



2019-20
RESEARCH &
MANAGEMENT
REPORT

**Non-Game Mammals
Conservation & Management**

Download additional reports at
mefishwildlife.com/wildlifereport



2019-20 RESEARCH & MANAGEMENT REPORT

Maine Department of Inland Fisheries and Wildlife protects and manages Maine’s fish and wildlife and their habitats, promotes Maine’s outdoor heritage, and safely connects people with nature through responsible recreation, sport, and science.

Non-Game Mammals Conservation & Management

Meet The Non-Game Species Conservation & Management Group1

Canada Lynx.....2

Bats8

Small Mammals..... 28

Northern Bog Lemmings..... 12

New England Cottontail 13

Download additional sections at mefishwildlife.com/wildlifereport

- » Game Species Conservation & Management
- » Habitat Conservation & Management
- » Regional Wildlife Management
- » Endangered and Threatened Species Conservation & Management
- » Beginning with Habitat
- » Bird Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management

Compiled and edited by Diana Harper and Lauren McPherson

Maine Department of Inland Fisheries & Wildlife

284 State Street
41 State House Station
Augusta, ME 04333-0041
207-287-5202

Project Funding

These studies are financed in part through Federal Aid in Wildlife Restoration Funds under Projects 88D and 87R and through State Wildlife Grants.

The Department of Inland Fisheries and Wildlife receives Federal funds from the U.S. Department of the Interior.

Accordingly, all Department programs and activities must be operated free from discrimination in regard to race, color, national origin, age or handicap. Any person who believes that he or she has been discriminated against should write to The Office of Equal Opportunity, U.S.



MEET THE NON-GAME MAMMALS CONSERVATION & MANAGEMENT GROUP



Jennifer Vashon
Wildlife Biologist
Black Bear and Canada Lynx

Jennifer oversees the management of black bears and Canada lynx – a federally-threatened species. Jen designs and implements surveys and monitoring plans for bears and lynx and analyzes biological data for these species. She is the departmental spokesperson for lynx and bear, makes annual recommendations for harvesting black bears, and provides technical support on bear and lynx issues to stakeholders in Maine and other states. Jen also ensures that the Department meets its obligations under the federal Incidental Take Permit for Canada lynx.



Shevenell Webb
Wildlife Biologist
Furbearers and Small Mammals

Shevenell oversees the management of furbearers and small mammals, work that involves monitoring populations, recommending trapping regulations, conducting research on small mammals, and serving as the departmental spokesperson for furbearers. Shevenell is participating in several research projects with the University of Maine and University of New England, including a study to determine the most effective way to monitor Maine’s marten population and a study to develop new DNA survey technique for northern bog lemmings. She shares bat management responsibilities with Sarah Boyden, Assistant Regional Biologist in MDIFW’s Strong Office.



Cory Stearns
Assistant Regional Wildlife Biologist

Cory works as an assistant regional wildlife biologist out of the Gray regional office. He collects biological data on hunter harvested deer and moose, conducts a variety of wildlife surveys, assists with the region’s Animal Damage Control program, reviews development projects, and collaborates with the Lands Program on management of Wildlife Management Areas among other duties. He also represents MDIFW on the range-wide New England cottontail technical committee, and leads the Department’s cottontail survey effort and translocation program.

MAMMAL GROUP CONTRACT WORKERS AND VOLUNTEERS

Lynx Project

Adrianna Bessenaire
Trina Wantman

Other Small Mammals

Adrianna Bessenaire
Trina Wantman

Bat Project

Alex Barnes
Caroline Byrne
Christopher Heilakka
Connor White
Dave Yates

New England Cottontail Project

Melissa Bauer
Andrew Johnson
Jeff Tash
David Tibbetts
Sarah Towle

CANADA LYNX

Jennifer Vashon

A Northern Species

Canada lynx (*Lynx canadensis*) thrive in northern Canada, which offers an abundance of the three important factors for this species' survival: boreal spruce/fir forests, high snow depths, and snowshoe hare. The southern end of their range extends to several northern U.S. states (**Figure 1**), with persistent breeding populations found in Maine, Minnesota, Montana, Washington, and Colorado. Lynx are classified as threatened in the lower 48.

FIGURE 1. CANADA LYNX RANGE



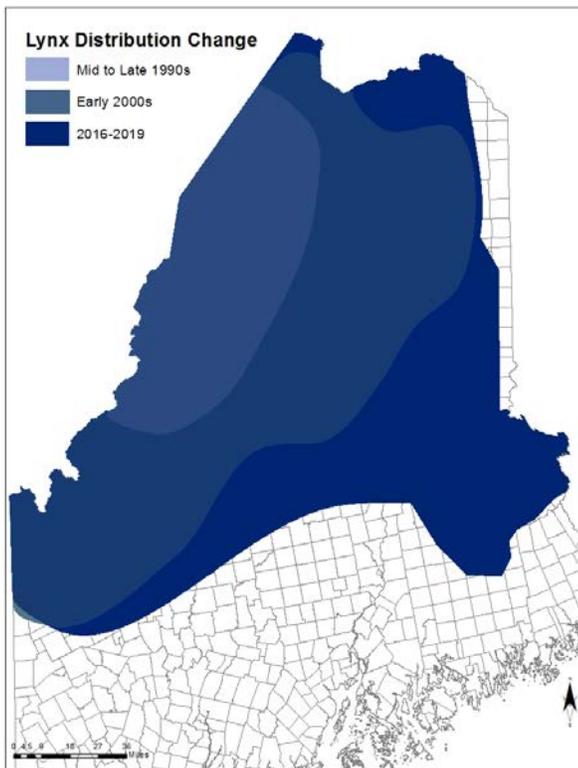
Range map by IUCN Red List



In Maine, lynx reside primarily in our northern spruce/fir forest, where snow depth often remains above a foot for at least three months of the year. Although eastern Maine is not considered part of lynx historic range, lynx have been expanding eastward in recent years (Figure 2) in response to optimal habitat, favorable winter conditions, and sufficient prey.

Their primary prey, snowshoe hare, seek cover and food in young, dense spruce/fir forests, including forests following natural or human disturbance (e.g., wind damage or forest cutting). They can also be found in older forests that have a dense understory of trees.

FIGURE 2. LYNX HAVE BEEN EXPANDING THEIR RANGE IN NORTHERN MAINE.



When Snowshoe Hare Thrive, Lynx Thrive, Too

Because lynx specialize on snowshoe hare, abundance of lynx is tied to snowshoe hare abundance.

In Canada, snowshoe hare populations follow predictable 10-year cycles, typically peaking in abundance at the beginning of the decade and dipping mid-way through before slowly increasing. Lynx survival and productivity increase with snowshoe hare abundance, lagging by two to three years. Once lynx become more common, snowshoe hare numbers begin to decrease followed by a decrease in abundance of lynx.

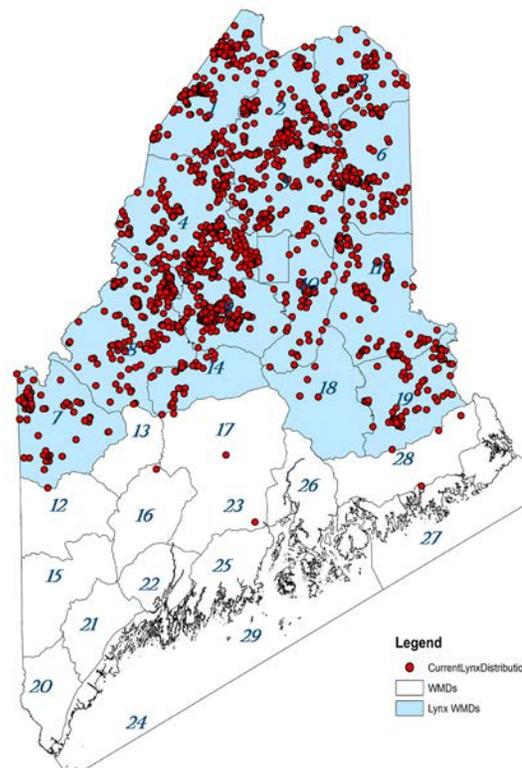
Snowshoe hare numbers also influence lynx reproduction rates, with female lynx producing more kittens when prey is abundant. In Canada, although litters as large as eight kittens have been observed, a normal litter is one to five kittens. In Maine, when snowshoe hares are abundant, litters of four to five kittens are common. Age is also a factor — lynx can reach reproductive maturity as yearlings; but even when snowshoe hares are abundant, only a small percentage of yearlings give birth to kittens, and younger females typically give birth to smaller litters.

Maine is Home to the Largest Lynx Population in the Lower 48

Estimates suggest there are more than 1,000 adult lynx in northern Maine. Including offspring, the total may approach 2,000. The population has been growing since the 1990s in response to habitat conditions that support an abundance of prey.

Over the last 20 years, people in northern Maine have been seeing lynx more regularly (Figure 3). Since lynx are naturally calm animals, and are generally ambivalent to the presence of people, they often remain in the area long enough for a viewer to snap a photo or capture a video. This opportunity to watch lynx in their natural environment makes for a truly unique and memorable experience.

FIGURE 3. CREDIBLE LYNX OBSERVATIONS IN MAINE SINCE 2000



Why are Lynx in Maine Thriving?

More than 90% of Maine’s land area is classified as forest – the highest percentage of any U.S. state. And within the expansive spruce and fir forests of northern Maine, conditions are ideal for lynx: human development is low, snow is deep, and a blend of natural and human disturbances have created record-high levels of lynx habitat.

Much of northern Maine’s acreage is actively managed for commercial forest products; and in the 1980s, a major insect outbreak impacted most of the spruce and fir, causing extensive areas to be cut to salvage dead or diseased trees. This event, combined with the ongoing harvest schedule, has created many young, dense, regenerative softwood thickets perfect for snowshoe hare (and therefore lynx).

Lynx are similar in appearance to bobcats but have more pronounced features, with larger ruff around the face, long black tufts on the ears, noticeably large feet, and a completely black tipped tail.

LYNX		BOBCAT	
EAR TUFTS	Generally greater than 1"	Generally less than 1"	
FACIAL RUFFS	Larger facial ruffs with black banding at outer edges	Smaller facial ruffs with less distinct banding on outer edge	
PELT COLOR	More uniform coat color. Generally grey pelt including the back of the hind legs. Belly fur greyish white with some black spots.	Reddish brown pelt with distinctive dark brown fur along the back of the hind legs. Belly fur white with distinct black spots.	
TAIL COLOR	Generally matches body color except the entire tip (about the last 1") is black	Usually has dark bars and the tip of the tail is black on upper side but is white on underside	
FEET	Large and snowshoe-like feet and hind legs are longer than the front, giving a "stooped" appearance	Smaller feet (proportional to body) and hind legs are not as long as lynx	
TRACK SIZE	In dirt: up to 3 3/8" wide x 3 3/4" long	In dirt: up to 2 5/8" wide x 2 1/2" long	
	In snow: up to 5 1/2" wide x 5 1/2" long	In snow: up to 2 1/2" wide x 2 1/2" long	
	Stride: 11-18"	Stride: 6-14"	

LYNX TRACKS

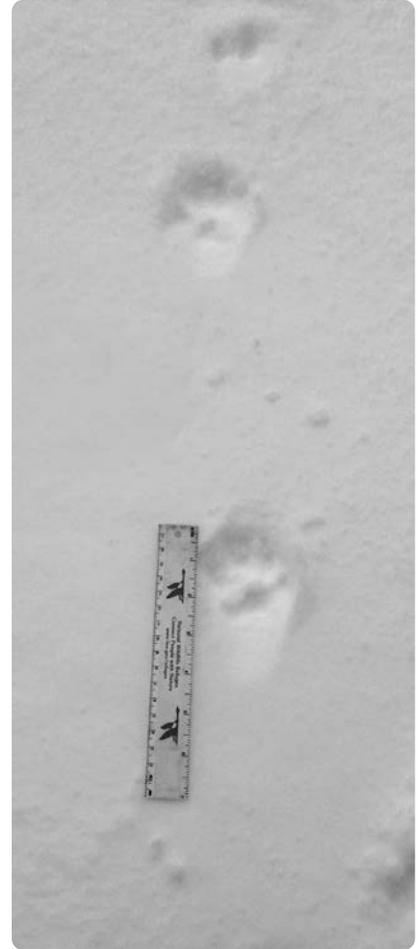


Set of lynx tracks in snow. Photo by MDIFW



Set of lynx tracks in crusty snow.
Photo by Chuck Hulsey.

BOBCAT TRACKS



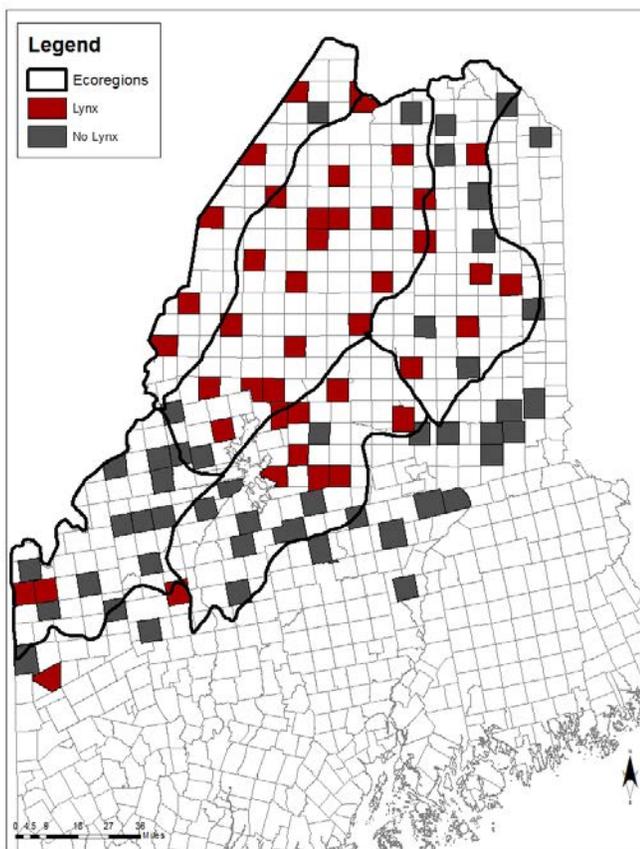
Set of bobcat tracks in crusty snow.
Photo by MDIFW

Lynx Management in Maine

Despite their recent population growth, lynx remain a federally-threatened species and a state species of special concern. MDIFW’s management efforts include:

- Monitoring lynx status, distribution, and habitat conditions
- Maintaining closed hunting and trapping seasons
- Enforcing laws to reduce illegal activities
- Implementing measures to minimize accidental take of lynx while trapping other species
- Sharing information with private land managers so they can continue to provide lynx habitat

FIGURE 4. LYNX SURVEYS COMPLETED DURING THE WINTERS OF 2003-2008 SHOW LYNX ARE FOUND PRIMARILY IN NORTHERN MAINE.



MAINE’S FIRST LYNX SNOW TRACKING STUDY

MDIFW began collecting baseline information on the status of lynx in the 1990s by conducting winter snow track surveys along the Maine/Quebec border. During the next decade, in an effort to document the distribution of lynx in the state, we expanded this effort to most of northern and western Maine. Between 2003 and 2008, MDIFW biologists surveyed 89 northern Maine towns and found lynx in 41 (46%) of them (**Figure 4**).

MAINE’S FIRST LYNX TELEMETRY STUDY

In 1999, we initiated a 12-year telemetry study in a four-township area near northern Maine’s Allagash Wilderness Waterway. This study, which involved capturing 191 lynx and fitting 85 of them with either GPS or VHF collars for monitoring, was instrumental in documenting the status of Maine’s growing lynx population and providing habitat recommendations to private forest landowners.

Through the study, biologists were able to identify lynx habitats and determine the size of the areas lynx were using. We found that lynx were spending most of their time in regenerating spruce/fir clearcuts with some of Maine’s highest snowshoe hare densities, and that a male would typically share an area with two to three females, who would each produce one to five kittens per year. When snowshoe hare were the most abundant, the normal range became four to five kittens.

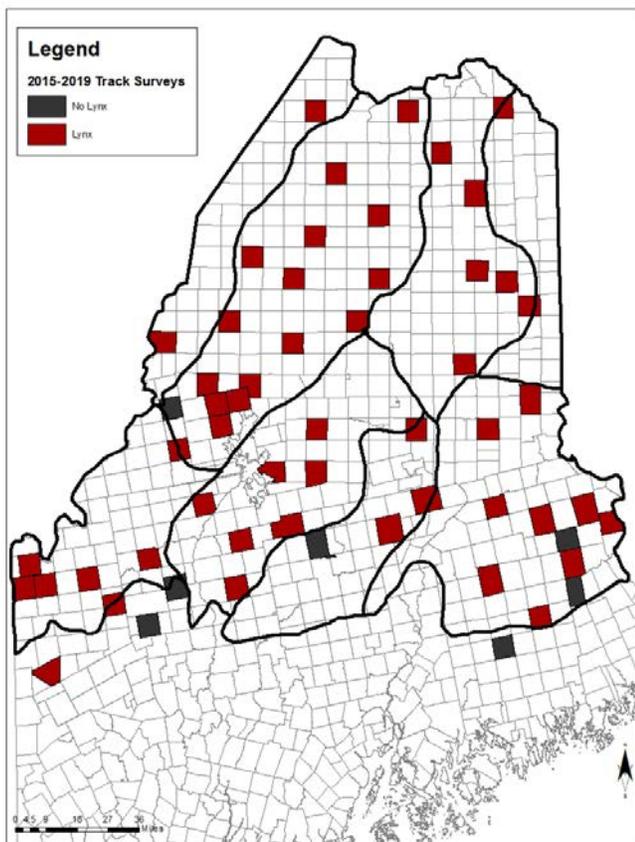
In 2012, the Department combined this data with the lynx densities and proportion of occupied areas (as determined by snow-track surveys) to develop a [*species assessment and the first data-driven statewide lynx population estimate.*](#)

SNOW TRACKING 2.0

In the winter of 2015, with an increase in reliable observations of lynx and kittens in eastern and western Maine, Department biologists began updating lynx population estimates. We started by systematically resurveying towns in northern, western, and eastern Maine, searching for lynx tracks in the snow. These surveys were concluded in 2019.

Results from this recent effort show that lynx now occupy a greater percentage of the available habitat in Maine. We surveyed 58 towns and found lynx in 51 (88%) of them (Figure 5). Of the 58 towns surveyed, 46 had been previously surveyed (see Figure 4), with a previous occupancy rate of 46%. This time, biologists found lynx in 42 the 46 towns, for a new occupancy rate of 91%.

FIGURE 5. LYNX SURVEYS COMPLETED DURING THE WINTERS OF 2015-2019 SHOW LYNX EXPANDING THEIR DISTRIBUTION IN MAINE



TELEMETRY 2.0

In the fall of 2015, biologists launched a second telemetry study, through which they have captured 26 lynx (17 males, nine females) to date, primarily along the southern

edge of Maine’s lynx range, and equipped them with GPS collars. These collars allow biologists to identify the habitats lynx are using across Maine and compare them both to each other and to previous telemetry studies. They also allow biologists to locate lynx denning sites and estimate how many young are born each year.

Although three of the 26 collars failed to send sufficient locational information, data from 23 GPS collars indicated that these areas support resident lynx with established home ranges. They also allowed us to document some long-range movement by a subadult dispersing female lynx who traveled east, crossing I-95 and venturing as far as Fredericton, New Brunswick before returning to establish a home range in eastern Maine.

Thus far, we have monitored five of the nine female lynx during the denning period, and we know that two produced litters of two kittens each. We plan to put the last three GPS collars on lynx this fall. With the habitat and productivity data we collect, we should be able to determine which forest conditions continue to support lynx; with survey and telemetry data, we’ll be able to update our statewide population estimate. This information will be made available to the US Fish and Wildlife Service (USFWS), forest managers, and the general public.

In addition to snow tracking and telemetry studies, MDIFW biologists also track credible lynx sightings (Figure 3) and document take of lynx by way of road mortality, accidental trapping, etc.

THE FUTURE

In 2000, USFWS listed lynx as a threatened species in 14 northern states including Maine due to inadequate protection of the species on federal lands. In 2018, USFWS reviewed the status of lynx. Since the initial threat had been addressed with forest planning, and since lynx populations were more abundant in at least three of the six geographic units (including Maine), they recommended removing federal protection under the US Endangered Species Act. Before lynx can be delisted, USFWS must open their proposal to public comments. And if federal protection is lifted, at least five years of monitoring lynx and/or lynx habitat will still be required to ensure that the species is not at risk.

This work is supported by the federal Pittman-Robertson program.

BATS

Shevenell Webb

Bats are incredible creatures with super hero qualities — they are the only mammals that can fly, and they hunt their prey using echolocation. They also benefit the ecosystem by consuming a tremendous number of insects each night. Eight bat species live in Maine, falling into two categories: tree bats and cave bats.

Silver-haired, Eastern Red, and Hoary bats (often referred to as tree bats) are species of special concern. They typically roost in tree foliage, are solitary, and do not hibernate in Maine. Like many bird species, tree bats fly south for the winter.

Little Brown (state endangered), Eastern Small-footed (state threatened), Northern Long-eared (state endangered, federally threatened), Big Brown (special concern), and Tri-colored bats (special concern) are considered the cave bats. They roost in tree cracks and cavities, tend to live in groups, and hibernate in caves during the long winter season (October-April). Little Brown and Big Brown bats are also commonly called house bats, because of their affinity to roost in old barns and attics.

The cave bats are affected by white-nose syndrome (WNS), a deadly fungal disease first documented in the U.S. in 2006 and named after the distinct white noses found on infected bats. The fungus grows in dark, moist, cool environments where bats like to hibernate, and spores can be easily moved from one cave to another by people and bats. Bats with the disease tend to wake up more often during hibernation, which causes them to burn through precious energy reserves and starve to death. Bats with WNS can do strange things, like flying around outside during the day in winter. Little Brown bats used to fill our night skies; but



since WNS spread to Maine in 2011, their population has declined by approximately 95%. As of 2020, WNS has been confirmed in over 35 states and 7 Canadian provinces. Researchers are studying this novel disease to better understand why some individuals or species are more susceptible than others and determine effective treatment options, but there is a lot left to learn.

In the meantime, our Department is continuing to expand our understanding of bat communities in the state. This includes developing long-term monitoring programs, addressing specific research needs, and promoting bat outreach and conservation.

MONITORING

Our Department has attempted several different types of surveys to better understand Maine's bat population status and trends. Bats are notoriously difficult to study — they are active at night, they are challenging to catch, and it takes a lot of effort to find bats these days. Luckily, we have specialized acoustic detectors that record high frequency bat calls, as well as software that, paired with a keen eye, can help us interpret the calls and determine which species they came from.



During the summers of 2017 and 2018, staff conducted driving transect surveys with detectors to develop baseline bat abundance indices. Unfortunately, the driving surveys were biased towards the louder, larger, and more common bat species, and the number of bats we detected per mile was low.

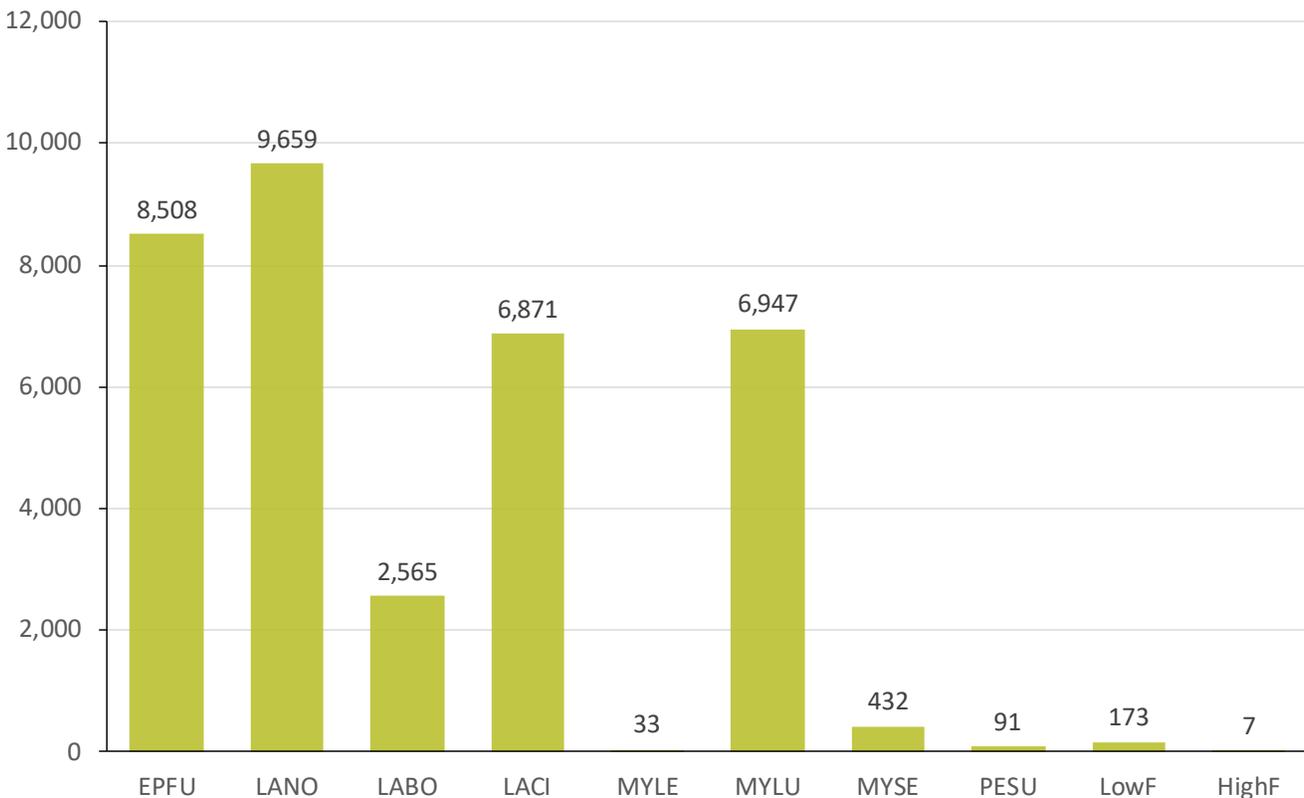
During the summer of 2019, we conducted our first comprehensive stationary acoustic survey to gather bat species occupancy data across a broad area of Maine. We surveyed 57 sites in 13 counties, and recorded over 100,000 call files during 741 detector nights. The survey results confirmed widespread statewide distribution of the more common bat species including Big Brown, Silver-haired, Eastern Red, and Hoary bats. Species of the Myotis guild (Little Brown, Eastern Small-footed, and Northern long-eared bats) and Tri-colored bats were recorded less frequently,

which may be partially explained by the habitats sampled, as well as by steep population declines from white-nose syndrome (Figure 1).

During the summer of 2020, staff conducted stationary surveys at approximately 160 sites across diverse habitat types to target all eight species that occur in Maine. Call analysis is ongoing, and we will use the results to refine our sampling protocol for summer 2021. The 2019 and 2020 survey seasons were important steps toward developing a long-term bat acoustic monitoring program and building a dataset capable of detecting multi-bat species trends throughout the state. In the long term, the data we collect will inform bat species management objectives, help reduce development-related risks to bat populations through environmental permit review, and provide baseline data to monitor recovery of species affected by white-nose syndrome.

FIGURE 1. FREQUENCY OF BAT SPECIES CALLS DETECTED DURING THE 2019 SUMMER SURVEYS ON WILDLIFE MANAGEMENT AREAS OR OTHER CONSERVED LANDS IN MAINE.

Species include EPFU = Big Brown, LANO = Silver-haired, LABO = Eastern Red, LACI = Hoary, MYLE = Eastern Small-footed, MYLU = Little Brown, MYSE = Northern Long-eared, PESU = Tri-colored, LowF = unknown low frequency bat, and HighF = unknown high frequency bat.





Stationary bat survey conducted in western Maine in July 2019. Photo by S. Boyden, MDIFW.

NON-TRADITIONAL HIBERNACULA STUDY

It's well known that some bats use caves and abandoned mines for hibernation. However, these are not the only places bats like to hibernate. Research in Acadia National Park (ACAD) indicates some species of *Myotis* bats may also hibernate throughout the winter in between the rocks in talus slopes and cliff faces. Since Maine has few traditional hibernacula, gaining a better understanding of our non-traditional alternatives will help Maine biologists conserve these bat species.

To that end, researchers at MDIFW, ACAD, and University of Maine recently partnered on a research project to document whether bats are over-wintering on talus slopes in coastal and inland areas.

The talus project's primary objectives were to:

- 1) Identify which bat species use talus hibernacula and to what extent
- 2) Identify what factors influence occupancy of hibernating bats on talus slopes
- 3) Investigate fungal loads of *Pseudogymnoascus destructans*, the causative agent of white-nose syndrome, to determine if loads differ between talus and cave/mine hibernacula

Over the course of three winters (2017/18, 2018/19, and 2019/20), we used acoustic detectors to record high-frequency bat calls in western, central, and coastal Maine.

During the non-active season of 2017/18 (November-March), we documented bat presence on at least one night in 24 of the 28 locations we monitored. We documented *Myotis* 40 (a guild of three *Myotis* species of bats: Northern Long-eared, Little Brown, and Eastern Small-footed bats) at 22 of the 28 sites. During the core winter period, (December-February), we documented *Myotis* at 15 sites.

During the winter 2018/19, we continued monitoring 30 talus slopes and added a second detector on talus slopes where we found bat activity the previous winter. We also monitored six control sites located at least one mile from any talus feature to evaluate whether talus activity differed from broad-scale winter bat activity. Preliminary results indicate that bat activity over talus was lower during winter 2018/19, compared to the previous winter. From auto-classified acoustic vetting, we documented *Myotis* activity at 13 of the 30 sites during the core winter period. However, at least 12 of the 15 sites that we sampled during winter 2017/18 and 2018/19 had *Myotis* activity during both core winter periods. We did not detect any winter bat activity at the control sites based on auto classification. We will be manually vetting and further analyzing all data through occupancy modelling to determine what covariates are associated with *Myotis* activity.



University of Maine graduate student Chris Heilakka conducts winter bat surveys over talus slopes in southwestern Maine. Photo by S. Webb, MDIFW.



Rogue Detection Teams locate bat scent in the rocks in southwestern Maine. Jack the dog is rewarded with his favorite chew toy for finding a bat point in the rocks.

Outreach

There are a lot of misconceptions about bats. Contrary to popular belief, bats do not get caught in people’s hair, and they are not blind.

EDUBAT

EduBat is a project to educate the public on the ecological and economic importance of bats, as well as the threat of white-nose syndrome. The EduBat website (batslive.pwnet.org/edubat) offers educational activities for all ages, including fun bat-related activities, interactive projects, and lesson plans that reinforce other common core classroom standards, from science to English to art.

Plus, every state has assembled its own EduBat Bat Trunk, which teachers are welcome to borrow. Contact us at 207-941-4466 to borrow the Maine Bat Trunk, and have fun exploring how you compare to a bat in size, what habitats bats use, how Maine biologists collect data, and more!

HOW TO HELP BATS

Sometimes bats accidentally get into people’s houses, but most of the time they’d rather be in their own! Here are some ways you can help promote natural homes for bats, and keep them safely out of yours.

Give them a habitat – If you have a dead tree on your property, consider leaving it there. Dead trees/ snags promote biodiversity and make wonderful homes for bats, who like to roost in the cavities and narrow spaces in between the bark and wood.

Build them a house – No dead tree? No problem. You can build a bat house by following the [guidelines from Bat Conservation International](#).

Keep them outdoors – Learn more about [how to bat-proof your home](#).

Give them a (touch-free) lift – If you find a bat in your

home, simply put a box over it after it lands. Then slowly slide a piece of cardboard or large envelope between the box and the surface so the bat goes into the box. Some bats may have a hard time flying from the ground, so place the box outside off the ground if you can (such as on a deck).

Call in help – If the bat appears sick and isn’t able to fly, [contact a bat rehabilitator](#).

Remove with care – If you have a colony of bats living in your attic and want to remove them, we recommend you avoid excluding the bats during the maternity season (summer), when pups are nursing and cannot fly.



A third grader compares herself to bats during Bat Week, the last week in October. Photo by S. Webb, MDIFW.

Do some citizen science – If you have a colony of bats in your old barn, attic, or bat house, you can report your observations [here on our website](#).

Keep your distance – Another simple way to protect bats (and yourself) is to avoid handling them. Some bats carry rabies, which is fatal to humans and pets if not treated.

Get a test – If a bat is found in a room with an intoxicated, handicapped, or sleeping person, a child, or if you’ve had contact with a bat, the bat will need to be captured and tested for rabies. For rabies consultation, contact the Maine CDC (1-800-821-5821).

SMALL MAMMALS

Shevenell Webb

Northern Bog Lemmings

The northern bog lemming (NBL), a state-threatened species, is Maine's most elusive mammal. It is more abundant in the core of its range in the tundra and alpine habitats in Canada and Alaska. The NBL reaches the southern edge of its range in Maine, where it has typically been found in forests at higher elevations (2,000 ft or higher) and in association with thick mats of sphagnum moss. NBL have only been found at five locations in the state, with Baxter State Park being a stronghold for the species.

Studying this species presents some unique challenges, starting with identification. To differentiate it from the much more numerous southern bog lemming, biologists have traditionally needed to capture and euthanize the animal and examine its teeth. But because the NBL is so rare, and because conventional methods used to capture small rodents (e.g., box traps, pitfalls, and snap traps) do not work well for it, we have had to think outside the box to better understand this species' range and habitat preferences.

The Department has partnered with Dr. Zach Olson at the University of New England to develop a northern bog lemming survey technique that uses DNA samples collected from the environment. One readily available source for such DNA samples is feces.

When feces pass through an animal's digestive tract, its intestinal wall sheds small amounts of cellular material. By picking up the feces and isolating the cellular material, scientists can identify what species of animal the sample came from.

In 2015, Dr. Olson successfully developed a technique to differentiate NBL from other rodents based on their genetic code. In 2016, fecal pellets were collected from three known NBL locations to test how well the technique performed in the field. Initial results were promising; NBL positive samples were identified at two of the three locations. But while this technique worked, it was time consuming to search and collect enough samples.

As a follow-up to the 2016 test, our next step is to investigate the feasibility of an environmental DNA (eDNA) technique. DNA is in every component of an animal's body; so when materials like tissue, hair, shed skin, etc., sluff off, that animal's DNA gets carried into the area's aquatic systems. With the eDNA approach, we would collect water samples downstream from a habitat where we suspect NBL are living, and extract DNA from the water.

With this technique, scientists can detect species just by sampling the water within the environment they inhabit. If Dr. Olson's lab can successfully develop an eDNA approach to sample NBL, it would enable the Department to sample large swaths of the state. Research to develop an efficient northern bog lemming survey method was delayed in 2020 due to the covid pandemic, but remains a high priority.



Northern Bog Lemmings are found at a handful of locations in Maine in forests associated with thick mats of sphagnum moss like this site in Baxter State Park. Photo by A. Bessenaire.

New England Cottontail

Cory Stearns

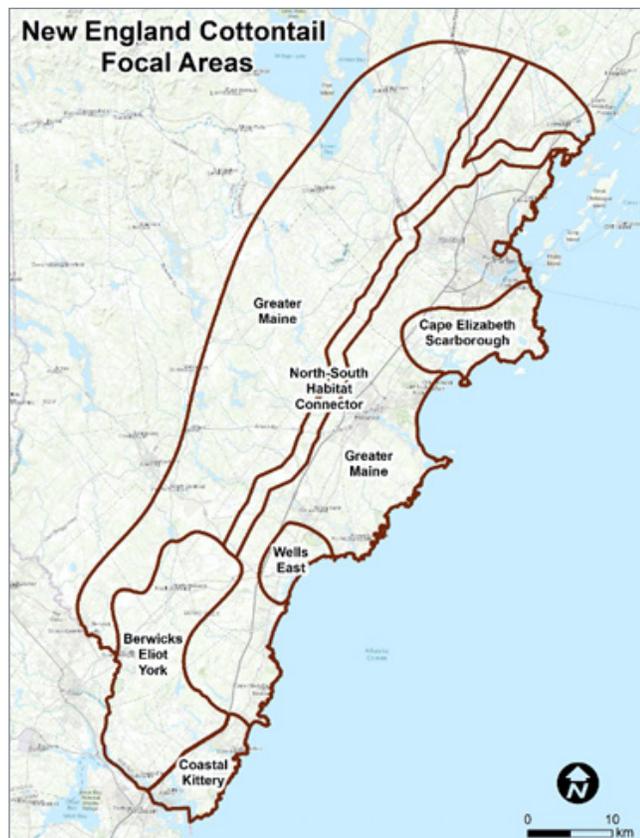
About the Rabbit

The New England cottontail (NEC; *Sylvilagus transitionalis*), or cooney, was once a common rabbit in Maine with a range from Kittery to Belfast. However, NEC populations declined markedly as old fields from abandoned farms reverted into mature forests and brushy habitats became residential developments.

In 2004, MDIFW closed the hunting season on NEC; and in 2007, we listed the species as endangered. By 2008, there were no known NEC populations north of Portland. Today, there are only about 300 individuals in the state, and they are only known to live in six towns: Cape Elizabeth, Scarborough, Wells, York, Kittery, and Eliot.

FIGURE 9. MAINE'S FIVE FOCUS AREAS FOR NEW ENGLAND COTTONTAIL (NEC) RESTORATION.

There are currently no known NEC populations in the Greater Maine focus area, so it has a lower priority for management than the others. The North-South Habitat Connector is not a focus area, but denotes a power utility right-of-way that NEC may use as a travel corridor.



THE NEW CHALLENGE

Formerly, the four biggest challenges to NEC recovery in Maine were:

- 1) Little remaining shrubland habitat
- 2) Small population sizes
- 3) Low genetic diversity resulting from isolated NEC populations and low rabbit numbers
- 4) The social and biological limitations associated with restoring shrubby habitat

Unfortunately, a new threat has emerged to the restoration of NEC populations in Maine: the eastern cottontail rabbit (*Sylvilagus floridanus*). Until recently, Maine was the only state in the northeast that did not have eastern cottontail rabbits. Eastern cottontails are very similar in appearance to NECs, but they are not native to New England. Around 1899, state wildlife agencies and hunting clubs introduced tens of thousands of eastern cottontails into states south of Maine.

The introduction of non-native animals or plants often threatens native wildlife populations. In this case, the introduced eastern cottontail rabbit can utilize a wider variety of habitats than the NEC can, and has higher survival and reproductive rates. Eventually, when the two species occur together, eastern cottontails can displace NEC. Rhode Island, for example, has lost most of its NEC population and now primarily has eastern cottontails.

In 2017, wildlife biologists verified an eastern cottontail population in Maine for the first time. They were found on Badgers Island (Kittery) and in one mainland Kittery location, and likely dispersed across the river from Portsmouth, New Hampshire, which has a large eastern cottontail population. Since then, more eastern cottontail individuals have been confirmed. Some were accidentally transported into the state potted plants and other landscaping materials, and others were brought here by well-meaning people that rescued orphaned young in other states. And unfortunately, in 2019, two New England cottontail x eastern cottontail hybrids were found in the heart of our Cape Elizabeth NEC population. There is no indication of how the hybrids or their parent eastern cottontail arrived there; but luckily, no full-blooded eastern cottontails have been detected despite extensive surveying.



Because they outcompete and replace NEC, eastern cottontails have the potential to devastate our native New England cottontails. So, MDIFW will continue our vigilant efforts to prevent their establishment and will conduct trap and removal operations if we detect any populations.

Monitoring Efforts

RANGE-WIDE OCCUPANCY STUDY

MDIFW continues to monitor NEC populations each winter. One aspect of this is our participation in a range-wide study to determine trends in the number of NEC-occupied habitat patches in Maine, New Hampshire, Massachusetts, Rhode Island, New York, and Connecticut.

To conduct this study, biologists search brushy habitat patches for fecal pellets. We send the pellets to laboratories at the University of New Hampshire and University of Rhode Island, who use DNA analysis to tell us whether the pellets we collected came from a NEC, eastern cottontail, or snowshoe hare.

This data, when combined with that of other states, gives biologists an overall range-wide picture of NEC population trends, helps wildlife managers understand whether current NEC populations are expanding or contracting geographically, tells us whether population restoration measures have been effective, and guides future management efforts.



INVESTIGATING NEW SIGHTINGS

In addition to the occupancy surveys, MDIFW surveys sites in Maine where biologists receive reports of rabbit sightings, or suspect NEC might occur. This includes historically-occupied areas with few recent surveys. Currently, there are only 27 NEC-occupied patches in Maine.

ABUNDANCE SURVEYS AT MANAGEMENT SITES

Finally, the Department conducts abundance surveys at specific NEC management sites in an effort to closely track the number of rabbits at a site and/or determine whether certain habitat restoration efforts have been effective.

Like the range-wide occupancy study, abundance surveys involve the collection of pellets; but in this case, the volume we need to collect is much higher. For these surveys, biologists walk through extremely thick brush and collect up to 100 pellets from each habitat patch. We send these pellets to the University of New Hampshire, where they use DNA analysis to identify the individual rabbit that deposited each pellet.

HABITAT RESTORATION EFFORTS

MDIFW receives tremendous help conducting habitat restoration and NEC recovery projects from our partners in the U.S. Fish and Wildlife Service, Natural Resources Conservation Service (NRCS), the Wildlife Management Institute, and Wells National Estuarine Reserve. Most of the NEC habitat restoration work in Maine occurs on private lands, so a special thanks also goes out to the many landowners who have participated in NEC conservation efforts.

Approximately 600 acres on over 55 public and privately owned sites are being, or have been, actively managed for NEC. These acres include existing habitat that is being actively maintained or enhanced, newly created habitat, and completed management.

Our habitat restoration efforts are led by Maine's NEC Restoration Coordinator Jeff Tash, who is based at Rachel Carson National Wildlife Refuge. Among other duties, Jeff actively recruits and works with private landowners to manage their lands for cottontails and other wildlife species dependent on young forest. If you're a landowner within the NEC focal areas, and you are interested in conducting habitat management for New England cottontails, contact Jeff at Jeffrey_tash@fws.gov or 207-646-9226.

THE NEW RESTORATION OPTION

In 2011, the New England cottontail captive breeding program was started when Roger Williams Park Zoo in Providence, Rhode Island began breeding NEC, with young produced in the Zoo being released in the wild. The program has since grown by adding Queens Zoo in Queens, New York, and a captive breeding pen at Great Bay National Wildlife Refuge in Newington, New Hampshire. The first rabbits produced in captivity were released on Patience Island, Rhode Island. A NEC population was established on the island and has grown to the point that the island itself is now used as part of the breeding program, with rabbits trapped annually for release on the mainland.

Rabbits born in the captive breeding program have been released in Rhode Island, New Hampshire, and Maine. In fall 2017, we released 20 New England cottontails at the Wells National Estuarine Research Reserve. We selected the Reserve for this initial release because it was one of our first partners for habitat management, the site contains a large amount of habitat, and a native NEC population occurred there until recently. In fall 2018, we released 22 more NEC at the Wells Reserve, as well as five in Cape Elizabeth to improve genetic diversity of the population there. In 2019, we released 18 more at Wells Reserve. While in captivity, each rabbit is equipped with a numbered ear tag for identification. In summer 2019, we obtained photos of rabbits that appeared to lack ear tags, suggesting that released rabbits are reproducing. We will be conducting abundance surveys at the Reserve in February 2020 to confirm reproduction and obtain a population estimate for the site.

This work is supported by the federal Pittman-Robertson and State Wildlife Grants programs, Natural Resources Conservation Service, USFWS Partners' Program, Rachel Carson National Wildlife Refuge, Wells National Estuarine Research Reserve, the National Fish and Wildlife Foundation, Wildlife Management Institute, state revenues from sales of hunting and trapping licenses, and many private landowners.