Northeastern Cave Conservancy News

Volume 21, Number 2 June 2019

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The *Northeastern Cave Conservancy News* is published quarterly by the Northeastern Cave Conservancy, Inc. The Northeastern Cave Conservancy promotes the study and preservation of speleologically significant properties in the northeastern United States. Annual membership is $20 (Regular), $5 (Additional Family), $50 (Benefactor), $100 (Institutional), $125 (Family Life Membership), and $400 (Life Membership). All checks made payable and sent to:

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In this Issue

Next Board Meeting

Sunday, June 2, 2019 at 10:00 am
Mike Chu's Home

Fall Board Meeting
(Date and location To Be Announced)

The Northeastern Cave Conservancy, Inc. (NCC) is a not-for-profit corporation committed to the conservation, study, management, and acquisition of caves and karst areas having significant geological, hydrological, biological, recreational, historical, or aesthetic features.

To these ends, the NCC combines the resources and expertise of affiliated cave explorers, educators, scientists, landowners, and conservation officials.

The NCC programs are focused mainly on the preservation of caves and karst. Outreach includes education in schools and local communities, establishment of park spaces on karstlands, and educational messages about the significance of groundwater pollution on this sensitive underground ecosystem.

NCC members assist in the exploration, survey, and protection of these natural resources, and manage them so you can explore them yourself.

NCC logo design by Christa Hay

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NYSDEC BAT ACOUSTIC SURVEY - SUMMARY REPORT 2018

— Katelyn Ritzko —

Introduction

Bats across North America face multiple population-level threats, especially as White-nose Syndrome (WNS) and wind energy generation continue to expand their reach. We have nine species of bats in New York; three of these are migratory bat species, and six are hibernating species. The migratory (tree bat) species found in NYS are the eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). These species are difficult to track, and their migratory patterns remain largely unknown. We do know that these species are particularly vulnerable to mortality from wind turbines, with most wind mortalities occurring in the summer and fall, coinciding with the presumed migratory season of July-September. Four hibernating (cave bat) species, the northern long-eared bat (*Myotis septentrionalis*), Indiana bat (*Myotis sodalis*), little brown bat (*Myotis lucifugus*), and tri-colored bat (*Perimyotis subflavus*), have experienced massive declines as a result of WNS. This fungal disease has continued to affect population levels since it was first discovered in 2007.

In 2009, the New York State Department of Environmental Conservation first implemented a statewide mobile acoustic monitoring program to evaluate the status of several species of bat, obtaining data that represents summer distribution and abundance of bats within NYS. This strategy is currently our only method of monitoring New York's tree bat populations. For cave bats, while surveys of caves and mines where bats are hibernating gives us an idea of population trends, the mobile acoustic program helps supplement data for following these trends. Our summer acoustic surveys have shown a decline in detections of northern long-eared bats, Indiana bats, little brown bats, and tri-colored bats, corresponding with severe decreases in our winter survey counts. Two species of cave bats, big brown bats (*Eptesicus fuscus*) and eastern small-footed bats (*Myotis leibii*), are highly variable in their winter roosting habits, making hibernacula surveys an impractical way to reliably monitor their populations. Both species appear to be more resistant to WNS than our other cave bats, and various summer monitoring helps increase our confidence about their population health. Big brown bats are easily detected during the summer acoustic surveys, giving us the ability to monitor them consistently. Unfortunately, small-footed bats are difficult to detect using acoustic surveys, though we hope to increase efforts that will expand our understanding of their calls in the future.

The data obtained by our volunteers' efforts is invaluable to the management of NY's bat species. The results, when analyzed alongside our other monitoring efforts, give us a comprehensive view when evaluating proactive approaches to understanding these bat populations. As WNS spreads across the continent, and wind energy development continues to grow, these annual surveys remain vitally important.

Results

This was officially the ten-year anniversary of the mobile acoustic program, marking a decade-long endeavor dedicated to these surveys. Great effort was made to recruit additional volunteers in an attempt to cover as many routes as possible. Aside from the usual constraints of survey equipment availability and sharing, new technology led to additional challenges. Tablets and more compact laptops are increasingly popular and are less compatible with the hardware requirements of the surveys.

Figure 1 depicts the total detections on each route that were run during the 2018 season (May 25th-July 6th officially, although some later surveys were accepted). Despite a few issues in finding enough coverage for certain routes, a rainy start to the season, and technological limitations, volunteers rallied and were able to successfully survey 49 routes, resulting in 93 route nights. Some routes were surveyed multiple nights. Percentage of detections by species is depicted in Figure 2, and Chart 1 details detections by species and year.

Two of our migratory bat species, the eastern red bat and the hoary bat, are showing an overall positive trend, even with fluctuations. The recent downturn in numbers could be explained by a number of factors, including weather, and numbers are still higher than in 2009 (Figure 3).

Silver-haired bats present a population-monitoring challenge. Their echolocation calls are structurally similar to those of big brown bats, and as a result the detections of silver-haired bats and big brown bats are grouped together (see Figure 4). As the silver-haired bat is rarer across New York compared to the big brown bat, we assume most of the calls are created by big brown bats. Again, since big brown bats are variable with hibernation location options, and winter counts can fluctuate each survey, mobile acoustic surveys are our most accurate method of determining the population trend for this species.

Little brown bat populations may be showing evidence of stabilization, although we have seen a small decrease in acoustic detection percentages over the last three years since a slight increase in 2015 (see Figure 5). Data from winter monitoring efforts, coupled with the acoustic data, may be lending evidence towards a slowed decline in New York at the very least. The state mortality rate (population decline) is currently hovering around 83% for this species. Other states in the Northeast are still experiencing worsening mortality rates for little brown bats, leading to questions about why these bats in New York may be faring somewhat better. The Myotis Index, by which we compare the averages of Myotis bats detected vs total bats, also acts as supportive evidence toward the possibility of a population stabilization in New York State (Figure 6).

As shown by Figures 5 and 6, any possible indication of stabilization is driven by little brown bat detections. The remaining Myotis species are rare to detect. Indiana bats and northern long-eared bats favor foraging in forested areas with more vegetation clutter that tends to obscure their naturally quieter calls. The Indiana bat has been federally listed as Endangered since 1967, due to disturbances to their hibernation sites. Their numbers were improving before the onset of WNS, but NY has now seen a 76% decline. Northern long-eared bats are at a 99% mortality rate and were listed at both the state and federal level as Threatened in 2015, with WNS being recognized as the major threat.

Tri-colored bats, although never detected acoustically in great numbers, have experienced a major decrease in population (97% mortality rate in NYS), and we are seeing fewer driving routes detecting them (see Figure 7). The mobile acoustic surveys, combined with the winter survey counts, are painting a grim picture for this species. They are being proposed for both state and federal listing as Endangered.

Conclusions

The mobile acoustic survey program is a valuable resource for determining bat abundance and distribution within New York State, generating useful, informative data. Continuance of these efforts will give the state long-term data, which aids in directing other monitoring efforts and management practices.

The network of volunteers involved in this project contribute an incredible level of effort, resulting in one of the longest-running mobile acoustic data sets in the nation for bats. The NYSDEC monitoring program has served as an example for other states creating their own mobile programs. The number of hours and miles dedicated to learning and reviewing the process and performing the surveys is an impressive demonstration of how residents of New York care for their wildlife. We are thankful to everyone who helped make this a success, for the tenth year. See Photos 1 and 2, provided by two of our volunteers.

We were saddened to hear of the passing of Alan Traino. Alan was a long-standing acoustic survey volunteer who has been running routes since the beginning of the program, surveying several routes over the years. His contributions to the program are deeply appreciated, and we are grateful to have had such a dedicated individual on the team.

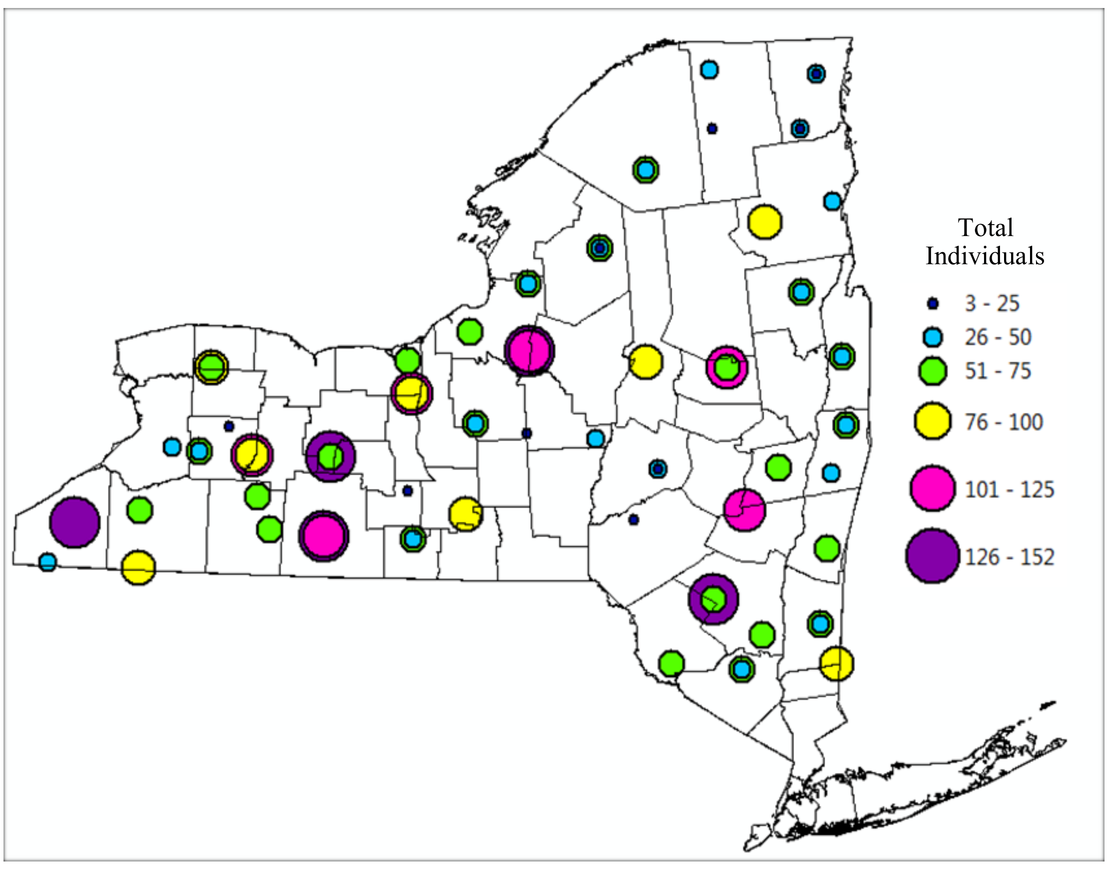
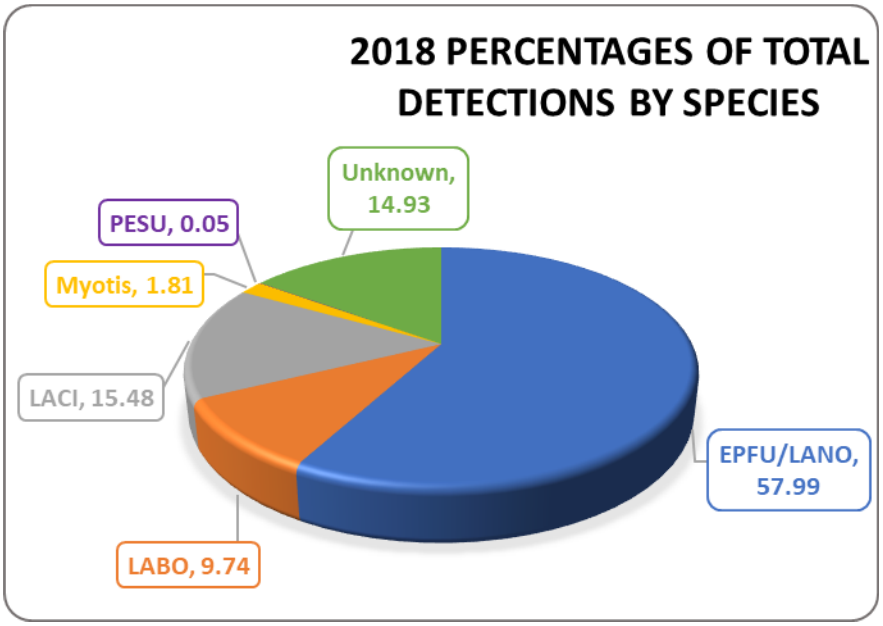


Figure 1. Total detections for all species across all routes completed in the 2018 mobile acoustic survey program. Larger circles represent routes where more bats were detected while smaller circles represent less individuals. Detections range from 3 - 152 bats per route night. Concentric circles indicate the route was surveyed multiple nights during the survey period with different detection ranges. Surveyors completed 49 routes, with a total of 93 route nights over the survey period (5/25 - 7/12).



KEY for Figure 2	
EPFU/ LANO	Big brown bat/ Silver-haired bat
LABO	Eastern red bat
LACI	Hoary bat
Myotis	Little brown, Northern long-eared, Indiana, Small-footed bats
PESU	Tri-colored bat

Figure 2. Big brown bats/silver-haired bats (EPFU/LANO) make up the majority of detections at over 57%, while tri-colored bats (PESU) make up the smallest percentage of total detections at .05%. Files that contain bat call pulses but could not be identified due to poor quality comprised nearly 15% of files.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Individuals	4414	4985	4868	5289	5556	6200	5350	4993	6111	5627
EPFU	1280	1579	1351	1269	1602	1827	2201	1889	2376	1830
LANO	656	905	1101	1321	1300	1303	882	1061	1017	1433
LABO	325	319	259	363	354	549	381	440	645	548
LACI	479	414	591	615	651	842	833	788	839	871
MYOTIS	659	438	348	338	214	158	169	144	146	102
MYLE	0	3	1	3	0	1	0	1	2	1
MYLU	575	407	301	295	194	147	161	132	139	96
MYSE	60	12	31	31	13	4	5	2	1	2
MYSO	24	16	15	9	7	6	3	9	4	3
PESU	54	41	39	51	21	35	13	6	9	3
UNKNOWN	961	1289	1179	1332	1414	1486	871	665	1079	840

Chart 1. Total counts of detections per species for 2009-2018. Big brown (*E. fuscus*-EPFU); Silver-haired (*L. noctivagans*-LANO); Eastern red (*L. borealis*-LABO); Hoary (*L. cinereus*-LACI); Eastern small-footed (*M. leibii*-MYLE); Little brown (*M. lucifugus*-MYLU); Northern long-eared (*M. septentrionalis*-MYSE); Indiana (*M. sodalis*-MYSO); Tri-colored (*P. subflavus*-PESU); MYOTIS shows the total of individuals from each Myotis species, and is not counted in the 'Total Individuals' column.

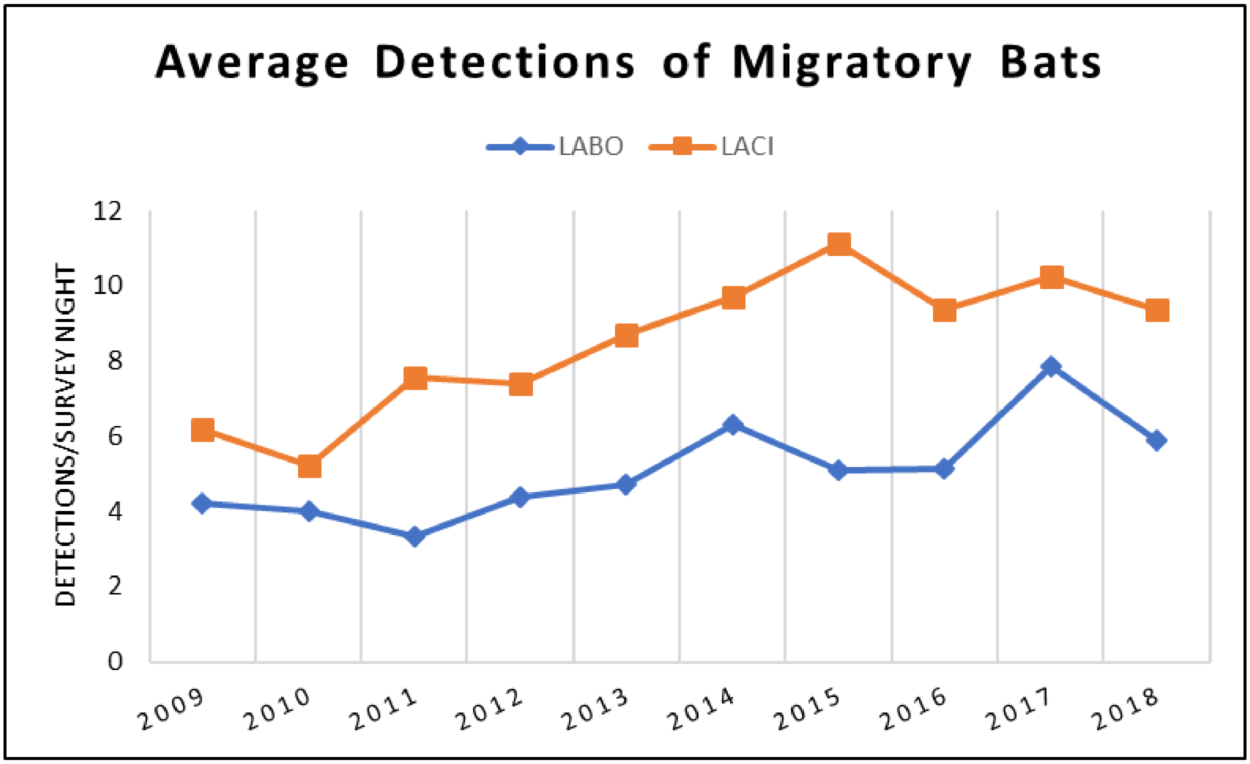


Figure 3. Average detections per route night for eastern red bats (LABO) and hoary bats (LACI).

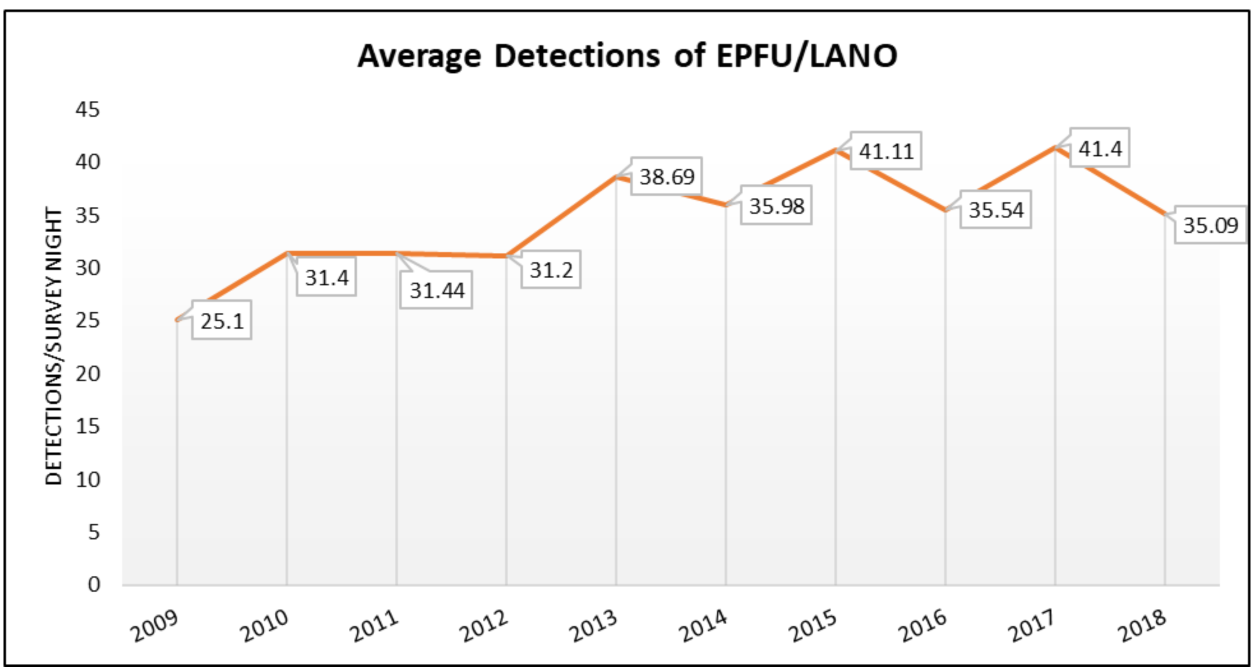


Figure 4. Average detections per route night of the big brown bat (EPFU)/silver-haired bat (LANO) complex.

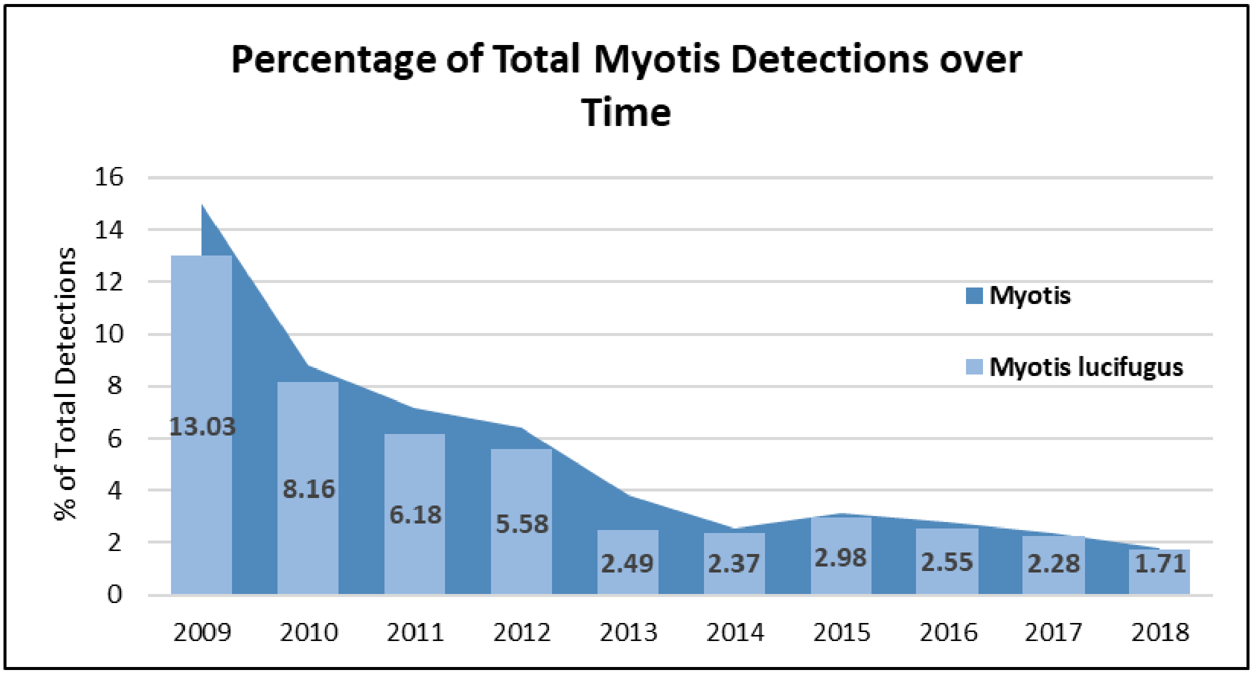


Figure 5. Percentage of total Myotis bat detections, paired with percentage of detections of little brown bats (*M. lucifugus*). Myotis bats include little brown bats (*M. lucifugus*), northern long-eared bats (*M. septentrionalis*), eastern small-footed bats (*M. leibii*), and Indiana bats (*M. sodalis*).

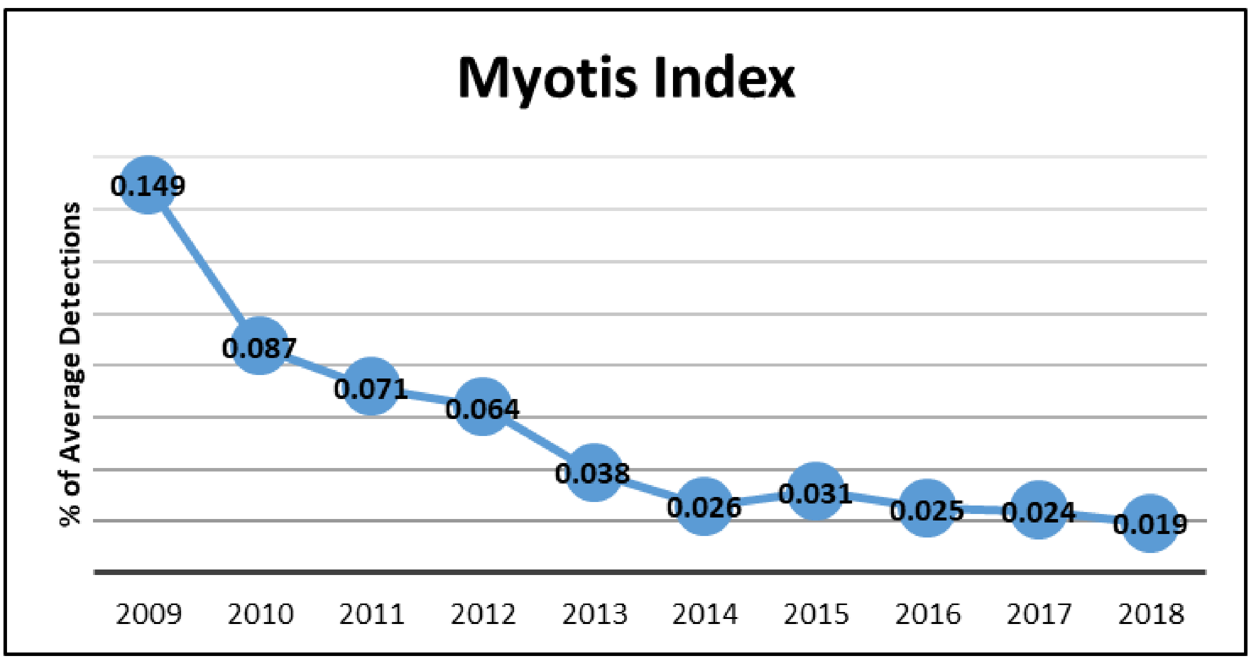


Figure 6. Percent of total Myotis detections out of total bat detections.

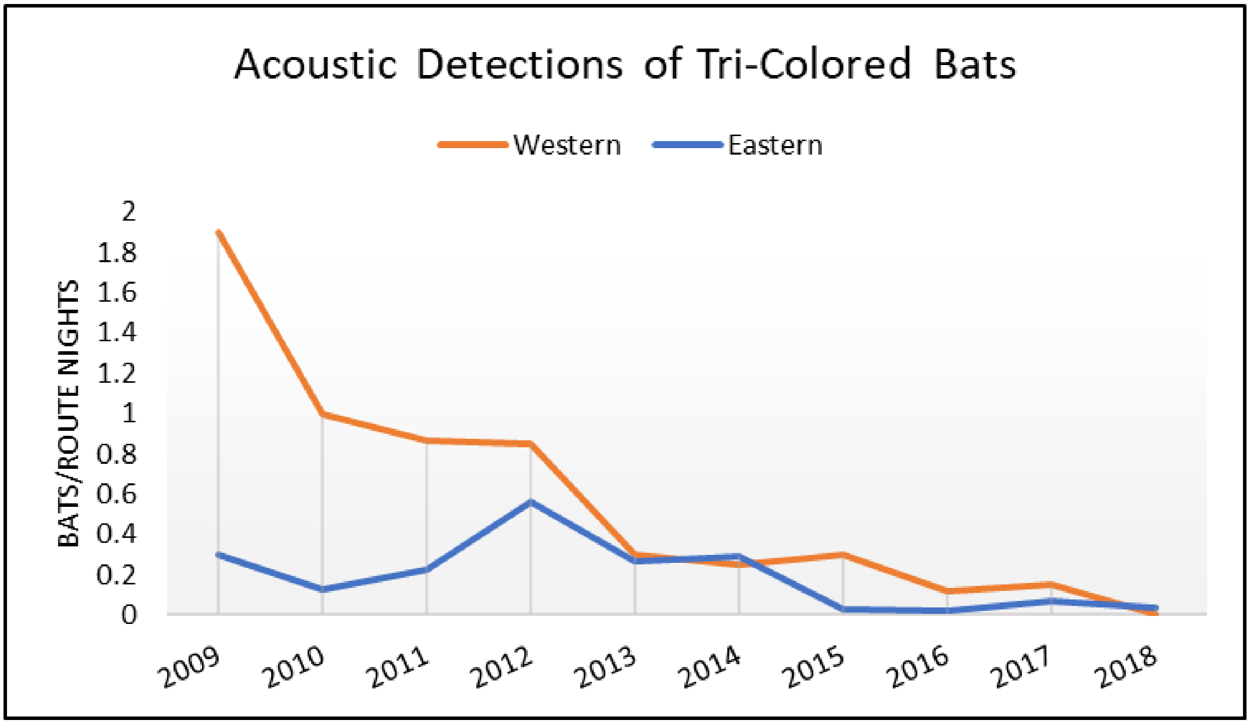
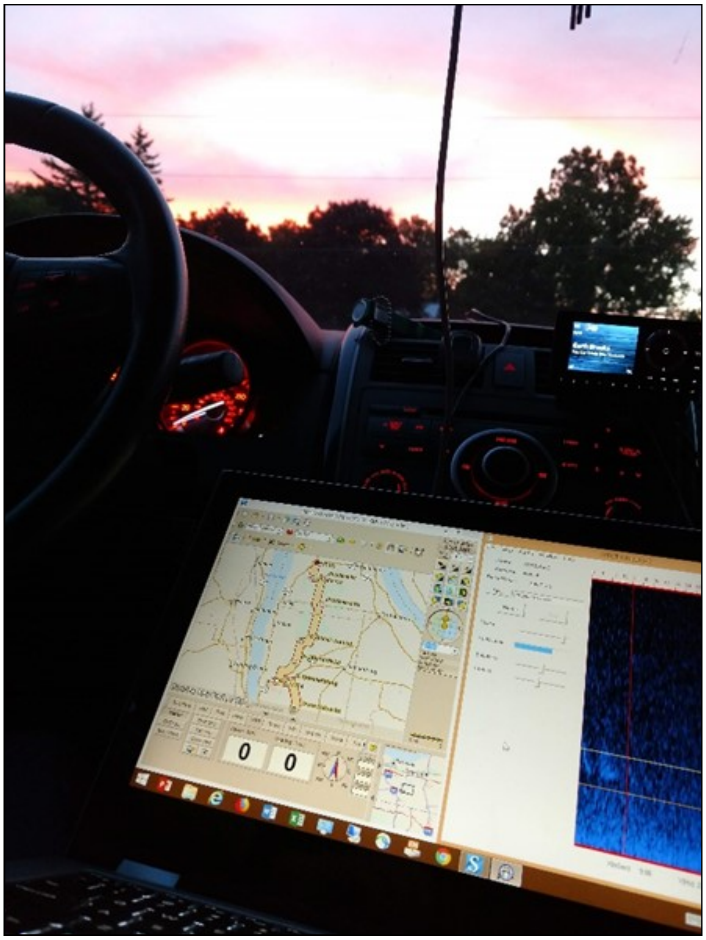


Figure 7. Average detections of tri-colored bats (*P. subflavus*) per route night, separated by 'western' and 'eastern' routes.



Photos 1 and 2. Photo submissions by volunteers performing the mobile acoustic surveys. Left - Photo by Erin Hutteman, with her laptop ready to go. Right - Photo by Valerie Mitchell, showcasing the microphone and GPS-unit setup.

2018 - 2019 OVERWINTER MONITORING PROJECT IN NCC CAVES

— Morgan Ingalls —

As many of you know, the NCC has been working on an overwinter monitoring project this past winter at eight of our caves that we close for the hibernation season: Clarksville, Knox, Ella Armstrong, Bensons, Onesquethaw, Bensons, Bentleys, Merlins, and Dragon Bones. The goal of this project is to track bat movement and human visitation during the hibernation season to determine how much bats are moving around during the winter and if there is a correlation between human visitation and bat disturbance.

How Are We Detecting Bats?

If you're an NCC member, you probably already know that bats use echolocation to hunt for prey and find their way around. To do this, bats make noise (or "calls") in specific frequency ranges that we can then record using acoustic detectors with special microphones. We can then process this data using special software that converts noise calls into spectrographs and determines which noise files are bats and which noise files are other things that may also be in the same frequency range (for example, insects, flying squirrels, wind, water, car keys, etc.) Using this data, we can determine when bats are echolocating near one of our microphones.

Acoustic detector in place at Bensons Cave. Photo by Morgan Ingalls.

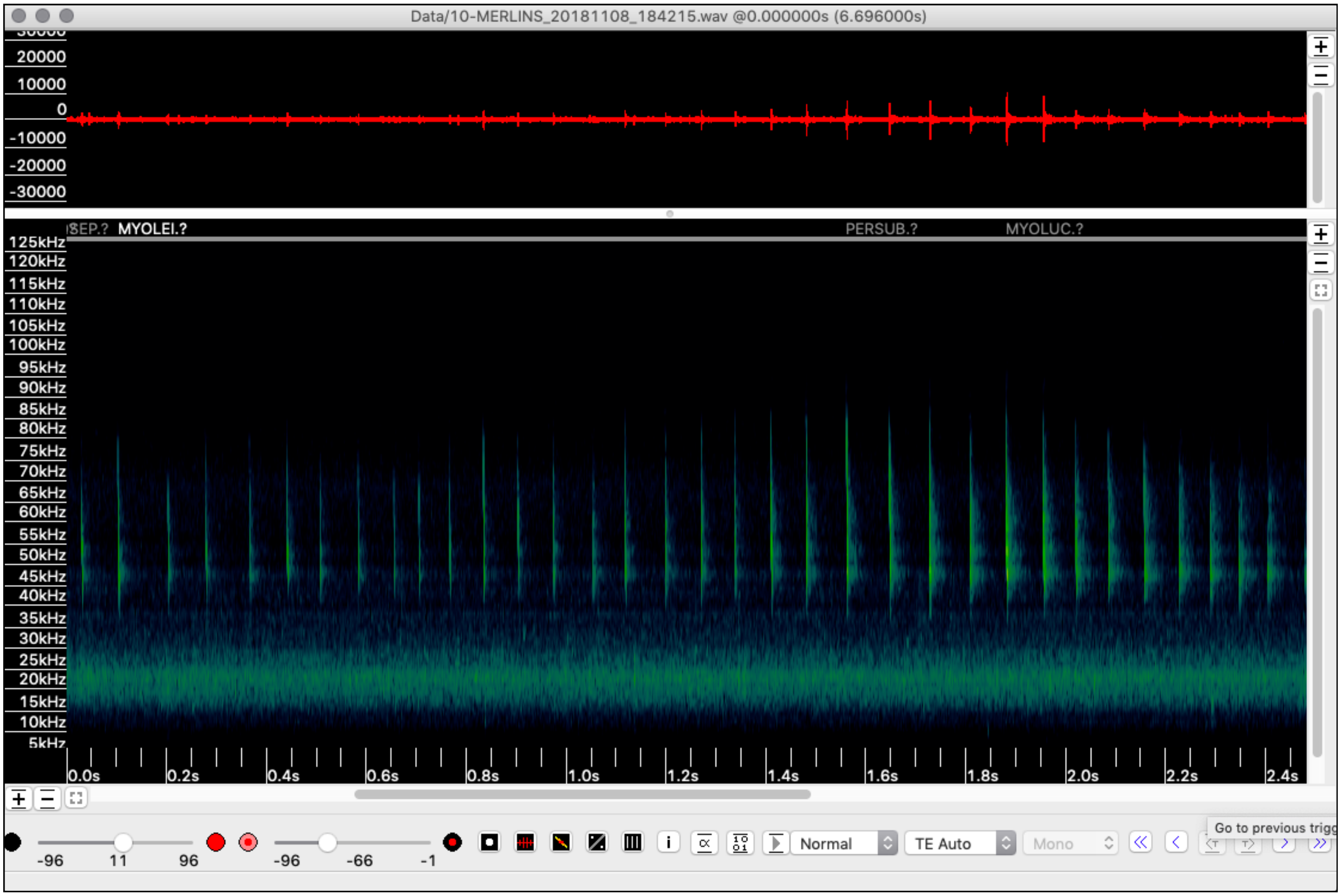
Peter Haberland placing a light sensor in Dragon Bones Cave. Photo by Mitch Berger.

How Are We Detecting People?

Since these eight caves are closed for the hibernation season, there shouldn't be any human visitation during this period. But people sometimes ignore the closures and go in anyway. In addition, some of these caves were surveyed by NYSDEC personnel over the winter when they were doing their winter bat counts. To determine human visitation, we used light detectors that were quite similar to those used by Norm Berg and CCG in the past (see NCC Newsletter Volume 19, Number 1 for the full article).

By combining our light data and our acoustic data, we can see if there was a correlation between people visiting closed caves and an increase in bat activity outside the same cave.

Light detector in Clarksville's Thook entrance. Photo by Mitch Berger.



Spectrograph of a *Myotis* bat call at Merlins Cave viewed in Kaleidoscope Pro. Photo by Morgan Ingalls.

We Have Awesome Volunteers!

To do this project, the NCC needed a lot of help from a lot of volunteers. While the light detectors had long-lasting batteries and we could place them in caves in the fall and then remove them in the spring (something we'll be doing quite soon!), the acoustic detectors required volunteers to hike out to them every two weeks to change the batteries and replace the SD cards. This was often quite a slog through all kinds of winter weather, and volunteers frequently had to troubleshoot issue with detectors and microphones. Additionally, since we used rechargeable batteries all winter, there was lots of logistical challenges swapping used batteries and SD cards for new batteries and SD cards at Speleobooks where Mike and Emily kindly acted as a home base for charging batteries and collecting SD cards so they could be packaged up and sent to me in Vermont.

Emily Davis and Erik Nieman setting up the acoustic detector at Clarksville's Gregory entrance. Photo by Mitch Berger.

What Did We Find?

I can't tell you yet! While I've been downloading all the acoustic data, I haven't been able to keep up with processing and analyzing all of it (it takes a long time), so I'll be working on that over the summer and fall, and possibly into the winter. Similarly, we haven't actually pulled the light detectors out of the caves yet, so I have no idea what we'll find out about overwinter visitation. Stay tuned!

This project is a collaboration between the Northeastern Cave Conservancy and the New York State Department of Environmental Conservation. Funding was provided by a grant from the New York State Conservation Partnership Program.

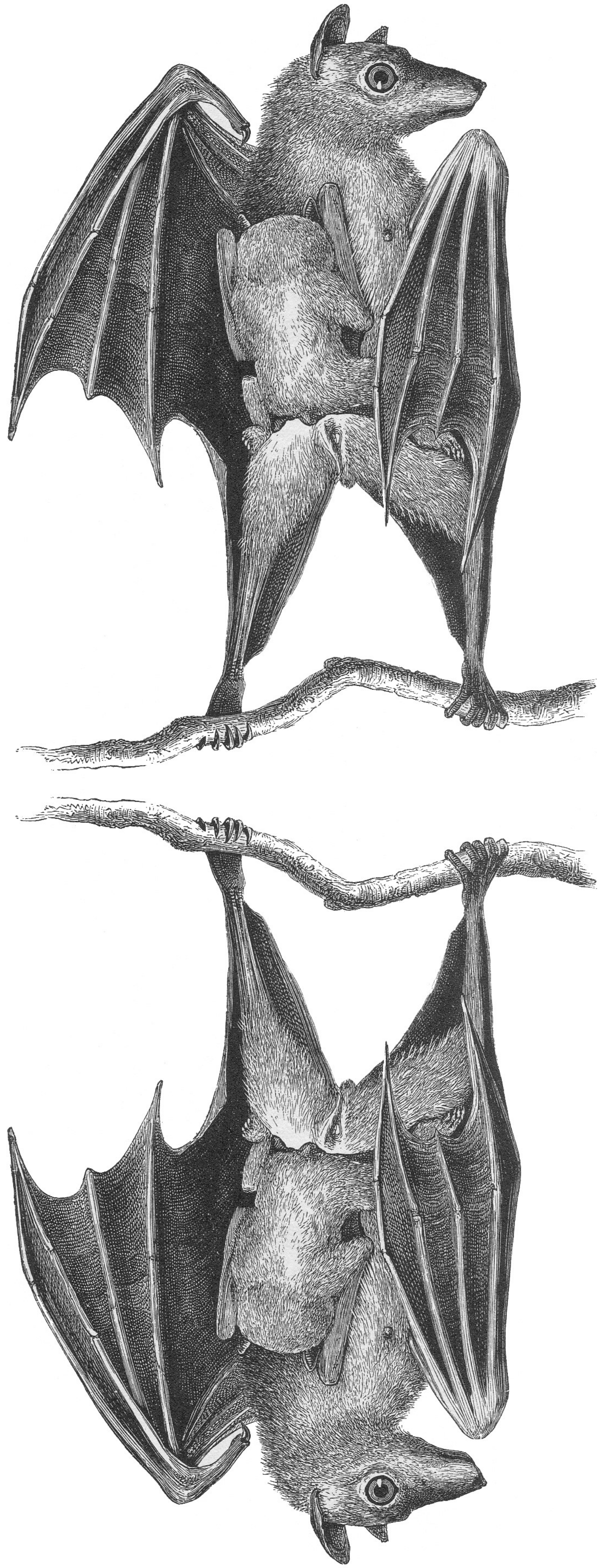
At the entrance to Knox Cave while checking the detector on February 2, 2019. Erik Nieman writes, “The walk in was exhausting. There was about four inches of snow on top of an ice layer with about 10 - 12 inches of snow below that. Each step required stepping out of the ice and breaking through it again after I weighted that leg, all the way to the sinkhole. This was the trip where I had a hard time locating the monitor, because it was buried in snow. The photo I took was the payoff though. Seeing the ice columns at Knox was beautiful.” Photo by Erik Nieman.

Little brown bats hibernating in Merlins Cave. Photo by John Dunham.

Thank You!

An extra special thank-you to everyone who has volunteered on this project so far, including…

Mitch Berger
Craig Cantello
Emily Davis
John Dunham
Peter Haberland
Leslie Hatfield
Devon Hedges
Shirley Madewell
Luke Mazza
Erik Nieman
Chuck Porter
Ellen Schwartz
Mike Warner



An Evolutionary Thought on the Variety of Hearing Organs in Nocturnal Insects

In days of old and insects bold
(Before bats were invented),
No sonar cries disturbed the skies—
Moths flew uninstrumented.

The Eocene brought mammals mean
And bats began to sing;
Their food they found by ultrasound
And chased it on the wing.

Now deafness was unsafe because
The loud high-pitched vibration
Came in advance and gave a chance
To beat echolocation.

Some found a place on wings of lace
To make an ear in haste;
Some thought it best upon the chest
And some below the waist.

Then Roeder's key upon the breeze
Made Sphingids show their paces.
He found the ear by which they hear
In palps upon their faces.

Of all unlikely places!

Pye, J. D. (1968). How insects hear. *Nature*. 218: 797

Echolocating Bats and Insect Prey - An Evolutionary Arms Race

Pye's poetic account of ultrasonic hearing in insects and echolocation in bats is more than just a pleasant ballad. It speaks directly to several important concepts in evolutionary biology. Details of the *Icaronycteris* fossil—the oldest bat known to utilize echolocation—had been published just a few years before Pye's poem had been penned. The discovery of pristine bat fossils dating to the Eocene Epoch (34 - 56 million years ago), and which included *Icaronycteris* and myriad other genera, provided a geologic context to help date the early evolution of echolocation in bats and put it into perspective to the foraging strategy of these small, insectivorous animals that hunted on the wing by night.

He also calls attention to the concept of an evolutionary arms race between echolocating bats and their potential insect prey. This is a widespread phenomenon in the natural world and, in the broadest sense, refers to the ongoing struggle for survival between predator and prey or parasite and host, in which development of a survival adaptation of one is countered by development of a successful outwitting strategy by the other. This evolutionary give-and-take is an example of how adaptation by natural selection favors survival and, under appropriate circumstances, speciation. In stressing the interrelationship between bats and insects, Pye reminds us of the interconnectedness of biological systems and that the study of such systems does not occur in a vacuum. A good understanding of natural history and ecology requires a multi-disciplinary approach, involving researchers in widely varying fields of study.

Pye's brief reference to Roeder's key refers to an observation reported by Kenneth Roeder that certain sphingid moths could be made to scatter while nectaring by a slight hiss or jingle of keys. The auditory receptors for high-frequency sound were subsequently found to be located on their labial palps, small processes associated with their mouths (see Roeder, K. D., Treat, A. E., and J. S. Vandeberg, 1968. Auditory sense in certain sphingid moths. *Science*. 159: 33).

Editor's Note: In view of the two articles on bat acoustic monitoring studies featured in this issue (one by Katelyn Ritzko and one by Morgan Ingalls)—both of which take advantage of the ability of many species of bats to utilize echolocation for hunting insects and navigating in the dark—I thought it would be appropriate to include some information on Pye's delightful poem about the origin of echolocation in insectivorous bats and the co-evolutionary arm's race that it fueled among bats and various insect species.

NCC MEMBERS APPRECIATION DAY

Please join us at Thacher State Park in Horseshoe Shelter 2 on July 6, 2019, for the First Annual NCC Members Appreciation Day. Activities—which will include food and beverage, hikes, caving, mapping and such—will be going on from 9:00 am until 6:00 pm. The day will also coincide with a Thacher Park workday, so there will be plenty to do. Near the shelter are great Cliffside views, access to park trails, restrooms, a disk golf course, and a playground, to name just a few.

Please RSVP to nccmembersday2019@gmail.com, so we have a head count and can also put you on the list to enter the park without paying the $6.00 park entrance fee. Please include your name, how many in you party (car), and whether you intend to be part of the work day.

Those coming for the work day who come through the gates before 11:00 am will get in free and at no cost to the NCC. Everyone that RSVPs will also be on a list at the gate and get in free (NCC covering the fee). If you show up and have not sent in an RSVP, you'll need to make a worthy $6.00 donation to the Park. So, we can have the lists made up and get the proper amount of shopping done to feed everyone, we will need to have you RSVP no later than noon on Wednesday, July 3, 2019. Thacher Park is located at 80 Thacher Park Road, Voorheesville, NY 12186 (https://parks.ny.gov/parks/128/details.aspx). Hope to see you all there!

NSS MEMBERSHIP RENEWAL

You may be one of the thousands of NSS members who don't yet realize that the NSS is no longer sending renewal notices by mail (USPS). Renewal notices are still being sent via email. But they no longer herald the arrival of a paper renewal form in the mail. Three notifications will be sent prior to the end of your membership—the last one being the day before your membership expires. So, keep this in mind when a notification arrives in your inbox.

Views of the entrance to Spider Cave on April 22. Top photo: from left to right - Elliott Mangione and Maggie Dumont. Photos by Kevin Dumont.