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**Species of Greatest Conservation Need
Mammal Research and Management**

Interim Report for Project Year
September 1, 2014 – August 31, 2015

NJ Department of Environmental Protection

**DIVISION OF FISH AND WILDLIFE
ENDANGERED AND NONGAME SPECIES PROGRAM
P.O. BOX 420
TRENTON, NJ 08625**



PERFORMANCE REPORT

STATE: New Jersey

PROJECT NUMBER: W-71-R-1

PROJECT TYPE: Research and/or Management

PROJECT TITLE: SGCN Mammal Research and Management

STUDY NUMBER AND TITLE: 1. Mammals

PERIOD COVERED: September 1, 2014 to August 31, 2015

JOB NUMBER AND TITLE: 1A. Bobcat Conservation

Prepared by: Gretchen Fowles

OBJECTIVE: Determine the distribution, minimum size, population and genetic structure, and habitat needs of New Jersey's bobcat population and use the information to preserve the habitat necessary to maintain a viable population.

Key Findings:

- The statewide Connecting Habitat Across New Jersey (CHANJ) working group (NJ T-11-T-1, Job 3, Habitat Connectivity Project) is developing a mapping approach that will likely serve the needs for a landscape level bobcat habitat map and corridor model. Bobcat location data is being used to validate the CHANJ core and corridor mapping being developed as a pilot in the Skylands region of New Jersey. Therefore, we have not yet created an updated landscape predictive habitat model for bobcat as initially proposed in this project.
- ENSP is collaborating with Montclair State University on a GIS analysis of the bobcat collar data to date, which will be completed after the data from the latest collar is retrieved in Spring 2016. A home range model is on hold until we have the collar data back from all of the bobcats.
- An analysis of habitat change over time has not been completed and is pending the predictive model development.
- The dog-handler team conducted bobcat scat surveys throughout northern New Jersey. The survey effort was prioritized to focus on areas where, since 2006, a) the dog-handler team found a bobcat scat for which the genetics lab was able to get an individual ID, b) the dog-handler team found a bobcat scat, c) a bobcat was recently reported being observed. This prioritization was done to increase the likelihood of "recapturing" individuals to feed into the capture-recapture analysis.
 - The dog-handler team ran 27 transects that were, on average, 2.6 km in length and intersected with 27 of the 5 km grid cells that were overlaid on the existing predictive habitat model. Transects were run in 26 of the 42 grid cells where the dog-handler team has found a scat representing a unique individual in the past and in 26 of the 47 grid cells where the dog-handler team has found a bobcat scat in the past. The scat surveys were conducted from March 23 to June 5, 2015.

- The dog-handler team collected and submitted 84 scats to the Rocky Mountain Research Lab for DNA analysis from the survey effort. The results are as follows:
 - 67 (80%) of the scats contained adequate DNA for species identification.
 - 32 of the scats were confirmed as bobcat.
 - The team collected verified bobcat scats in 16 of the 27 grid cells surveyed.
 - The 2015 scat survey dataset included 14 unique bobcat individuals (10 females, 4 males).
- The GPS locations of all scats were recorded and the DNA results were linked to the resulting shapefile.
- Seventeen tissue samples were collected from animals hit by cars (N = 5), accidentally trapped (N = 11), and captured in live traps targeting cats for GPS collars (N = 1), during the reporting period for a total of 111 tissue samples to date. All samples were submitted to the Rocky Mountain Research Lab for DNA analysis. The data have been incorporated into the dataset being used for the capture-recapture analysis.
- ENSP biologists compiled all of the scat survey data to date (2004–2015) along with the tissue, and collar data to date (2002–2015) and are working with a statistician from Rutgers University to develop a spatially explicit capture-recapture model to evaluate sex ratio, population size, density, and survival rate of the bobcat population in Northern New Jersey over time.
 - To date, 487 bobcat scats have been collected by the dog-handler team and have resulted in the identification of 174 unique individuals (90 females, 84 males).
 - The compiled bobcat dataset, representing both scat and tissue samples collected 2002-2015, includes 277 unique individuals (138 females, 139 males).
 - ENSP is collaborating with the Rocky Mountain Research Station and a mammologist at Montclair State University to develop a plan for analyzing information on parent-offspring relationships based on the scat and tissue samples.
- The Rocky Mountain Research Station Genetics Lab is finalizing the regional genetic analysis that includes samples from New Jersey, neighboring Pennsylvania and New York, as well as samples from Maine, the source population of the New Jersey bobcat reintroduction. ENSP tracked down and sent in 8 additional tissue samples from 3 historic New Jersey bobcat specimens during the reporting period to represent the baseline bobcat genetic profile prior to the reintroduction. This baseline information has been a missing component of the analysis.
- One reproductive tract (for a total of 24) and teeth from 9 animals (for a total of 66), were collected opportunistically from bobcat carcasses during the sampling period. The reproductive tract was analyzed by a veterinarian and found to have at least 3 placental scars indicating that the female had successfully bred within the last year and had 3 kittens. Forty-five of the teeth samples (collected between 2007 and 2013) were submitted to a laboratory to estimate the age of each animal from which teeth were extracted. Over 50% of the teeth samples were from individuals less than 2 years of age, the majority of which were killed by vehicles (Fig. 1). The maximum age of an individual in the sample was 6 years old.

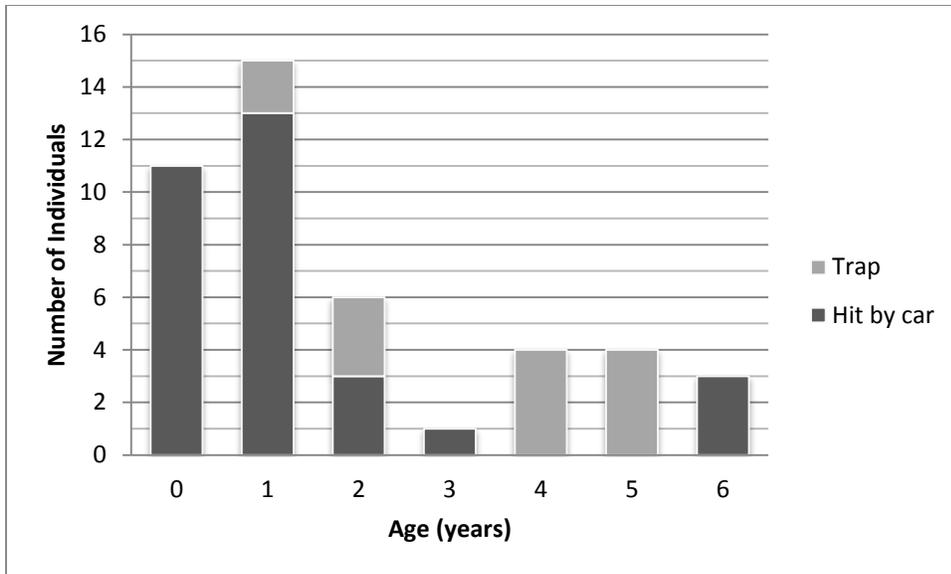


Figure 1. Number of bobcats by age in years and the cause of mortality based on 45 teeth samples collected between 2007 and 2013.

- Opportunistically collected bobcat carcasses were also tested for rodenticide exposure (Fish and Wildlife Health Project, FW69-R-19). Thirteen carcasses collected between 4/1/13 and 7/8/15 were tested and 7 (54%) were found to have exposure to rodenticides.
- A letter and flyer requesting information on bobcat sightings, vehicle mortality and accidental trapping was emailed to all state and municipal police, animal control and clerk offices for which we could find valid email addresses in December 2014. The documents described the mechanism for reporting the different types of incidents to the NJ Division of Fish and Wildlife. An updated ad was published in the Division of Fish and Wildlife’s Hunting Digest that requested the same information and described the reporting mechanisms.
- This was the first year that biologists within the Endangered & Nongame Species Program (ENSP) collaborated with Bureau of Wildlife Management (BWM) biologists to respond to bobcats accidentally captured in cable restraints midway through the trapping season when the long-time bobcat project leader retired. ENSP also worked to develop mechanisms to better understand and minimize injury and mortality resulting from accidental capture.
 - A protocol was developed for the ENSP and BWM biologists responding to bobcat calls following the latest recommendations from Safe-Capture International, Inc. training, and to insure that standardized data are collected and samples and recorded information get to the appropriate ENSP biologist.
 - A total of 12 trapped bobcats (Fig. 2) were reported by trappers during the reporting period; 4 (33%) died and 8 (67%) were successfully released. Ear tags were put in 50% (3 of 6) of the bobcats handled and released successfully by ENSP/BWM and DNA samples were taken from all bobcats and carcasses handled by ENSP/BWM (N=10).
 - Game code changes were recommended and adopted, and will go into effect in the 2015-2016 trapping season. They include mandatory reporting of trapped

bobcats within 24 hours, and require the use of relaxing locks on cable restraints. A recommendation of avoiding the possibility of entanglement of the anchoring system or cable was also posted on the Division of Fish & Wildlife's website for avoiding injury or mortality of bobcats accidentally trapped in cable restraints.

- ENSP and BWM biologists, managers, and veterinarian met in June to review the bobcat response that occurred during the 2014-2015 trapping season to discuss changes that could be made to the response protocol to enable a more effective response and data collection. Results of the necropsies and injuries observed from bobcats that required medical attention were reviewed.
- There were 5 road-killed bobcat carcasses recovered by ENSP during the reporting period (Fig. 2), from which tissue samples, teeth, reproductive tracts (females) were taken and rodenticide testing was performed. Two other road-killed bobcats were reported to ENSP from credible sources, but were unable to be located. The twelve cameras located in 9 crossing structures under two high volume roadways in northern New Jersey with suitable bobcat habitat on both sides of the road, captured a total of 6 occurrences of bobcats in the vicinity of 4 of the structures. It is unclear if the bobcat used the structures to cross under the roadway in all of the occurrences.

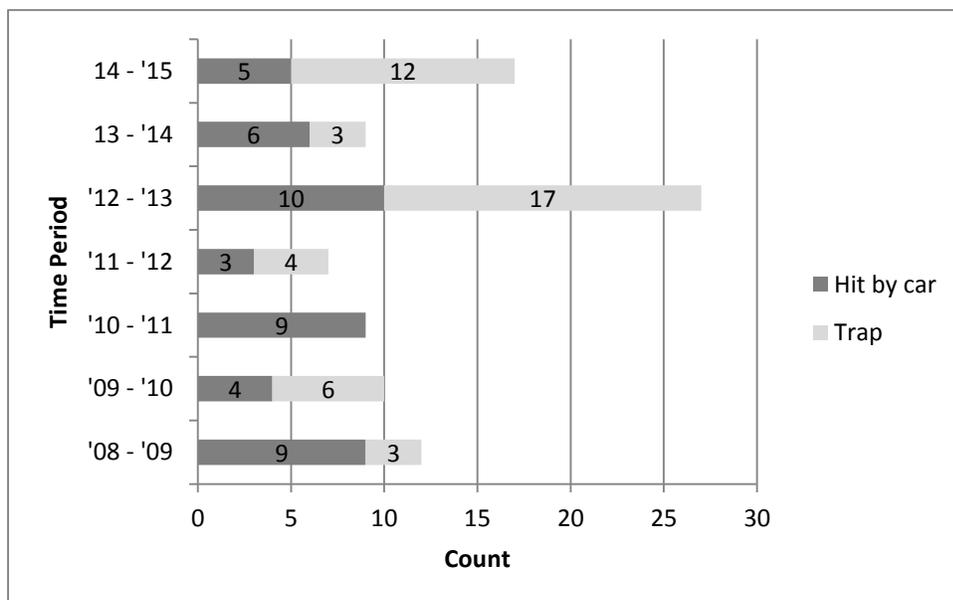


Figure 2. Number of bobcats hit by cars and trapped accidentally in New Jersey over the past 7 reporting periods from September 1 to August 31 each year.

- One adult female bobcat was live-trapped during the reporting period. The bobcat was chemically immobilized using a dose of 10 mg/kg of Ketamine and 2 mg/kg of Xylazine following protocols established by Dr. Keith D. Amass and Dr. Mark Andrew of Safe Capture International, Inc. Once immobilized the bobcat was fitted with ATS store on board GPS collars with a VHF transmitter. The collar is programmed to capture location data once every hour for 350 days following deployment and is scheduled to drop off on 3/23/16. This bobcat and three bobcats collared during the last reporting period were tracked using an ATS receiver every 7 to 21 days to make certain the animals are still

alive and to track their movement patterns to aid in collar recovery after drop-off. Two of the collars, previously deployed, dropped off as scheduled around 1/15/15 and 2/1/15 and were recovered by ENSP. The third collar was on a bobcat that died in a trap on 1/1/15 (the scheduled collar drop off date was 3/18/2015), and ENSP recovered the carcass and collar from the trapper. The bobcats were trapped adjacent to major roadways in northern NJ to help determine whether high-volume traffic roadways pose a barrier to bobcat movements and to identify potential crossing corridors. ENSP is collaborating with Montclair State University to analyze the resultant data.

- The Biotics database was updated with bobcat observations received from the public and the tissue samples. The bobcat scat data collected in 2015 has not been entered into the database during the reporting period because the DNA results were still pending.
- Work was not done on the bobcat status assessment and recovery plan.

Conclusions:

- The survey effort in 2015 by the dog-handler team was less extensive than in 2013, mainly due to the aging of the wildlife detection dog. The deep snow and ice cover results in difficult walking conditions for the dog, while warmer temperatures and snake emergence are not conducive to the surveying effort, thus the number of days with good surveying conditions was limited. The team surveyed approximately 62% of the grid cells where individual IDs of bobcats have been obtained in previous years (down from 90% in 2013) and collected verified bobcat scats at approximately 59% of the grid cells surveyed. Despite being a reduced effort, it did result in the addition of 14 unique individuals to the capture-recapture database and will contribute to the analyses on population size and density as well as the parent-offspring analyses.
- The drying technique ENSP started using 3 years ago was again used, but only 80% of scats had adequate DNA for species identification, compared to 95% in 2013. It is difficult to explain and correct, as there are many factors that contribute to scat degradation.
- The opportunistic collection of DNA samples from live bobcats as well as teeth, reproductive tracts, DNA samples, and rodenticide testing, including the spatial locations of those samples, are all contributing valuable information to increase our understanding of the status and health of the New Jersey bobcat population.
- A compiled dataset of individual IDs, sex, and spatial locations of bobcats collected between 2002 and 2015 is being analyzed by a statistician at Rutgers University to evaluate sex ratio, population size, density, and survival rate of the bobcat population in Northern New Jersey over time. A plan for analyzing information on parent-offspring relationships from the 2002–2015 bobcat dataset is being developed in collaboration with a mammologist at Montclair State University. The regional genetic analysis is being finalized by the Rocky Mountain Research Station. There had been a delay in results because the nuclear DNA analysis of the historic samples did not yield results and the first analysis of the mitochondrial DNA sequencing showed a contaminant in the negative control, so the analysis is being re-run. Additional historical samples have now been sent to the lab to serve as the baseline genetic profile of the New Jersey bobcat population prior to the reintroduction between 1978 and 1982.

- The majority of our dataset of opportunistically collected bobcat carcasses (roadkills or died in traps) between 2007 and 2013 have been young cats, <2 years old and over 92% (24/26) of those young cats were killed on roadways likely due to naivety with respect to roads. The fact that the oldest bobcats in the dataset are just 6 years old when bobcats have been known to live in the wild for 12-13 years is interesting, though caution must be applied in drawing any conclusions from the dataset because the sample size is small. It is also concerning that over half of the bobcat carcasses tested (7/13) show rodenticide exposure. It will be informative to evaluate the spatial distribution and the associated land use/land cover of the positive and negative samples to gain a better understanding of the pattern of exposure.
- An outreach effort was made to increase awareness that ENSP is collecting bobcat data that includes live sightings, bobcats found dead on roads and those accidentally trapped. The number of bobcats reported hit by cars and recovered did not increase during the reporting period, but the number of reports of trapped bobcats quadrupled compared to the previous year. It is unclear if this was a result of trappers made more aware of the need to report these incidents or if more bobcats were accidentally trapped this reporting period. Anecdotally, many trappers did not set snares during the prior reporting period due to heavy snows and icy weather during the months of January and February.
- The rate of successfully releasing bobcats caught in traps was 67% (8/12) during this reporting period. Forty-three percent (3/7) of the bobcats handled by the team required medical attention. The new requirement of using relaxing locks on cable restraints and the Division's recommendation for avoiding entanglement of the cable and anchoring system that was posted on the Division's website are both measures suggested in the Association of Fish & Wildlife Agencies Best Management Practices for Trapping in the United States (http://jjcdev.com/~fishwild/?section=best_management_practices).
- The first year of the collaborative effort of biologists within ENSP and Bureau of Wildlife Management biologists to respond to bobcats accidentally captured in traps was generally successful in providing a standardized response and data collection when bobcats are accidentally trapped in cable restraints. Improvements to the protocol were discussed and will be implemented in the 2015-2016 trapping season.
- ENSP successfully recovered the data on the three GPS collars deployed in 2014 and fitted a fourth GPS collar on a bobcat in 2015 near a major roadway. The resultant data from the four collars will be useful in examining whether high-volume roadways pose a barrier to bobcat movements and to identify potential crossing corridors, particularly in combination with the bobcat roadkill data, the habitat corridor mapping, and the data obtained from the remotely triggered cameras at structures under two of the high volume highways in northern New Jersey that bisect suitable bobcat habitat.

Recommendations:

- Determine whether the mapping approach chosen by the statewide connectivity map working group will serve the needs for a landscape level bobcat habitat map and corridor model. If not, develop an updated landscape level habitat predictive map to feed into bobcat specific corridor modeling effort. Develop a within home range predictive model once all of the collar data is available.
- Continue to use scat, tissue, remotely triggered camera, and GPS collar data to help validate CHANJ core and corridor modeling.

- Continue to survey for scat with the wildlife detection dog as long as he is able and excited to do so.
- Given the lower success rate of extracting quality DNA for species identification from scat, be cognizant of drying the scats as quickly as possible after they have been collected to avoid DNA degradation.
- Continue to opportunistically collect tissue samples from live and dead bobcats to add to the capture-recapture database.
- Continue to work with the statistician at Rutgers University to develop the spatially explicit capture-recapture model using the compiled bobcat dataset from 2002 to 2015, and estimate sex ratio, population size, density, and survival rate of the bobcat population in Northern New Jersey over time.
- Continue to work with the mammologist at Montclair State University to evaluate the parent-offspring relationship data gleaned from the 2002–2015 bobcat genetics dataset.
- Work with the Rocky Mountain Research Station to finalize the regional genetic analysis that includes the new historic New Jersey samples and distribute results to NY, PA, and ME who all contributed samples to the dataset.
- Continue to collaborate with biologists from the Bureau of Wildlife Management to implement recommended changes to the bobcat trap response protocol for the upcoming trapping season.
- Continue collecting and analyzing reproductive tracts and teeth to gain a better understanding of the age structure, fecundity, and pregnancy rates of the population, and continue to test bobcat carcasses for rodenticide exposure to assess the extent of the risk factor.
- Begin compiling the results of the varied analyses in a bobcat status assessment/recovery plan and develop outreach information based on the assessment to distribute to trappers, state and municipal police, and animal control officers to inform them about the health and status of the New Jersey bobcat population and the important contribution samples from both road-killed and trapped bobcats have been making to our understanding of the population.

JOB NUMBER AND TITLE: 1B. Allegheny Woodrat Conservation

Prepared by: Gretchen Fowles

OBJECTIVE: Annually monitor NJ's Allegheny woodrat (*Neotoma magister*) population and assess the potential exposure risk to raccoon roundworm (*Baylisascaris procyonis*). Actively manage raccoon roundworm levels in the raccoon population at New Jersey's last remaining Allegheny woodrat population through the use of medicated raccoon baits.

Key Findings:

- ENSP partnered with a professor at Montclair State University and AmeriCorps members working with that same professor to conduct research on woodrats in New Jersey. ENSP and the Montclair State professor also are developing a plan with researchers in the region (Pennsylvania and Maryland) to conduct habitat inventories and evaluate vulnerability to infestation by raccoon roundworm at active and inactive woodrat sites.

- ENSP has designed and begun implementing a year-round roundworm mitigation plan at the Palisades habitat in collaboration with Purdue University. ENSP, Montclair State University, AmeriCorps members, and volunteers collected 15 raccoon scats in 4 of the 6 active sites at the Palisades on May 13, 2015, to evaluate the prevalence of *B. procyonis* egg loads in the scat. The scats were sent to Wheaton College for analysis and all came back negative.
- Concurrently to collecting raccoon scats, 6 bait dispensers were deployed (Boulanger et al. 2006) in close proximity to the 6 active woodrat sites, and each was loaded with approximately 50 Piperazine-treated fishmeal/polymer baits for delivery to free-ranging raccoons. A second batch of 300 medicinal baits was loaded into the bait dispensers in early August and we plan to continue a re-supply schedule of every 6-8 weeks year-round.
- Standard trapping protocol was conducted at six separate talus slope sites at the base of the Palisades Interstate Park from September 29 through October 1, 2014. Tomahawk TM Model 201 (5"x5"x16") Collapsible and Standard Single-door Live Traps were used for sampling. The traps were baited with apple slices and peanut butter.
 - Forty traps were set for two consecutive days (September 29 and October 1) for a total of 80 trap-nights of sampling effort.
 - Trapping success in 2014 was the same as it was in 2013 with the capture of just 15 unique individuals. Woodrat numbers (based on capture index) had been declining at the Palisades site from 2006 to 2009 but then began a gradual increase in 2010. The capture index (# of individuals captured/10 trap nights) in 2014 was 1.87, the same as 2013, up from 1.50 in 2012 and comparable to 2010 and 2011.
 - Captured animals consisted of seven adult males, seven adult females and one sub-adult male.
 - Two animals (1 male and 1 female) were recaptures from 2012, six were recaptures from 2013 (3 males and 3 females), and seven animals were first time captures (4 males and 3 females).
 - All captured animals were held for several minutes prior to their release to determine if they exhibited any symptoms of infection by *B. procyonis*. No animals displayed any symptoms. All animals were sexed, weighed and ear-tagged at the point of capture. One adult male did have two deformed front feet with toes either absent or very short (Fig. 1). It did appear to still be an agile climber.
- Woodrat scats (N=12) were collected at two of the active sites and will be sent to a geneticist at Purdue University to extract DNA to evaluate whether the non-invasive technique of scat analysis could be an effective method of monitoring the population status in the future.
- Purdue University completed a genetic assessment of the Palisades woodrat population incorporating genetic samples from 2009, 2011, and 2012. The average heterozygosity (29%) and allelic richness (1.909) remain very low, but were at similar levels to those in 1999: 28.7% and 2.0 respectively (Castleberry et al. 2002).
- ENSP coordinated a meeting with regional woodrat experts from New Jersey, New York, Indiana, and Pennsylvania on April 23, 2015, to explore the possibility of translocating woodrats from Pennsylvania to the NJ population as a strategy to maintain adequate genetic diversity in the NJ population. The overwhelming consensus was that a “genetic rescue” through translocation was worth pursuing.

- A translocation effort was conducted at the end of July.
 - ENSP, in collaboration with Montclair State University, biologists from the Pennsylvania Game Commission, and researchers from Indiana University of Pennsylvania trapped two sub-adult Allegheny woodrats (a male and a female) over two trap nights at two active woodrat sites in Huntingdon County, Pennsylvania, on July 28 and 29, 2015. The Allegheny woodrats inhabiting the two sites were previously determined to be the best option, genetically, for the translocation by researchers at Purdue and Indiana University of Pennsylvania, and also would be able to sustain the loss of two sub-adults.
 - The two sub-adults were transported to New Jersey on July 30 and received a health assessment by a wildlife veterinarian, ear tags were put in, they were fitted with ATS telemetry collars, and genetic samples were obtained from each.
 - The two individuals were released in the Palisades on July 31, 2015 into sites with suitable habitat known to be occupied by woodrats, but based on camera monitoring in the weeks prior, were locations with potential unoccupied dens. The female was released in the southern-most site known to be occupied and the male was released at a site approximately 0.81 km north.
 - ENSP, in collaboration with Montclair State University and AmeriCorps members closely monitored the two individuals after the release with telemetry (locations were recorded) and by setting up and moving as needed, four motion-triggered cameras (two at each site where telemetry indicated the individual was located) set to capture 10 second videos when triggered. The telemetry and video review took place every day for the first week, and then every 2-3 days through the end of the reporting period. The two translocated woodrats were identifiable on the videos by their collars and unique ear tags. Within two weeks the two individuals had each settled into an area where we consistently located them. We recorded the female moving a maximum of 0.07 km from the site of release, but then settling in an area 0.02 km from the release site. We recorded the male moving a maximum of 0.41 km from the site of release, where he seemed to have settled. The site is one that is between two sites that ENSP monitors as part of the annual trapping effort.
 - Everyone on the team of regional experts has been sent regular updates on the status of the translocated individuals.



Figure 1. Adult male Allegheny woodrat trapped during annual trapping effort in the Palisades Interstate Park in New Jersey with deformed front feet.

Conclusions:

- The planned collaborative efforts with Montclair State University and researchers in Maryland and Pennsylvania will be useful for developing a management plan for the conservation of woodrats and their habitat at the Palisades and for evaluating historic sites and determining if they could support woodrats again in the future.
- The baseline prevalence of roundworm eggs in raccoon scat collected at the Palisades woodrat sites in May 2015 was zero, which is a good sign given its known devastating impacts on Allegheny woodrat populations in other areas of New Jersey and New York (LoGuidice 2000, McGowan 1993). The implementation of a year-round schedule of medicinal bait distribution is aimed at keeping that serious mortality factor at bay.
- Allegheny woodrat captures have remained relatively low but constant over the past four years and may be cause for concern due to the findings that the population is suffering from significant genetic isolation. The fact that the low heterozygosity and allelic richness has not declined even more in the last 10-12 years is good, but given that the Palisades population is completely isolated from other extant populations of Allegheny woodrats, it is not expected to improve without intervention. The adult woodrat trapped that had deformed front feet, may be the first physical manifestations of the low genetic diversity.
- The habitat inventory work planned in collaboration with Montclair State University, Pennsylvania and Maryland will begin in the next reporting period and will help with the identification and mapping of suitable habitat both in the Palisades and at inactive sites. The genetic analysis of woodrat scat will help determine whether that technique could be used as a mechanism for surveying and monitoring woodrat populations in the future.
- ENSP has coordinated for the first time, in collaboration with woodrat experts from around the region, a translocation of Allegheny woodrats to the last remaining population of woodrats in New Jersey, in an attempt to increase the genetic diversity of the isolated population. The fact that the translocated individuals had survived at least a month post-release gives them the same chances of survival as the other individuals in the population. The two translocated individuals, by the end of the reporting period, appeared healthy and were behaving normally based on the video coverage we were getting of them on a regular basis. Within 2-3 weeks after their release they seemed to each have settled into one consistent area. Our use of telemetry and cameras to track movements, behaviors, and confirm survival has proven successful. The male has settled into an area never previously monitored by ENSP, which is an added benefit of closely monitoring movements of individuals.

Recommendations:

- Continue the collaborative planning efforts with Montclair State University, Maryland, and Pennsylvania to develop management plans for the conservation of woodrats.
- Research suggests that *B. procyonis* infection in Allegheny woodrat populations is a serious mortality factor and can result in rapid population declines for the intermediate host (LoGuidice 2000, McGowan 1993). Therefore, continue to collaborate with Purdue University and continue to implement the year-round raccoon roundworm mitigation effort and collect and analyze raccoon scat for *B. procyonis* egg prevalence on an annual basis at least.
- Genetic testing has indicated that inbreeding depression is a serious threat to the population. The first attempt at a translocation of individuals from nearby Allegheny

woodrat populations has gone well so far. Continue to monitor the movement, condition of, and survival of the translocated individuals as long as possible throughout the upcoming year. Collect genetic samples from all individuals trapped during the next annual trapping in the fall of 2015 to establish a baseline genetic profile of the population before the translocated individuals had a chance to breed.

- The regional team of woodrat experts agreed that regular influxes of new genes would be advantageous to the genetic health of the Palisades population so we are tentatively planning on conducting another translocation effort in 2016.
- Continue to collaborate closely with the regional team of experts.

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JOB NUMBER AND TITLE: 1C. Small Mammal Survey

Prepared by: Gretchen Fowles

OBJECTIVE: To develop survey and habitat sampling protocols for several species of terrestrial small mammal that can be used for sampling statewide.

Key Findings:

- Due to staff reductions, ENSP biologists have not had the capacity to complete the surveys that ultimately are needed to better understand the status of many small species in the state.

JOB NUMBER AND TITLE: 2A. Bat Conservation and Management

Prepared by: MacKenzie Hall

OBJECTIVE 1: To identify, characterize and monitor summer bat colonies roosting within man-made structures and to provide guidance for proper management of those sites, especially where the federal endangered Indiana bats roost or maternity colonies exist.

OBJECTIVE 2: To identify, characterize, and monitor important winter habitats of New Jersey's bat species, including the federal endangered Indiana bat; and to gather Indiana bat winter population counts to contribute to USFWS database.

OBJECTIVE 3: To identify, characterize and monitor summer roost selections and maternity colonies of White-nose Syndrome affected bat species, including the little brown bat, Indiana bat, and the newly federally listed northern long-eared bat.

Key Findings:

- ENSP Bat Project personnel changes happened at the end of 2014, when long-time project leader Mick Valent retired and MacKenzie Hall was hired and became the new project leader.
- The ENSP continued to build familiarity among NJ's nuisance wildlife control operators (NWCOS) of the appropriate timing and procedures for excluding bats from buildings. We continued outreach to companies that perform bat exclusion work, providing them with state guidelines, educational resources about bats in buildings, reminders of NJ's exclusion "safe dates," and information on identifying and reporting colonies of bats that they encounter. More than a dozen NWCO companies are now included on a "List of NJ Professional Bat Excluders," a homeowner resource which is posted on the Conserve Wildlife Foundation of NJ's Bats in Buildings webpage (see www.conservewildlifenj.org/protecting/projects/bat/buildings/). The ENSP also participated in a White-nose Syndrome Conservation and Recovery Working Group, helping to develop a NWCO Acceptable Management Practices document for use nationally (see <https://www.whitenosesyndrome.org/node/1147>).
- The ENSP fielded dozens of phone calls and emails, particularly between May and July, from residents seeking help or information regarding bats found in their buildings. We worked cooperatively with the Conserve Wildlife Foundation of New Jersey (CWF) and Rutgers University (RU) to provide the needed information and assistance, such as explaining bat behavior and providing a list of qualified NWCOS to perform bat exclusion work. These organizations also offer free bat houses for eviction sites. The ENSP, CWF, and RU provided guidance on the appropriate placement of bat houses.
- NJ's annual Summer Bat Count was coordinated by a new CWF biologist with help from the ENSP and student volunteers from RU. Seventeen colonies were monitored via emergence counts during the maternity season, and volunteers tallied at least 1,300 individual bats. Consistent annual data dating back to pre-White-nose Syndrome (WNS) years only exists for seven of these sites; three of them representing little brown bat colonies (*Myotis lucifugus*) and the other four representing big brown bat colonies (*Eptesicus fuscus*). The small sample size makes it somewhat difficult to establish population trends, especially with some colonies exhibiting regular roost-switching

throughout the summer, but overall it appears there was an increase in little brown bat colony sizes in 2015 (with a 42% recruitment rate at one well-monitored colony where members did not disband until mid-July). Big brown bat colonies appeared to drop by almost 20% in size since 2014, following a few years of steady inflation. Compared with pre-White-nose Syndrome counts, little brown bat numbers have dropped 95% and big brown bat numbers have grown 19%.

- A Summer Bat Count volunteer tallied 36 Indiana bats exiting a “rocket box” bat house in the backyard of a residence in Chester, Morris County in early July. The colony had switched roosts prior to our annual maternity colony survey two weeks later.
- The ENSP confirmed one new, previously unknown colony of little brown bats this year, in a bat house located on a Morris County Park preserve. A volunteer reported bats using the bat house over the past three years. This colony was a significant discovery, as it contained more than 50 little brown bats, including banded individuals from Hibernia Mine. Summer 2015 maternity colony surveys were funded under the USFWS White-nose Syndrome Grants to States program (New Jersey E-11-TW-1) and will be reported accordingly, but the discovery of the bat house colony in Morris County yielded 5 previously banded female little brown bats that connect to other elements of this project. Four of the bats had been banded originally in Hibernia Mine between 2011 and 2013; another had been banded as a juvenile at a maternity colony in Hunterdon County, and translocated into Hibernia Mine to document the progression of White-nose Syndrome using Ultraviolet light photography. It was great to see she survives and is now part of a local maternity colony.
- The ENSP continued to monitor the bat population hibernating at Hibernia Mine (Rockaway Twp., Morris Co.) with help from our partners at BATS Research Center, RU, and CWF. The annual census in March 2015 tallied 462 bats, including 455 little brown bats and one or two individuals each of big brown, eastern small-footed (*Myotis leibii*), northern long-eared (*M. septentrionalis*), Indiana (*M. sodalis*), and tricolored bats (*Perimyotis subflavus*). This count follows a tally of 574 bats in March 2014 and continues the downward trend brought on by the arrival of WNS in early 2009. Since WNS, Hibernia Mine has lost about 98% of its hibernating bats. At least one-third of the bats still present in Hibernia Mine in March 2015 have survived at least four winters since the arrival of WNS, as evidenced by bands dating back to the winter of 2010-11 (our initial season of attempting to band all bats in this most important hibernaculum).
- The ENSP and BATS Research Center deployed seven temperature and humidity loggers inside Hibernia Mine to continuously record climate data throughout the mine. Bat surveys are now being recorded spatially in order to correlate areas of bat concentration with climate.
- The ENSP assisted in WNS-related research by collecting swabs from bats and substrates inside Hibernia Mine in March, 2015, for Dr. Winifred Frick’s (UC Santa Cruz) WNS Continental Transmission study. Staff also conducted banding and re-sighting surveys of Hibernia’s bats for use in Dr. Brooke Maslo’s (Rutgers University) survivorship analyses.
- The ENSP coordinated with Sanders Environmental to continue their fall swarm surveys at Mount Hope Mine (Rockaway Twp, Morris County), which supports NJ’s largest known wintering population of Indiana bats. Across nine survey nights during the fall of 2014, the Sanders team netted/harp-trapped 110 unique Indiana bats, 80 of which had previously been banded (including three bats from a maternity colony in Chester, Morris.

County). At least two of the 50 little brown bats captured had previously been banded at nearby Hibernia Mine in 2011.

- The ENSP assisted in writing a successful proposal for a USFWS Recovery Land Acquisition Grant for the acquisition of Mount Hope Mine, which is currently under private ownership. NJDEP Green Acres is pursuing this important land purchase.
- The ENSP conducted summer mist-netting and radio-telemetry starting in June 2015, with the help of CWF and students from RU. Surveys targeted the northern long-eared bat and sought to document habitats and roosts used by this species in NJ. We selected five state-owned parcels in areas of the state that would complement other survey work being done by researchers and consultants. Netting was focused along small stream corridors, narrow roads and trails through woodlands, Atlantic white cedar swamps/streams, and vernal pools. Our first northern long-eared bat was caught by mist-net at the Sparta Mountain Wildlife Management Area (Sussex Co.) in late June; we radio-tracked the lactating female to a house where she and a few other bats were found roosting beneath cedar-shake siding, more than two miles from the capture site. Capture locations and roosts were characterized and entered into the ENSP's Biotics database of rare species occurrences (for SOA v.11). Our survey work in July and August was funded by the WNS Grants to States Program and will be reported to that Program.
- Due to personnel changes and time demands associated with the 2015 State Wildlife Action Plan (SWAP) revision as well as the recent federal listing of the northern long-eared bat, the ENSP has not made headway on researching or exploring unknown caves and mines for possible bat activity.

Conclusions:

- The Bats in Buildings resources and services provided by CWF and RU have proven to be invaluable. They offer much-needed education and guidance to concerned homeowners and have greatly streamlined our conversations to that effect. Professional NWCOs are increasingly cognizant of state guidelines for bat exclusion and are taking advantage of the free bat houses offered. NWCOs are also becoming engaged in reporting bat colonies, though this has not led to any new discoveries of little brown bat colonies over the past year. Bats are benefiting from properly timed exclusion work and from bat houses installed to provide them with alternative roosting habitat.
- Little brown bat summer colonies remain difficult to locate. Nearly every new report of a house bat colony turns out to be big brown bats. Big brown bats are increasingly found to occupy roosts formerly used by little brown bats.
- The significant new discovery of a little brown bat colony in the bat house at a Morris County Park will offer us another source of trend data on this species, as well as opportunities to quantify the effects of White-nose Syndrome on known juveniles during their hibernation at Hibernia Mine. We have had very few opportunities to garner data from known juveniles over winter.
- The number of Indiana bats occupying the rocket box in Chester was 50% higher this year than previously observed, which may be due to increased monitoring. Bi-weekly emergence counts at little brown bat colonies, too, showed how much variation (i.e., roost-switching) can occur throughout the pup-rearing season as well as after volancy.
- Hibernating bat populations appear to continue dropping at our primary monitoring locations.

- Northern long-eared bats are sparse across the landscape, but do still exist in high enough numbers to be captured during mist-netting surveys. Surveys done by consultants greatly augmented the ENSP's netting efforts and documentation of northern long-eared bats across the state. Development-related surveys done by consultants may be our most efficient source of capture and telemetry data for this species.

Recommendations:

- Continue to try to locate new little brown bat maternity colonies through outreach to NWCOs, homeowners reporting bat issues, wildlife rehabilitation centers, and the State Rabies Lab.
- Request bi-weekly emergence counts at all known *Myotis* roosts to determine reproductive success and to schedule banding surveys before the colonies disband. Band all bats as part of the little brown bat survivorship investigation (which will continue to be funded by either W-71-R-2 or the WNS Grants to States Program).
- Install additional roosts (rocket boxes, Brandenbark™) within suitable, preserved Indiana bat habitat near the maternity colony in Chester (Morris Co.), or elsewhere, to offer additional roosting habitat and potentially improve our ability to locate and monitor colonies of this species.
- Survey historical bat hibernacula that have not been visited since WNS, using acoustic detectors where entry is not possible or advisable. For example, Pattenburg tunnel, Oxford tunnel, Mount Hope east shaft, Manunka Chunk tunnel, and Copper Mine.
- Use historical maps and written accounts to locate additional abandoned iron mines and caves. Search for existing openings that could provide entry for wintering Indiana bats or colonies of other species. Refer to Bat Conservation International's "Mine Portal Survey" and "External Mine Survey" guidance.
- Further investigate and identify bats roosting at residence(s) in Ogdensburg (Sussex Co.), where a lactating female northern long-eared bat was radio-tracked in July 2015.