*) was fitted with a individually numbered lipped metal band provided by the Virginia Department of Game and Inland Fisheries. Photographs were taken to document species, and to show unusual or problematic conditions whenever applicable. All bats were released on site immediately after these data were collected. Figure 6 illustrates the technique used to measure right forearm length on an *Eptesicus fuscus* during a recent survey.



Legend

- 2016 Net Locations
- Bull Run Mountains NAP



Figure 5. Locations of mist net surveys conducted during 2016 at Bull Run Mountain Natural Area Preserve, Virginia (results associated with numbered sites shown in Appendix 2, some points represent multiple nearby net sets)



Figure 6. Right forearm measurement being taken from an *Eptesicus fuscus* during 2015 at Fort Belvoir, Fairfax County, Virginia (photo J.L. Pilcicki)

Radio Telemetry

DCR-DNH purchased radio transmitters from Holohil, Inc., and acquired radio receiver and antenna equipment to be used to track the movements of *Myotis* bats captured during mist net surveys. A single adult female *Myotis septentrionalis* was captured near High Point on 11 August 2016, and this individual was fitted with a 0.27 g Holohil transmitter prior to its release on the same night of capture. Efforts to find tagged bats were accomplished using two different receivers with directional antenna. For more than two weeks, multiple individuals traversed roads, trails, and ridgelines searching for radio signals from the transmitter.

Results and Discussion

The devastating effects of White Nose Syndrome on bats in the eastern United States cannot be understated. It has been estimated that more than 4 million bats have perished in eastern North America since the discovery of WNS in New York State in 2006. White Nose Syndrome was first detected in Virginia in 2009. Among the hardest hit species has been the little brown bat (*Myotis lucifugus*) with mortality rates exceeding 95% in some populations. Tri-colored bats, Big brown bats, Northern long-eared bats, and Small-footed bats have also been heavily impacted by WNS, particularly those populations using caves as hibernacula. Federally Endangered Indiana bats, Gray bats, and Virginia Big-eared bats have not seen the drastic declines from WNS that other species using caves have experienced so far.

The so called tree bats (*Lasiurus* sp.) have not been shown to have WNS to date, and may not be impacted due to differences in their life history and ecology as they rarely, if ever, enter caves to hibernate and may not be as susceptible to the *Pseudogymnoascus destructans* fungus that causes WNS. However, it is important to continue to monitor all bat species at BRMNAP to determine if there are declines in species that are known to occur within the preserve, and further define areas that are important to bat populations using the area.

Prior to our 2016 surveys there has been only a handful of data points regarding bats at BRMNAP, mostly anecdotal, with no previous mist net surveys or bat detector surveys. Below are the summarized results of our 2016 mist net surveys and acoustic surveys, along with a species account for each taxa.

Acoustic Sampling

Acoustic sampling is not an exact science at this point in its development, and there is considerable interpretation, and post analysis necessary to verify results. There are multiple detector brands and models, and multiple analysis software systems available, and there is a wide range of variation amongst these systems. Recent studies have shown that data run through different analysis software packages from the same dataset can lead to very different results during analysis (Lemen et al. 2015). The data collected during our surveys at Bull Run Mountain NAP was auto-classified by Sonobat version 3.2.2 and vetted by the author of this report.

During 12 individual sampling periods (14 detector nights), we recorded 806 total bat passes, of which 478 were high frequency, and 328 were low frequency. High frequency bats include all of the *Myotis* species, *Lasiurus borealis*, *Nycticeius humeralis*, and *Perimyotis subflavus*. Low frequency bats include *E. fuscus*, *L. cinereus*, *L. noctivagans*, and *C. rafinesquii*. There were two sites where no bat passes were recorded, possibly a result of equipment malfunction. See Appendix 3 for site by site summary results for the auto-classified data for bat species detected during 2016, including MLE and likelihood of presence.

The high count for high frequency bats was recorded on one D500x detector on 4 August 2016 in Jackson Hollow. A majority of these 258 hi frequency bat passes consisted of *N. humeralis* and *L. borealis* auto-classified calls, followed by *E. fuscus*.

The high count for low frequency bats was 84 recorded on one D500x detector on 11 August 2016 at High Point. This high count coincides with a large number of *E. fuscus* auto-classified during the same

sampling period. The next highest count for low frequency bats (66) was also recorded at High Point earlier in the year on 9 June 2016. The early June number coincides with the high count for *L. cinereus* auto-classified calls during this same sampling period.

Sonobat auto-classification results included 7 species of bats at BRMNAP based on calls collected and analyzed between June and August, 2016. Four of the seven species were verified by mist net captures as reported below. Three other species were identified by call only. Those identified by call only include Hoary bat (*Lasiurus cinereus*), Tri-colored bat (*Perimyotis subflavus*), and Silver-haired bat (*Lasionycteris noctivagans*).

As a result of the vetting process, some of these auto-classified results were rejected. Most of the mis-identified call sequences included either multiple bats, were non-search phase calls, or were of such poor quality as to be disqualified. However, through the vetting process, there were enough calls of sufficient quality that the three species not verified by mist netting, appeared to be correctly represented within the overall collection of calls during 2016 (see species accounts below).

In addition, Sonobat auto-classifier did classify 3 call sequences as “MyLuSo.” Sonobat classifies calls this way due to the similarity of the calls of *Myotis lucifugus* and *Myotis sodalis*. These calls were also vetted, however, they were not able to be verified based on the data collected. It is possible that small numbers of either species could utilize habitats within the NAP, but the existence of these species remains unverified.

Of all sites surveyed with acoustic detectors, one site produced more bat passes and higher diversity of species than any other. This site was the Jackson Hollow lower bridge site just below the blown out dam. There were more than 311 total bat passes recorded, including more than 50 Evening bats and Red bats on 4 August 2016. Acoustic results are supported by mist net results at the same site on 22 July 2016, wherein there were 14 individual bats captured, including three species. This includes the only mist-netted *N. humeralis* bats during the project amongst all sites. This site represents an important bat activity site for multiple species, and should be monitored, and managed to maintain conditions appropriate for bat roosting and foraging. The presence of both adult and juvenile bats at this site, and the numbers of individuals recorded and captured suggest that this may be an important maternity site for multiple species.

High Point appears to be an important area for bats within the BRMNAP as well. Mist net results did not produce the numbers of bats that were seen in Jackson Hollow, but with both Silver-haired and Hoary bats detected here with acoustics, and the capture (and acoustic detection) of a federally listed female Northern long-eared bat at the site, along with captures of Red bats and Big brown bats, this site should be considered a priority for conservation planning within the BRMNAP. This is true, particularly when considering habitat management, access, and other potential issues concerning bats.

Mist Netting

DCR-DNH mist net surveys were conducted on 12 dates from June-August 2016. We captured 53 bats in total over 25 net nights. There were 2.24 bats captured per net night, and 4.82 bats captured on average each sampling period. Captured bats represent four species, including Big brown bat (*Eptesicus fuscus*), Eastern red bat (*Lasiusurus borealis*), Evening bat (*Nycticeius humeralis*), and Northern long-eared bat (*Myotis septentrionalis*). The most frequently captured species was the Big brown bat (n=28), followed by Eastern red bat (n=22), followed by Evening bat (n=2), and a single Northern long-eared bat. There were no bats recorded during one survey session on 31 August. All other surveys recorded one or more bats.

Each of the 53 total bats captured was given an age determination of adult or juvenile. Of these 53 age-determined bats, adults made up 86% and juveniles 14% amongst all captures. Juvenile bats were captured for three of the four species (*E. fuscus*, *L. borealis*, *N. humeralis*). More juvenile *L. borealis* were caught as a proportion of the total captured than was the case with *E. fuscus*. For *L. borealis*, 5 of 22 captures were recorded as juveniles, whereas only 2 of 28 total *E. fuscus* were juveniles. This is expected due to the higher birth rate typically exhibited by *L. borealis* females.

The first juvenile *L. borealis* was encountered on 6 July 2016, with both juvenile *E. fuscus* and the single *N. humeralis* juvenile captured on 22 July 2016. These results suggest that the pupping period at BRMNAP is likely June through July with the early July 6 record allowing for several weeks to become volant from the date of parturition. Figure 7 shows the wing of a juvenile Red bat captured on 6 July 2016, with translucent cartilage at the joints.

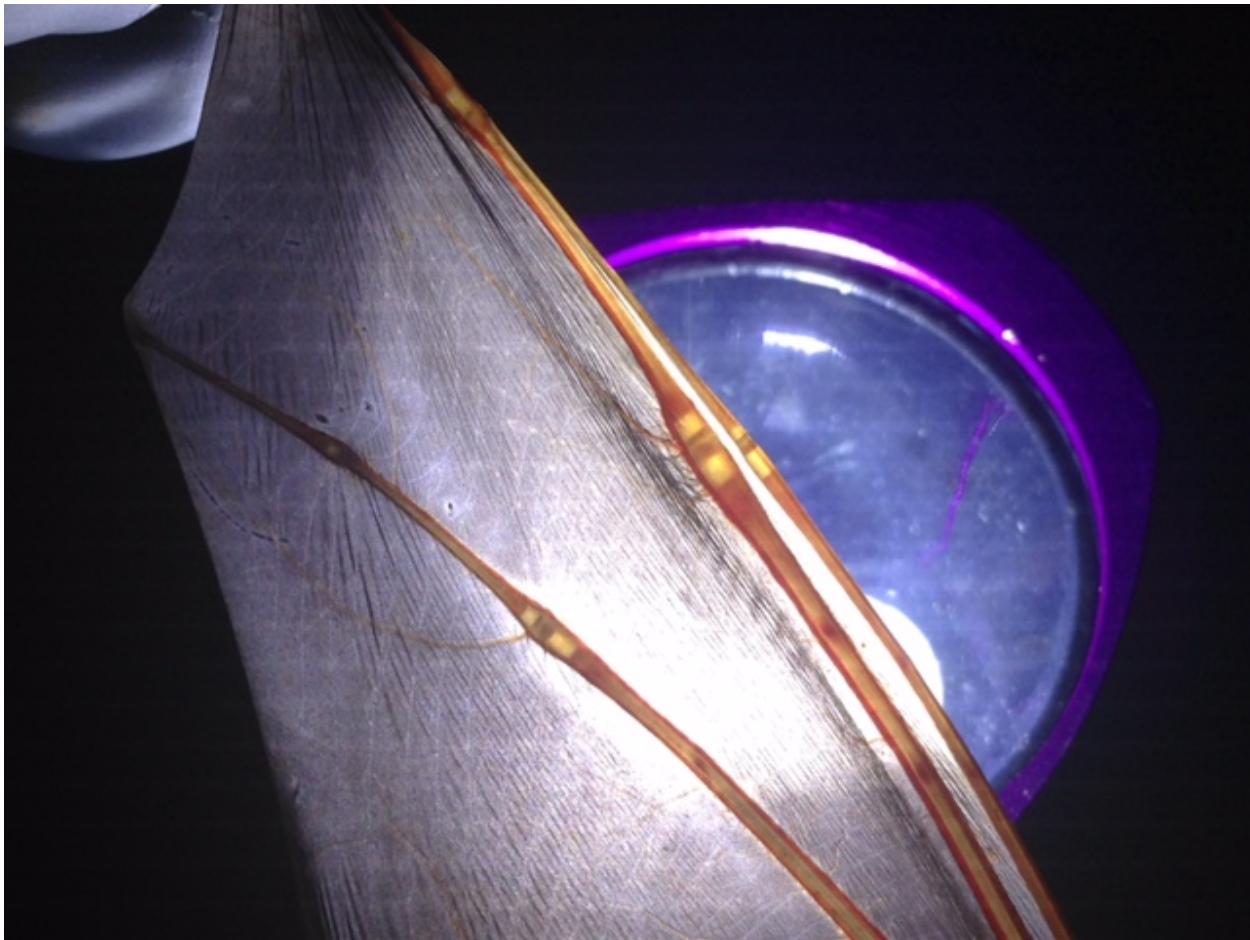


Figure 7. Photo of wing of a juvenile Red bat (*Lasiurus borealis*) captured at a small pond along Hopewell Road within the Bull Run Mountain Natural Area Preserve on 6 July 2016, Fauquier County, Virginia (photo C.S. Hobson).

Species Accounts

Myotis septentrionalis- This bat has been recently listed as a Threatened species by the U.S. Fish and Wildlife Service, and the Virginia Department of Game and Inland Fisheries. Our mist net surveys produced one capture of an adult female (VADGIF band # A55755) just south of High Point on 11 August 2016. This female was also fitted with a small Holohil 0.27g transmitter to try to identify roost habitat. Multiple attempts to find this bat over the 2 weeks following the capture were unsuccessful.

Sonobat auto-classifier identified two call sequences as belonging to this species amongst all calls recorded at BRMNAP. The first recording (Figure 8) was taken on 11 August 2016, the same night as the adult female was captured in the mist net only meters away from the detector near High Point. The second recording was made at Arlington Outdoor Laboratory (AOL) on 30 August 2016, and is of questionable quality. It has only a few pulses that were auto-classified as *M. septentrionalis*, with part of the recording made up by another species. There is suitable habitat at the AOL facility, and additional mist netting is recommended to attempt to document this species residency at the site.

This species may be a summer resident at Bull Run Mountain Natural Area, but the single capture and small number of recordings suggest that they may be restricted to certain areas of the preserve, or present in small numbers overall. Both recordings were made late in the season, and may or may not be representative of summer resident bats at BRMNP.

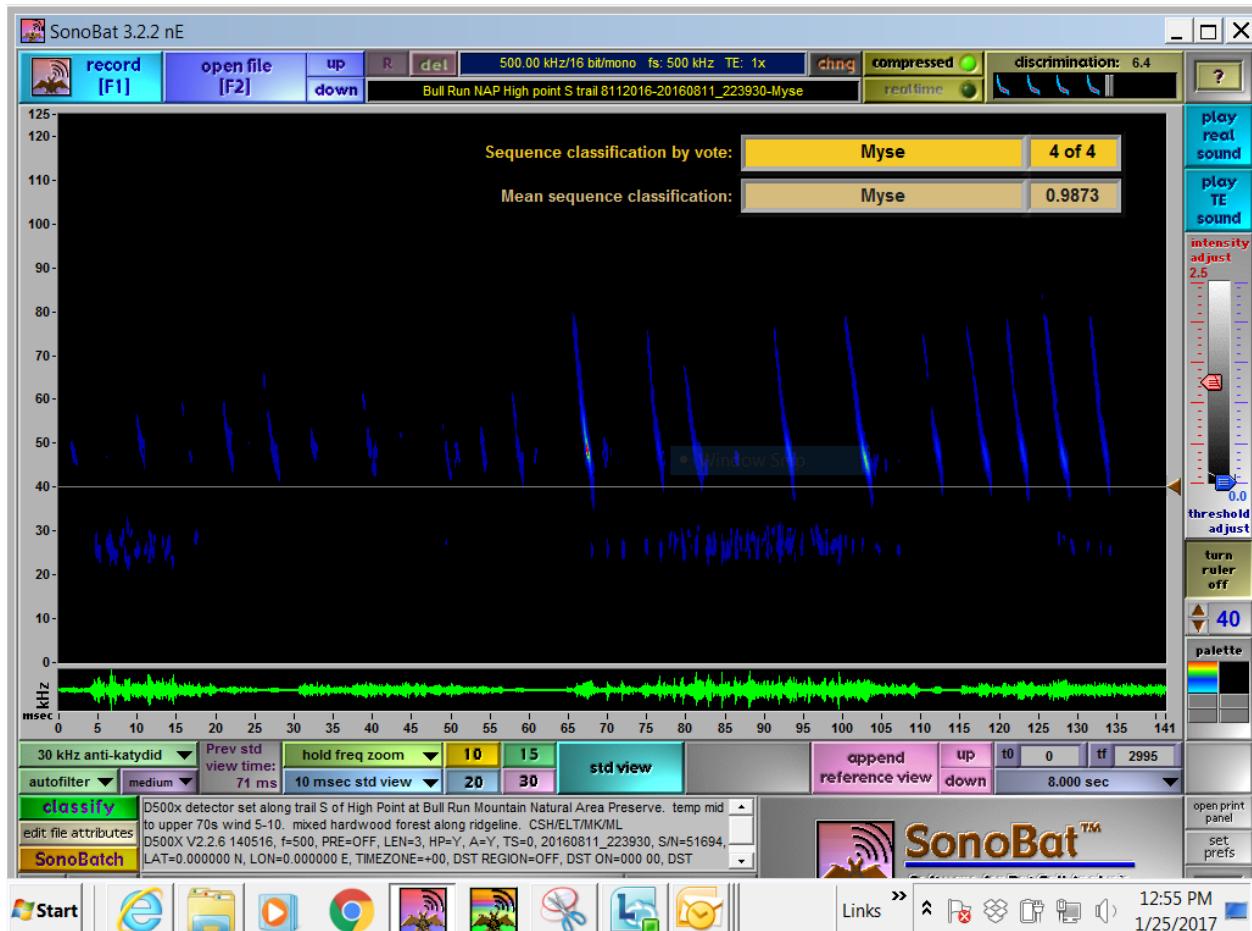


Figure 8. Sonobat auto-classifier output showing *Myotis septentrionalis* as the result of call analysis from a recording taken on 11 August 2016 along the ridge trail just south of High Point, Bull Run Mountain Natural Area, Prince William County, Virginia



Figure 9. Photo of an adult female *Myotis septentrionalis* captured on 11 August 2016 along the ridge trail near High Point, Bull Run Mountain Natural Area Preserve, Prince William County, Virginia (photo M. Kieffer).



Figure 10. Adult female *Myotis septentrionalis* captured at Bull Run Mountain Natural Area Preserve on 11 August 2016, fitted with a Holohil radio transmitter and an aluminum band prior to release.

Eptesicus fuscus- Our mist net surveys documented this species as the most commonly captured bat with 28 captures total from 9 of 12 net sites sampled. This bat was also detected acoustically at multiple sites within the study area. This species is a well documented common and widespread summer resident in a wide variety of habitats at BRMNAP. Both adults and juveniles were captured suggesting that the forests, swamps, hillsides, and ridgelines are important maternity habitat for this local population. This bat may occur during the hibernation season as well, particularly in old buildings, rock walls, and cliffline crevices.

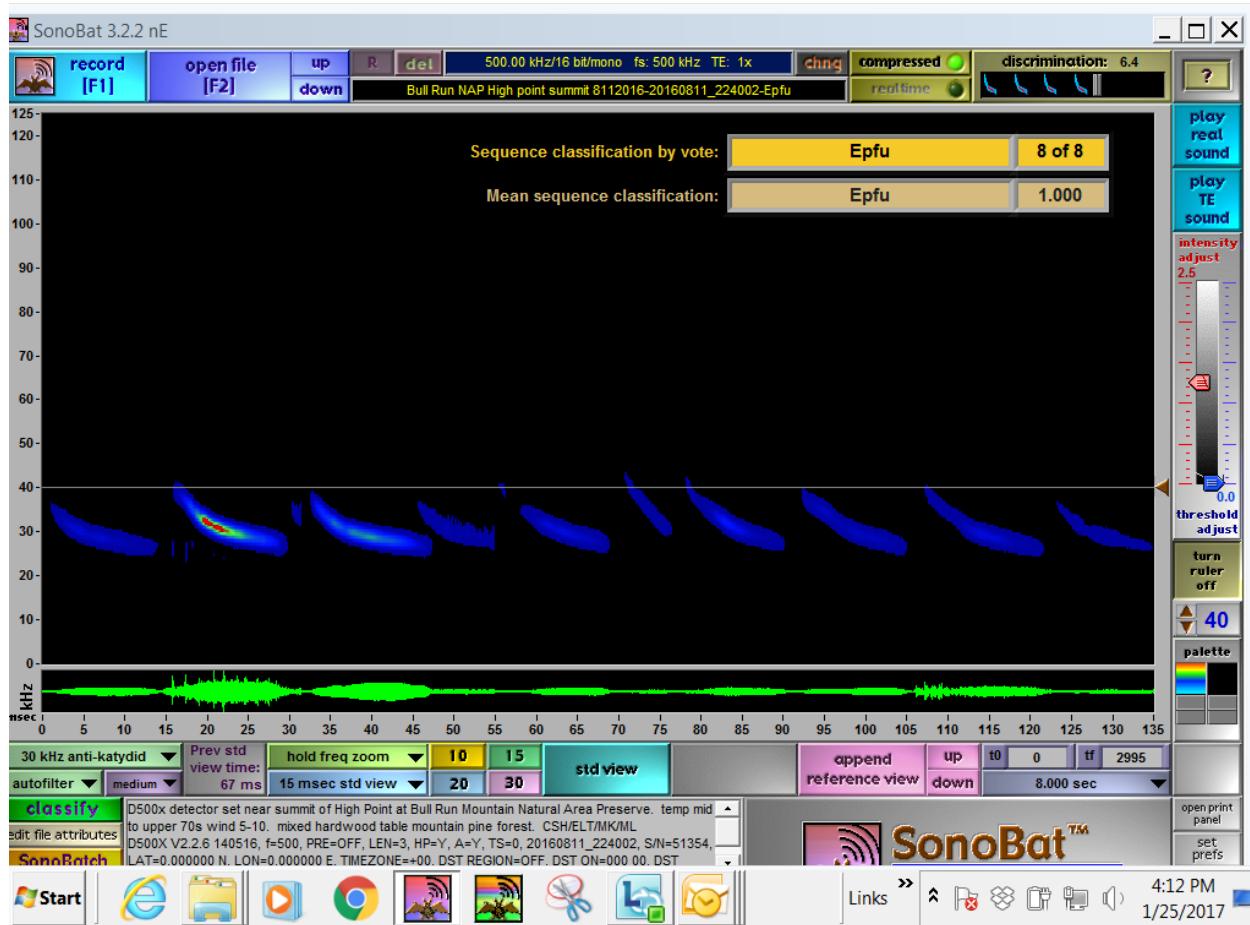


Figure 11. *Eptesicus fuscus* recording made with a D500x detector on 11 August 2016 just south of High Point, Bull Run Mountain Natural Area Preserve, Prince William County, Virginia

Lasionycteris noctivagans- This species was not captured in mist nets set within the study area at BRMNAP during 2016, and remains unverified but likely. Sonobat auto-classifier identified several call sequences as belonging to this species. However, the recordings are not ideal to identify definitively in most cases. All of the auto-classified recordings made for this bat came from detectors deployed near the summit at High Point. This species is likely a year round resident in small numbers, with larger numbers moving through during Spring and Fall migration.

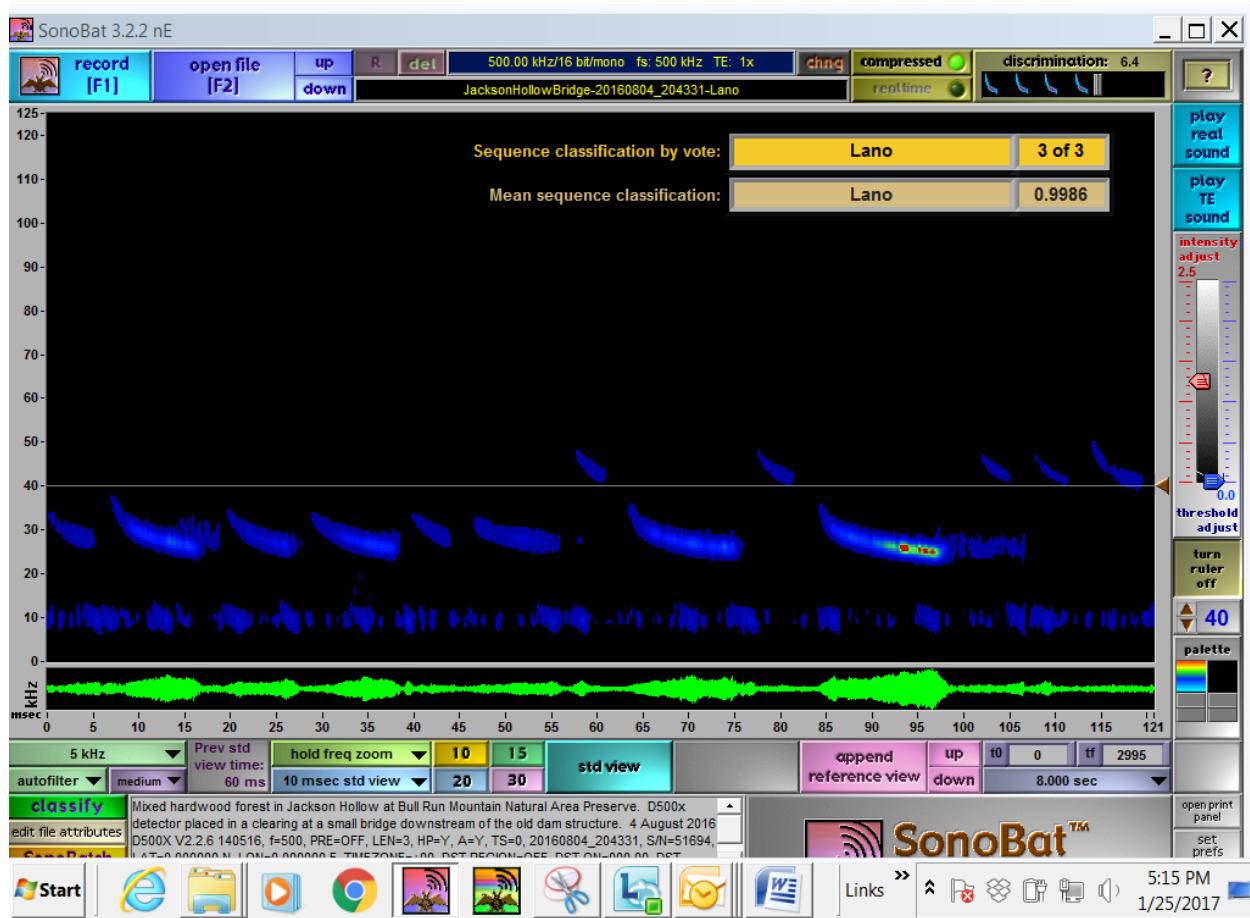


Figure 12. Likely *Lasionycteris noctivagans* call (with partial calls of another species) recorded with a D500x recorder on 4 August 2016 in Jackson Hollow, Bull Run Mountain Natural Area Preserve, Prince William County, Virginia

Lasiurus borealis- Our surveys confirmed that this species is indeed one of the most common and widespread species occurring at BRMNAP, second (n=22) only to *Eptesicus fuscus* in total number captured during 2016. This bat occurs in a wide variety of habitats having been captured at 10 of 12 net sites sampled, and was detected at most sites sampled acoustically. This species is a well documented common summer resident, and possible winter resident with expected increases in numbers seasonally during Spring and Fall migration.

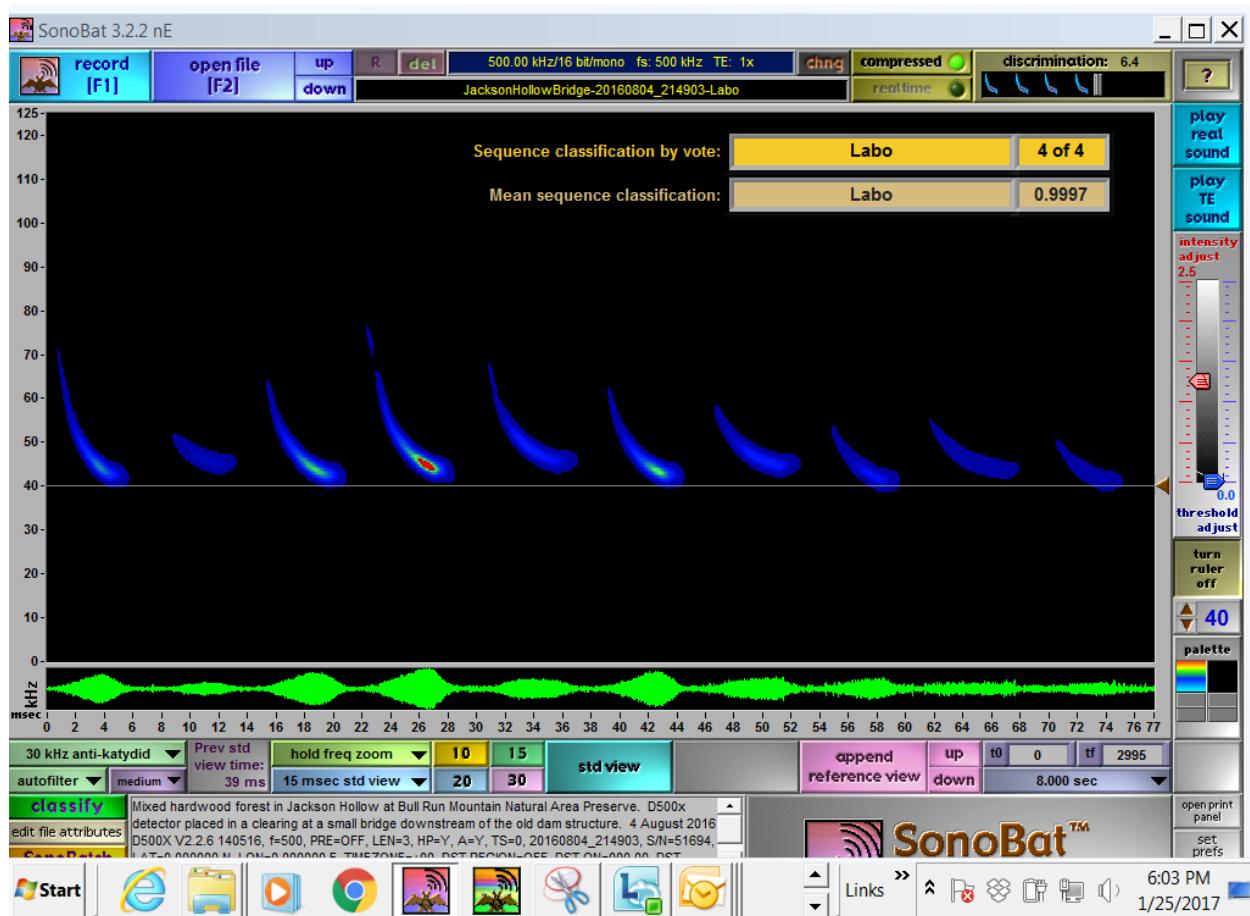


Figure 13. Auto-classified *Lasiurus borealis* from recording made in Jackson Hollow on 4 August 2016 at Bull Run Mountain Natural Area Preserve, Prince William County, Virginia

Lasiurus cinereus- The Hoary bat was not captured during mist net sampling during 2016 at BRMNAP. However, Sonobat auto-classifier identified multiple calls for this species, all of which came from detectors set along the trails and clifflines near High Point. A number of these recordings were poor in quality and were rejected during the vetting process. However, a small number of these calls appear to be representative of the species. Figure x. shows a call recorded at High Point on 9 June 2016. This species, like the Silver-haired bat is likely a summer resident in small numbers with larger numbers occurring during Spring and Fall migration. With a preference for roosting in evergreens, the forests along the ridge at High Point could provide roosting habitat for the species.

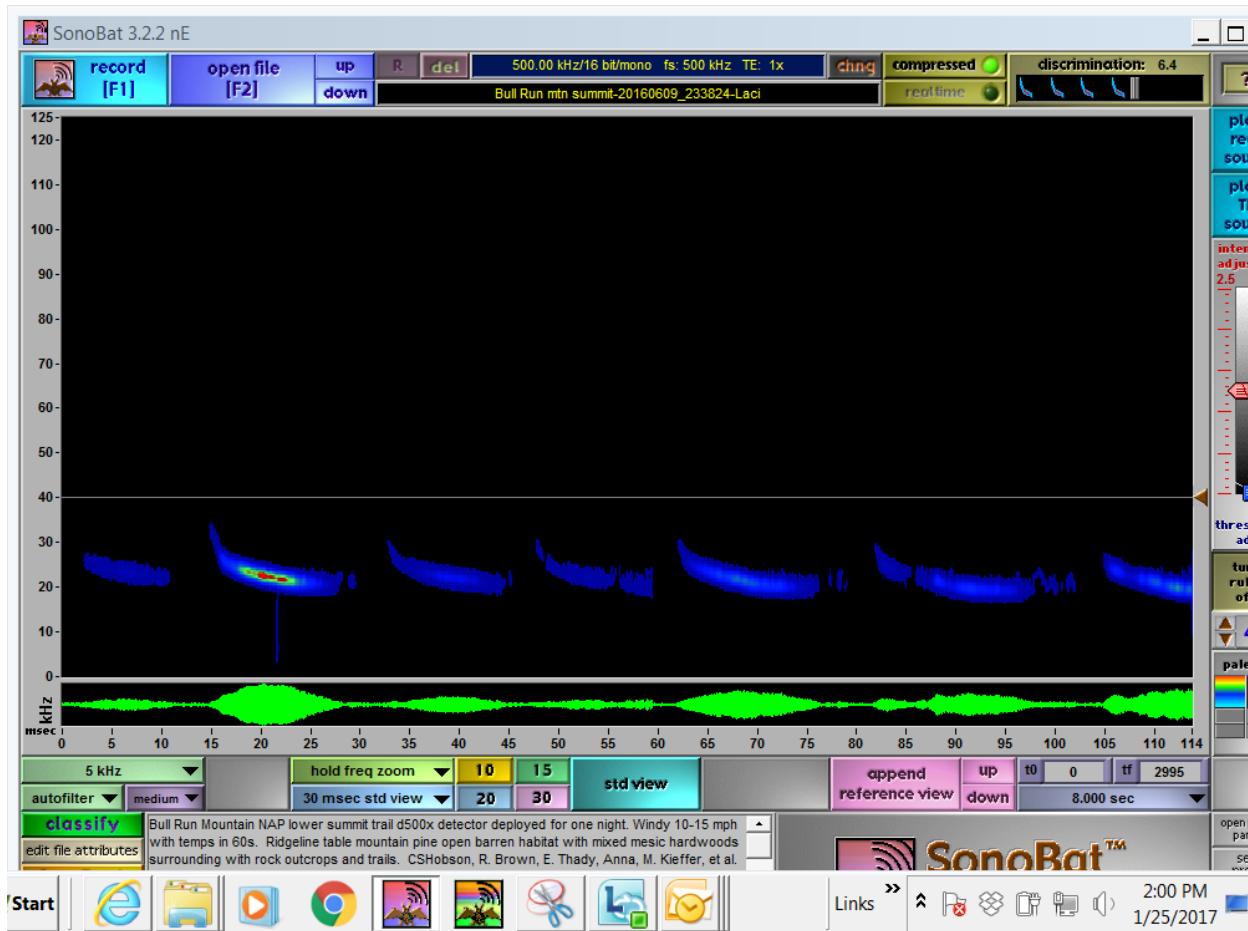


Figure 14. Likely *Lasiurus cinereus* recorded from High Point during 2016 bat surveys at Bull Run Mountain Natural Area Preserve, Virginia

Myotis lucifugus/Myotis sodalis- Our acoustic monitoring and analysis did identify a small number of calls as “MyLuSo” (indistinguishable between *Myotis sodalis* and *Myotis lucifugus*), but these calls could not be verified positively as one or the other species. Additional focused netting in areas with high levels of bat activity, and in areas where undetermined “MyLuSo” calls were recorded, is recommended to attempt to document these species as occurring within BRMNAP. Any capture of these species should be accompanied by radio telemetry to determine roost areas, and areas of activity important to them. Any specimens captured should also be banded to attempt to track movements back to hibernacula.

Nycticeius humeralis- Two individuals of this bat were captured on one occasion at the Jackson Hollow net site during our 2016 surveys. One of the two was a juvenile suggesting that they are using the area as a nursery site. Acoustic sampling revealed auto-classified recordings of this species from several sites within the preserve in addition to Jackson Hollow. It is likely a common resident within the preserve, and may be locally abundant in some areas. This bat has an affinity for human dwellings and structures as roost sites, and may utilize these structures in and around the preserve.

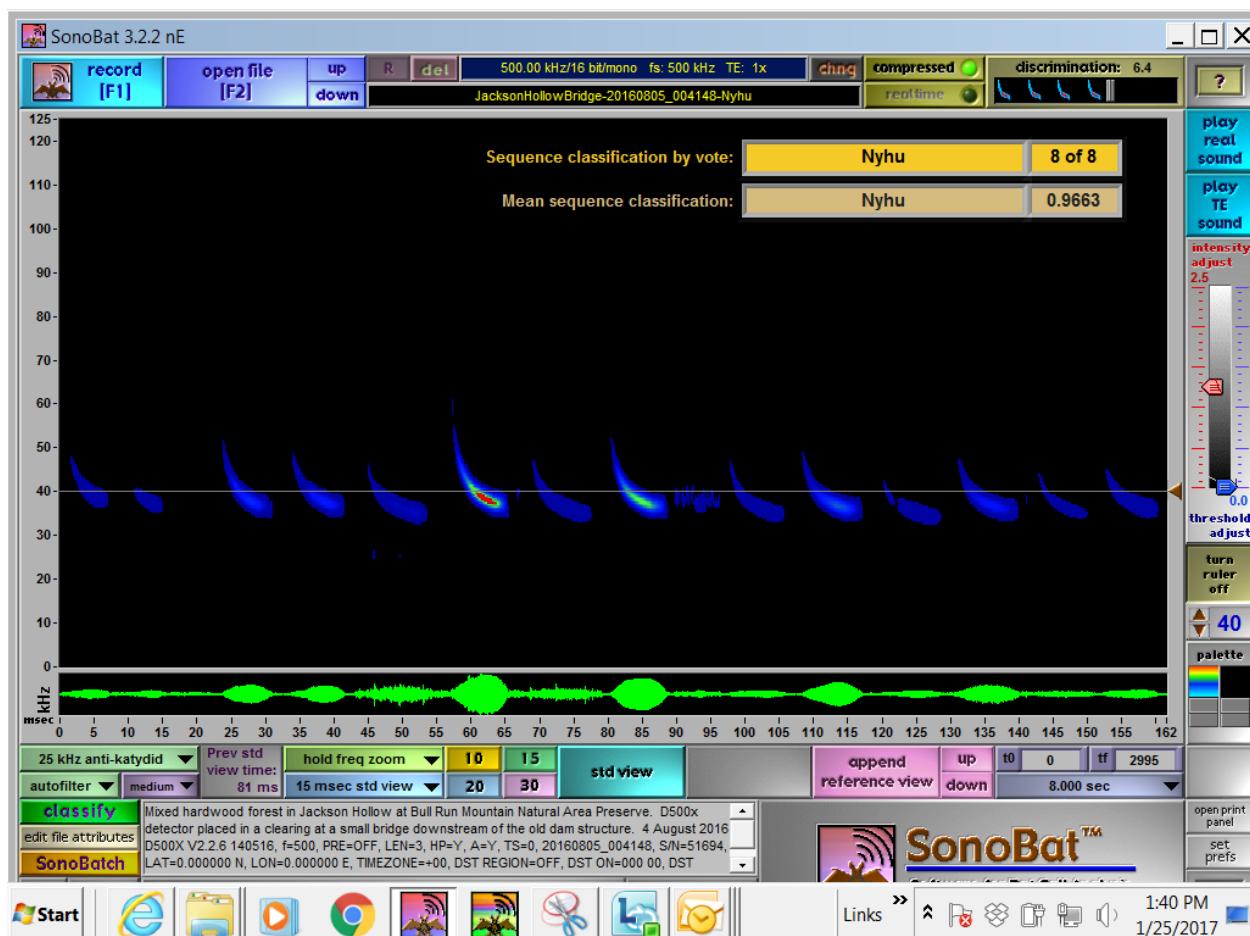


Figure 15. Sonobat auto-classified recording of *Nycticeius humeralis* taken on 4 August 2016 at Jackson Hollow, Bull Run Mountain Natural Area Preserve, Prince William County, Virginia

Perimyotis subflavus- This State Endangered bat was not captured during mist net surveys in 2016. However, Sonobat auto-classified several recordings from several sites as *Perimyotis subflavus*. Vetting of these calls by the author resulted in the rejection of some of them based on poor quality or improper call phase, but there were several calls that appear to be representative of this species. In particular, several calls from the Jackson Hollow and High Point area appear to be good representative search phase calls for this species. This bat typically occupies forested habitats, and is likely a resident at BRMNAP. If verified by capture, like other rare bats, it is recommended that radio telemetry be utilized to determine important foraging and roost habitats for this species.

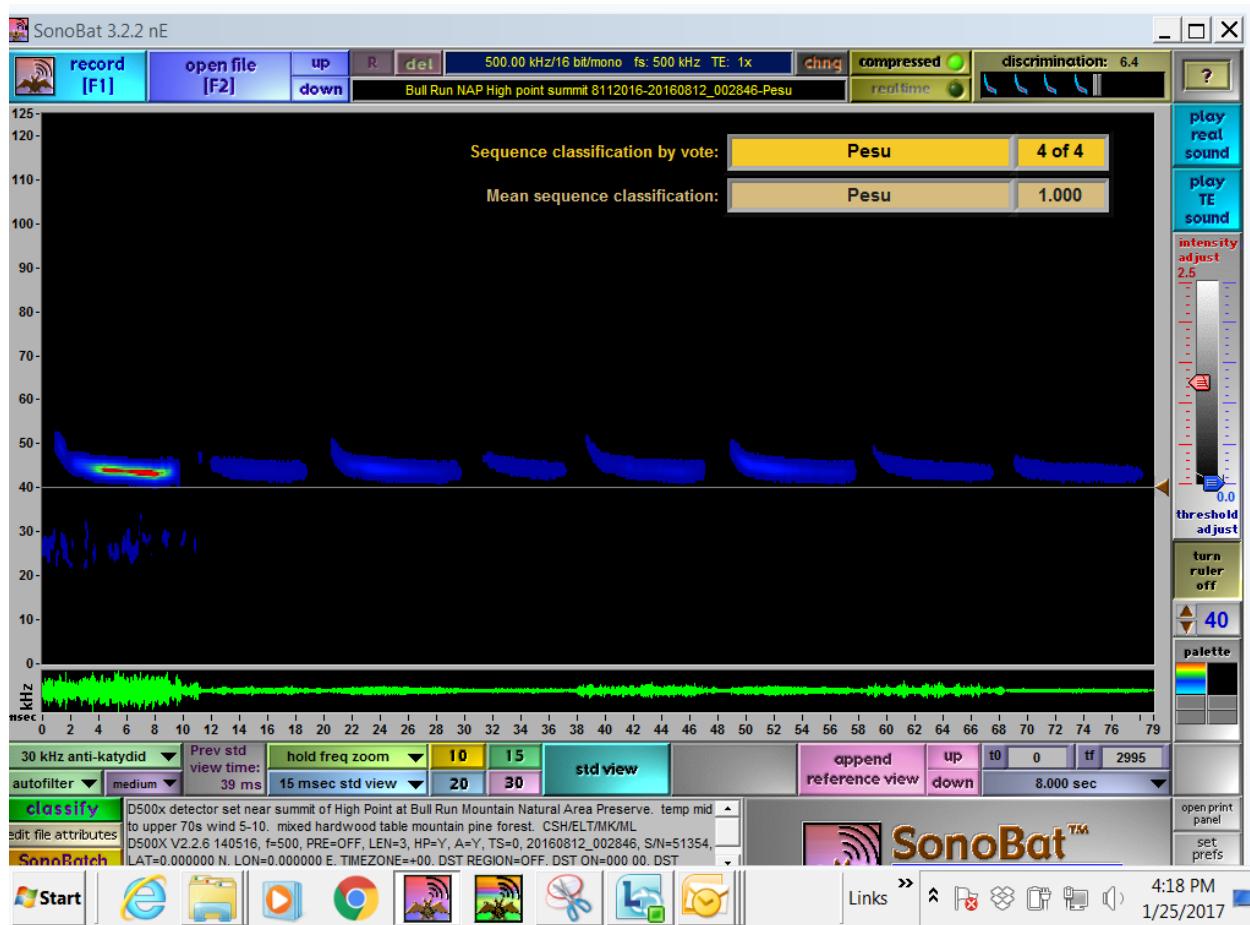


Figure 16. Auto-classified *Perimyotis subflavus* recording from High Point on 11 August 2016, Bull Run Mountain Natural Area Preserve, Prince William County, Virginia

Recommendations and Conclusions

The summer bat fauna at the Bull Run Mountain Natural Area Preserve consists of four verified species, including Eastern red bat (*Lasiurus borealis*), Big brown bat (*Eptesicus fuscus*), Evening bat (*Nycticeius humeralis*), and Northern long-eared bat (*Myotis septentrionalis*). In addition, there appear to be three additional species at the preserve based on acoustic data collected during 2016. These include Hoary bat (*Lasiurus cinereus*), Silver-haired bat (*Lasionycteris noctivagans*), and Tri-colored bat (*Perimyotis subflavus*).

Several sites stood out for diversity and abundance during our surveys, including Jackson Hollow and High Point. However, these survey results represent only a snapshot in time, and may change seasonally, or as habitat changes and management actions occur over time.

Continued efforts to document the bat population throughout the preserve are recommended, and efforts to identify important breeding areas, foraging areas, and roost sites should be priorities for future work. In particular, sites where *Myotis septentrionalis* was verified, or is suspected based on acoustic records, should be mist netted earlier in the season to attempt to determine the residency status of this species at the preserve, and if the area is an important breeding site. This will require additional radio telemetry study if the bat is captured.

Literature cited and references:

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Roble, S. M. 2013. Natural Heritage Resources of Virginia: Rare Animal Species. Natural Heritage Technical Report 13-05. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 46 pp.

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APPENDIX 1:

Definitions of Abbreviations Used on Natural Heritage Resource Lists
of the Virginia Department of Conservation and Recreation

**Definitions of Abbreviations Used on Natural Heritage Resource Lists
of the
Virginia Department of Conservation and Recreation**

Natural Heritage State Ranks

The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources, or "NHR's," are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The criterion for ranking NHR's is the number of populations or occurrences, i.e. the number of known distinct localities; the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals; the quality of the occurrences, the number of protected occurrences; and threats.

S1 - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer populations or occurrences, or very few remaining individuals (<1000).

S2 - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 populations or occurrences or few remaining individuals (1,000 to 3,000).

S3 - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically having 21 to 100 populations or occurrences (1,000 to 3,000 individuals).

S4 - Apparently secure; Uncommon but not rare, and usually widespread in the state. Possible cause of long-term concern. Usually having >100 populations or occurrences and more than 10,000 individuals.

S5 - Secure; Common, widespread and abundant in the state. Essentially ineradicable under present conditions, typically having considerably more than 100 populations or occurrences and more than 10,000 individuals.

S#B - Breeding status of an animal within the state

S#N - Non-breeding status of animal within the state. Usually applied to winter resident species.

S#? - Inexact or uncertain numeric rank.

SH - Possibly extirpated (Historical). Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

S#S# - Range rank; A numeric range rank, (e.g. S2S3) is used to indicate the range of uncertainty about the exact status of the element. Ranges cannot skip more than one rank.

SU - Unrankable; Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

SNR - Unranked; state rank not yet assessed.

SX - Presumed extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SNA - A conservation status rank is not applicable because the element is not a suitable target for conservation activities.

Natural Heritage Global Ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note GX means the element is presumed extinct throughout its range. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity. **These ranks should not be interpreted as legal designations.**

FEDERAL LEGAL STATUS

The Division of Natural Heritage uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

LE - Listed Endangered

LT - Listed Threatened

PE - Proposed Endangered

PT - Proposed Threatened

C - Candidate (formerly C1 - Candidate category 1)

E(S/A) - treat as endangered because of similarity of appearance

T(S/A) - treat as threatened because of similarity of appearance

SOC - Species of Concern species that merit special concern (**not a regulatory category**)

NL - no federal legal status

STATE LEGAL STATUS

The Division of Natural Heritage uses similar abbreviations for State endangerment.

LE - Listed Endangered

PE - Proposed Endangered

SC - Special Concern - animals that merit special concern according to VDGIF (not a regulatory category)

LT - Listed Threatened

PT - Proposed Threatened

C - Candidate

NL - no state legal status

For information on the laws pertaining to threatened or endangered species, please contact:

U.S. Fish and Wildlife Service for all **FEDERALLY** listed species;

Department of Agriculture and Consumer Services, Plant Protection Bureau for **STATE** listed plants and insects

Department of Game and Inland Fisheries for all other **STATE** listed animals

Conservation Sites Ranking

B rank is a rating of the significance of the conservation site based on presence and number of natural heritage resources; on a scale of 1-5, 1 being most significant. Sites are also coded to reflect the presence/absence of federally/state listed species:

Conservation Site Ranks

B1 – Outstanding significance

B2 – Very High significance

B3 – High significance

B4 – Moderate significance

B5 - Of general Biodiversity significance

Legal Status of Site

FL – Federally listed species present

SL – State listed species present

NL – No listed species present