



2019-20
RESEARCH &
MANAGEMENT
REPORT

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ALL IN FOR THE MAINE OUTDOORS

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.

**COMPILED AND EDITED
BY DIANA HARPER**

**MAINE DEPARTMENT OF INLAND
FISHERIES & WILDLIFE**

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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.



2019-20

RESEARCH & MANAGEMENT REPORT

This is a compilation of all Research & Management Reports for the Maine Department of Inland Fisheries & Wildlife for 2019-20. Each report can be downloaded individually at mefishwildlife.com/wildlifereport.

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ALL IN FOR THE MAINE OUTDOORS

Looking back on 2019, when we compiled much of the data in this report, feels like looking back a decade or more. In general, as a society, the changes we experienced starting in early 2020 were disruptive, challenging, and unprecedented.

Maine's residents were asked to reduce the spread of COVID-19 by avoiding gatherings and staying home from work and school. Restaurants closed, gyms hit pause, and organized sports were canceled. But through it all, one thing remained open and unchanged: the Maine outdoors.

It's times like these that remind us how important well-managed, accessible land is – and how fortunate we are to have it here in Maine. During the summer of 2020, the outdoors was a refuge, with the time-tested recipe of fresh air and physical activity delivering much-needed mental serenity. Participation in outdoor recreation soared, reminding us of the importance of nature, and giving us an outlet...or many.

Maintaining six feet of distance was easy for those who chose to hunt in the vast Maine woods, explore a new Wildlife Management Area, fish the inland waters, or collect data for the Maine Bird Atlas citizen science project. We saw a slight increase in fishing licenses, a 6.8% increase in resident hunting licenses, and increased use of Wildlife Management Areas for hiking, paddling, hunting, trapping, and more.

Despite everything else, the unique circumstances of 2020 served to strengthen the ties between Maine people, Maine wildlife, and the habitats we share, bringing new resonance to our tagline, All in for the Maine Outdoors.

Recognizing the demand for outdoor options, and knowing the value of connection with nature, our Department went all in as well. Among many other adjustments, we started by opening the spring turkey hunting season two days early and temporarily waiving tagging requirements. We also built and launched a virtual version of our in-depth hunter education course, which proved a resounding success (while MDIFW's in-person courses educates and certifies 6,000 new hunters per year, our virtual version certified 6,000 in just a quarter of the time). And our biologists went to work finding covid-safe ways to conduct the types of research referenced in this report.

And while I do look forward to a return to normalcy in almost every area of everyday life, I also see a silver lining in new habits built, new interests found, and new innovations made. I hope they last for years to come. Because the more time people spend enjoying our natural resources, the more value our society will place on its enhancement, protection, and preservation.

In future years' reports, I hope to say that we've seen even more citizen scientists out there, more interest in conservation, more partnerships between diverse stakeholders, and as a result, more healthy wildlife populations and habitats. In the meantime, I hope you enjoy learning about our division's work in 2019 and early 2020 – a snapshot in time that may have upended our everyday lives, but couldn't touch our dedication to Maine's wildlife species and the habitats we all call home.

Sincerely,

Judy Camuso
Commissioner, MDIFW



DEDICATED TO CHARLIE TODD, WITH OUR APPRECIATION

This report is dedicated to Endangered and Threatened Species Biologist, Charlie Todd, who retired in September 2020 after more than 34 years with the Maine Department of Inland Fisheries & Wildlife.

Charlie dedicated his professional career to protecting and restoring Maine's most imperiled wildlife species through a combination of hands-on field management and State House policy engagement. His soft-spoken, patient, and thoughtful approach to addressing complex wildlife issues inspired respect and collaboration from a wide range of agency colleagues and conservation partners, many of whom are committed to carrying on his legacy.

Charlie's conservation career began in 1976 when, through his graduate program at the University of Maine, he worked closely with MDIFW on studies of bald eagle ecology — investigating their diets, measuring contaminant levels, and helping the Department conduct aerial surveys of nest sites.

After earning his Master of Science in Wildlife Ecology in 1979, Charlie continued working with bald eagles as a UMaine Research Associate and MDIFW contractor; and 1986, he officially joined MDIFW as our Raptor Specialist. Over the next 30 years, Charlie spearheaded the Department's bald eagle restoration, recovery, and conservation efforts. He spent countless hours, often on his own time, surveying and monitoring nests, locating new eagle territories, tending to injured or orphaned eaglets, providing eaglets to other states for re-introduction, and supervising the banding of 847 Maine bald eagles.

Charlie's rare ability to resolve conflicts and foster collaboration between landowners, conservation agencies, municipalities, industries, and other stakeholders was paramount to the recovery and 2009 removal of the bald eagle from Maine's Endangered Species List. Under his leadership, Maine's bald eagle population soared from just 90 nesting pairs in 1987 to 734 in 2018.

But bald eagles were far from the only species to benefit from his work. Charlie also led the state's re-introduction and restoration of the peregrine falcon, a species that was extirpated from Maine in 1962. From 1984 to 1997, he coordinated the captive rearing and release of over 150 nestlings at eight different sites across the state. In 1987, Maine saw its first nesting pair of peregrine falcons in 25 years. Today, at least 37 nesting pairs have been documented across the state.

In 2012, Charlie was promoted to MDIFW's Endangered and Threatened Species Coordinator. In this role, he was able to apply his experience to even more imperiled wildlife species, working with teams of biologists to conserve species as diverse as the Canada lynx, piping plovers, little brown bat, New England cottontail, and grasshopper sparrow.

Throughout his career, Charlie's dedication and outstanding contributions to the conservation of Maine's endangered and non-game wildlife have duly earned him recognition by both his peers and conservation partners. He has been the recipient of several esteemed awards, including the U.S. Fish & Wildlife Service Recovery Champion award and The Maine Audubon Society Conservationist of the Year (both in 2009) and the Maine Chapter of The Wildlife Society's Award of Professional Achievement in 2017. As Charlie closed his chapter as a MDIFW biologist in 2020, it was not without one final recognition of the vital role he has played over the last four decades. The Northeast Wildlife Administrators Association presented Charlie with the 2020 William T. Hesselton Award to recognize his "initiative and significant contributions that furthered the ideals of the Federal Aid in Wildlife Restoration Program" over the course of his career. Charlie's humble expertise and devotion to wildlife as well as the partnerships, working relationships and friendships he built, will not be forgotten.

Thank you, Charlie, for your dedicated service to the people and wildlife of Maine!



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- » Habitat Conservation & Management
- » Non-Game Mammals Conservation & Management
- » Beginning with Habitat Updates
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Compiled and edited by Diana Harper and Lauren McPherson

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ENDANGERED AND THREATENED SPECIES CONSERVATION IN MAINE

Charlie Todd, Shevenell Webb, Phillip deMaynadier, and Brad Allen

A Mandate to Conserve Wildlife Diversity in Maine

The 107th State Legislature enacted Maine's Endangered Species Act (MESA) in 1975. Its primary directive reads:

"The Legislature finds that various species of fish or wildlife have been and are in danger of being rendered extinct within the State of Maine, and that these species are of esthetic, ecological, educational, historical, recreational and scientific value to the people of the State. The Legislature, therefore, declares that it is the policy of the State to conserve, by according such protection as is necessary to maintain and enhance their numbers, all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend" (Title 12, Maine Revised Statutes § 12801).

The Legal Framework Behind Listing Species Under Maine's Endangered Species Act

In Maine, state-listing of any animal species as Endangered or Threatened (E/T) requires that the Legislature review and adopt changes proposed by the responsible agency. The Maine Department of Inland Fisheries and Wildlife (MDIFW) holds that authority for all terrestrial animals, all birds (regardless of habitat), and all fauna that inhabit freshwater systems. The Maine Department of Marine Resources has jurisdiction for animals (except birds) that occur in tidal waters. Maine's Natural Areas Program in the Department of Agriculture, Conservation, and Forestry maintains the State list of E/T plants.

MDIFW biologists and administrators review potential changes to the E/T list internally, then open them up to further scrutiny from peer scientists. Next, we present proposals, first to the MDIFW Advisory Council, then at legally mandated public hearings. A formal 30-day comment period follows, in compliance with Maine's Administrative Procedures Act. Finally, we present our

recommendations as a bill to the Maine Legislature's Joint Standing Committee on Inland Fisheries and Wildlife. When the bill goes in front of the committee, the public has yet another opportunity to provide input.

Maine's state E/T listing process is quite different from other states. Whereas we adopt changes in statute via the legislature in response to agency recommendations, other states typically do this by agency rulemaking alone. This extra legislative oversight has perhaps averted legal petitions and court challenges that sometimes confound endangered species conservation.

To designate fauna as E/T, MDIFW biologists review the best available information on the distribution and status of populations and habitats combined with objective listing criteria to judge species vulnerability. These criteria include low population abundance, dramatic declines, limited distribution or loss of range, significant fragmentation of populations or habitat, endemism, E/T status under the U.S. Endangered Species Act, and regional conservation status in the Northeast. Threats are secondary considerations, and do not trigger listing unless they present additional hazards to already-vulnerable species.

The MDIFW thresholds for listing Maine species rely mostly on combinations of risks. These listing guidelines (see <https://www.maine.gov/ifw/docs/listingHandbook.pdf>) have successfully guided MDIFW and the Legislature's state-listing decisions since 1996. The last time the state E/T list changed was 2015, and the next update is due by 2023.

This scorecard shows the current status of 52 species listed by MDIFW since MESA was enacted in 1975, and whether each species has experienced improvements, setbacks, or no significant change in the following three categories:

- **Population** (based on indices of abundance, number of occupied sites, or trends)
- **Research and monitoring** that contributes to species conservation
- **Habitat security** (from conservation status, land management, or stewardship programs)


































































FIGURE 1. A SCORECARD FOR SPECIES LISTED BY MDIFW UNDER MAINE ESA, 1975 - 2020

-  SIGNIFICANT IMPROVEMENTS
-  NO SIGNIFICANT CHANGES
-  SETBACKS OR NEW LIMITATIONS



BIRDS (CLASS AVES)




SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
American Pipit (<i>Anthus rubescens</i>)	ENDANGERED (SINCE 1997)			
Arctic Tern (<i>Sterna paradisaea</i>)	THREATENED (SINCE 1997)			
Atlantic Puffin (<i>Fratercula arctica</i>)	THREATENED (SINCE 1997)			
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	DELISTED (SINCE 2009)			
Barrow's Goldeneye (<i>Bucephala islandica</i>)	THREATENED (SINCE 2007)			
Black-crowned Night Heron (<i>Nycticorax nycticorax</i>)	ENDANGERED (SINCE 2015)			
Black Tern (<i>Chlidonias niger</i>)	ENDANGERED (SINCE 1997)			
Common Gallinule (<i>Gallinula galeata</i>)	THREATENED (SINCE 2007)			
Golden Eagle (<i>Aquila chrysaetos</i>)	ENDANGERED (SINCE 1987)			
Grasshopper Sparrow (<i>Ammodramus savannarum</i>)	ENDANGERED (SINCE 1987)			
Great Cormorant (<i>Phalacrocorax carbo</i>)	THREATENED (SINCE 2007)			
Harlequin Duck (<i>Histrionicus histrionicus</i>)	THREATENED (SINCE 1997)			
Least Bittern (<i>Ixobrychus exilis</i>)	ENDANGERED (SINCE 2007)			
Least Tern (<i>Sternula antillarum</i>)	ENDANGERED (SINCE 1984)			
Peregrine Falcon (<i>Falco peregrinus</i>)	ENDANGERED (SINCE 1975)			
Piping Plover (<i>Charadrius melodus</i>)	ENDANGERED (SINCE 1987)			
Razorbill (<i>Alca torda</i>)	THREATENED (SINCE 1997)			
Roseate Tern (<i>Sterna dougallii</i>)	ENDANGERED (SINCE 1997)			
Sedge Wren (<i>Cistothorus platensis</i>)	ENDANGERED (SINCE 1987)			
Short-eared Owl (<i>Asio flammeus</i>)	THREATENED (SINCE 2007)			
Upland Sandpiper (<i>Bartramia longicauda</i>)	THREATENED (SINCE 1997)			

FISH (CLASS ACTINOPTERYGII)



















































Redfin Pickerel (<i>Esox americanus americanus</i>)	ENDANGERED (SINCE 2007)			
Swamp Darter (<i>Etheostoma fusiforme</i>)	THREATENED (SINCE 1997)			



-  SIGNIFICANT IMPROVEMENTS
-  NO SIGNIFICANT CHANGES
-  SETBACKS OR NEW LIMITATIONS













INSECTS (CLASS INSECTA)



SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
Boreal Snaketail (<i>Ophiogomphus colubrinus</i>)	THREATENED (SINCE 2007)			
Clayton's Copper (<i>Lycaena dorcas claytoni</i>)	THREATENED (SINCE 2015)			
Cobblestone Tiger Beetle (<i>Cicindela marginipennis</i>)	ENDANGERED (SINCE 2015)			
Edwards' Hairstreak (<i>Satyrium edwardsii</i>)	ENDANGERED (SINCE 1997)			
Frigga Fritillary (<i>Boloria frigga</i>)	ENDANGERED (SINCE 2015)			
Hessel's Hairstreak (<i>Callophrys hesseli</i>)	ENDANGERED (SINCE 1997)			
Juniper Hairstreak (<i>Callophrys gryneus</i>)	ENDANGERED (SINCE 2007)			
Katahdin Arctic (<i>Oeneis polixenes katahdin</i>)	ENDANGERED (SINCE 1997)			
Pine Barrens Zanclognatha (<i>Zanclognatha martha</i>)	THREATENED (SINCE 1997)			
Purple Lesser Fritillary (<i>Boloria chariclea grandis</i>)	THREATENED (SINCE 2007)			
Rapids Clubtail (<i>Gomphus quadricolor</i>)	ENDANGERED (SINCE 2007)			
Ringed Boghaunter (<i>Williamsonia lintneri</i>)	THREATENED (SINCE 2007)			
Roaring Brook Mayfly (<i>Epeorus frisoni</i>)	THREATENED (SINCE 2015)			
Sleepy Duskywing (<i>Erynnis brizo</i>)	THREATENED (SINCE 2007)			
Tomah Mayfly (<i>Siphonisca aerodromia</i>)	THREATENED (SINCE 1997)			
Twilight Moth (<i>Lycia rachelae</i>)	THREATENED (SINCE 1997)			

MAMMALS (CLASS MAMMALIA)












Eastern Small-footed Bat (<i>Myotis leibii</i>)	THREATENED (SINCE 2015)			
Little Brown Bat (<i>Myotis lucifugus</i>)	ENDANGERED (SINCE 2015)			
New England Cottontail (<i>Sylvilagus transitionalis</i>)	ENDANGERED (SINCE 2007)			
Northern Bog Lemming (<i>Synaptomys borealis</i>)	THREATENED (SINCE 1987)			
Northern Long-eared Bat (<i>Myotis septentrionalis</i>)	ENDANGERED (SINCE 2015)			








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MOLLUSCS (CLASS BIVALVIA)

SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
Brook Floater (<i>Alasmidonta varicosa</i>)	THREATENED (SINCE 2007)			
Tidewater Mucket (<i>Leptodea ochracea</i>)	THREATENED (SINCE 1997)			
Yellow Lampmussel (<i>Lampsilis cariosa</i>)	THREATENED (SINCE 1997)			

REPTILES (CLASS REPTILIA)

Black Racer (<i>Coluber constrictor</i>)	ENDANGERED (SINCE 1987)			
Blanding's Turtle (<i>Emydoidea blandingii</i>)	ENDANGERED (SINCE 1997)			
Box Turtle (<i>Terrapene carolina</i>)	ENDANGERED (SINCE 1987)			
Spotted Turtle (<i>Clemmys guttata</i>)	THREATENED (SINCE 1987)			

SNAILS (CLASS GASTROPODA)

Six-whorled Vertigo (<i>Vertigo morsei</i>)	ENDANGERED (SINCE 2015)			
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MEET THE BIOLOGISTS WORKING WITH ENDANGERED & THREATENED SPECIES



Charlie Todd, *Endangered & Threatened Species Coordinator*
Retired September 2020

Charlie has been involved with endangered species conservation in Maine since 1976. After 9 years of research and recovery efforts on bald eagles at the University of Maine, he joined MDIFW in 1986 to continue eagle duties and spearhead similar work on peregrine falcons and golden eagles. In 2012, Charlie became the Department's Endangered / Threatened Species Coordinator: a position that supports the full array of staff working on Maine's most vulnerable wildlife, including the species specialist and group leaders below.



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 and fisher populations and a study to develop a new DNA survey technique for northern bog lemmings. She shares bat management responsibilities with Sarah Boyden, Assistant Regional Biologist in MDIFW's Strong Office.



Phillip deMaynadier, Ph.D., *Wildlife Biologist and Group Leader*

Phillip supervises reptile-amphibian-invertebrate Group activities and serves as one of the Department's lead biologists on issues related to reptile, amphibian, and invertebrate conservation and endangered and nongame policy. Some of his recent projects include: a) participation on the lead team for Maine's 2015 State Wildlife Action Plan, b) coordination of MDIFW's program for protecting high value vernal pools, c) coordination of state butterfly, dragonfly, amphibian, and reptile atlas efforts, and d) advising landowners on management practices for rare and endangered species. Phillip is also a Graduate Faculty member at the University of Maine's Department of Wildlife Ecology.



Brad Allen, *Wildlife Biologist and Bird Group Leader*

Brad oversees bird group activities and budgets and continues to investigate the lives and times of the common eider, focusing currently on a collaborative duckling survival study. Brad also coordinates Department interests in seabird research and management activities.

Endangered Species Conservation Strategies

There are no easy fixes or shortcuts for species on the brink of extirpation (disappearing from Maine). Reversing the fate of a species (recovery) almost always requires decades of attention. Management strategies need to not only address the initial factor(s) that led to species rarity, but they also need to adapt to new threats that arise once populations and/or habitats are compromised and vulnerable.

As an example, in the mid-1940s, persistent byproducts of the insecticide DDT began to greatly depress the nesting success of raptors, especially fish-eating birds. By 1978, the bald eagle—our national symbol!—was endangered or threatened in all 48 contiguous states.

During that time, in addition to contaminant influences, Maine's bald eagles also faced increasing habitat threats and nest disturbances. MDIFW began monitoring bald eagle populations in 1962. We initiated four decades of contaminants research in 1967, and started intense habitat protection efforts in 1972. Our agency and others addressed habitat threats by forging cooperative agreements with landowners of key eagle habitats over the course of 18 years. Over the following 19 years, we enacted special regulations for the oversight of land use permitting decisions by designating Essential Habitat. MDIFW did not de-list bald eagles until 2009, when enough conservation lands and easements had been established to create a safety net to protect traditional nesting habitat from future threats.

Now, let's apply those lessons to the future of cave bats, which were newly listed in 2015 as Endangered or Threatened in Maine. Over the span of just a few years, Maine's little brown bat and northern long-eared bat populations declined by roughly 90%. First detected in 2006, White Nose Syndrome (caused by an exotic fungus spreading from a cave in New York) has killed millions of bats across the U.S. That's equivalent to reversing all the progress that bald eagles have made over the past forty years at a rate of change 10 times more rapid. At best, bats face a very slow comeback dictated by their life history (raising only one pup each year).

As we do with most newly listed species, Maine's biologists have started monitoring and researching our bat populations to guide evolving conservation strategies. Biologists will also need to address additive risks like recreational cave use, disruption of maternity colonies, and incidental bat losses from low-speed wind turbines operating at night. In 2020, biologists had to curtail some in-person research

and monitoring to avoid potentially exposing bats to the virus that causes COVID-19, which could pose another mortality risk.

Some listed species are highly specialized to habitats with limited availability; and in those cases, the key conservation focus is habitat maintenance or enhancement. One of the best examples of this in Maine is the six-whorled vertigo, a land snail reliant on calcareous fens typically found only in areas of limestone bedrock. Granite underlies most of the state, resulting in primarily acidic soils and waters that are not suitable for the vertigo. Since this limitation is unlikely to change, conservation of specific sites is the only practical strategy for this species and others whose habitats are similarly limited. The primary mandate of Maine ESA is to avoid losses of the State's biodiversity. With that in mind, while it is not always possible to fully recover listed species as self-sustaining populations or to delist some species with naturally limited habitats, we do have the tools to minimize their extirpation risk.

For some species, the condition of suitable habitats is the limiting factor. In other words, habitat quality (rather than abundance) is the bottleneck. Take the brook floater: Maine's extensive waterways seem to offer ample riverine habitat for this threatened freshwater mussel. However, water quality and connectivity barriers render some streams and rivers unsuitable for this species. The species is also an example of ongoing conservation efforts across state boundaries. Maine has contributed brook floaters for captive hatchery propagation and subsequent reintroduction to restored waters throughout the Northeast. It's possible that unsuitable stream habitat can be remediated by restoring riparian buffers and paying careful attention to watershed land use practices.



Brook floater photo by Ethan Nadeau

Some endangered wildlife rely on transient habitats, such as grasslands, old fields, shrublands, and young forests. A few such state-listed species include upland sandpipers, grasshopper sparrows, black racers, juniper hairstreak butterflies, and New England cottontails. Without active management, transient habitats naturally transition into forest, rendering a site unsuitable for these species. Connectivity can also be a challenge – without a large block, or mosaic, of early successional habitats, a setting can become too fragmented. For these species, thoughtful land management and incentives to create and enhance transient habitats can be more beneficial than regulatory MESA provisions.

Another variation on this theme are habitats that once rejuvenated themselves naturally, but no longer do, such as the Northeast’s dry pine barrens. These habitats emerged in sandplains left by the retreat of glaciers, and persisted in part due to naturally occurring wildfires, a phenomenon that has been largely short-circuited by smaller barren patch sizes (from development) and fire suppression. A pattern of wildfires favors fire-resistant vegetation like the pitch pine and scrub oak, which provide essential habitat to many vulnerable butterflies and moths including four state-listed species: Edward’s hairstreak, sleepy duskywing, pine barrens Zanclognatha, and the twilight moth. By contrast, fire suppression allows other trees to establish and out-compete them. In lieu of fire, pine barren habitat on conservation lands is now maintained by using prescribed fire and silviculture.

One of our most successful endangered species conservation efforts is ongoing. The piping plover is a resident shorebird that nests only on front dunes and uppermost reaches of sandy beaches. Not only is its habitat extremely limited in Maine, but its nesting sites are also subject to intense recreational use. Decades of management efforts by MDIFW, Maine Audubon, state parks, USFWS, USDA Wildlife Services, and municipalities have led to a rebound in plover abundance, but long-term stewardship is crucial. Coastal beaches naturally erode, accrue and shift, presenting problems for nesting birds and their young. And climate-change-driven issues like rising sea levels and major storm events present additional threats. Fortunately, we can create suitable habitat through careful deposition of spoils from coastal dredging projects.

Maine is a natural ecoregional transition zone, and as such hosts a blend of species that mostly reside further north or south. Species listed under MESA that are at their northernmost range limit in Maine include Blanding’s turtle,

spotted turtle, northern black racer, grasshopper sparrow, and New England cottontail. Those at their southernmost range limit in Maine (whose future here is threatened by climate change) include Atlantic puffin, razorbill, Arctic tern, great cormorant, frigga fritillary butterfly, and northern bog lemming. Species with low mobility and exacting habitat requirements need extra attention — not only to secure existing habitat, but also to allow for potential shifts in geographic range associated with climate change.

Brief Updates on Species Listed Under Maine ESA

- **No extirpations:** No Endangered or Threatened Species in Maine have disappeared from the state since listing.
- **“Up-listing”:** Three species originally designated as Threatened in Maine have been reclassified as Endangered, owing to further setbacks in their status: Blanding’s turtle, roseate tern, and black-crowned night heron.
- **“Down-listing”:** The status of three species once considered Endangered in Maine improved sufficiently to reclassify them as Threatened: Clayton’s copper, Roaring Brook mayfly, and bald eagle. Bald eagles were eventually “de-listed” (removal from the State list of E/T Species) after a full recovery.

MDIFW staff in the Wildlife Research and Assessment Section (WRAS) are tasked with developing surveys, research, and conservation strategies. We have three taxa teams: one focused on birds, another on mammals, and a third on reptiles, amphibians, and invertebrates. A fourth WRAS team focuses on habitats and data management. Regional wildlife biologists in the Management Section often assume prominent roles in implementing strategies and conducting environmental reviews. Unlike most state wildlife agencies, where a small staff assumes all these duties, nearly the entire Department participates in Maine’s endangered species programs.



Box turtle photo by Derek Yorks

Birds

- **Golden eagles** have been an endangered species in Maine since 1987 and remain on the brink of extirpation. Maine is the only eastern U.S. state where they can be seen every month of the year, but they no longer nest here (the last active nest remaining in Maine was abandoned in 1998). That could change, as recent population increases in northern Quebec may provide a natural source for repopulation. Most of Maine’s traditional golden eagle nests were on cliffs that are protected habitats. Today, nearly half of those cliffs support nesting peregrine falcons.
- Intensive management of **pipng plovers** over the years has yielded record numbers of piping plovers on Maine’s southern beaches: 98 nesting pairs fledged 197 fledgling plovers in 2020. These statistics greatly surpass even the all-time records set in 2019! More than 60% of this year’s plover nests were at locations where MDIFW has established beach management agreements for plover stewardship. We thank the towns of Ogunquit, Old Orchard Beach, Scarborough, and Wells, as well as the Maine state parks and the Prouts Neck Association.
- **Least terns** may nest on some of these same beaches. Often concentrated in a few small colonies, they are quite vulnerable to predators and tidal overwash. Rachel Carson National Wildlife Refuge has championed efforts to safeguard the species for many years, and year 22 appears to have been a good year for least tern production.
- Two colonial nesting seabirds listed under Maine ESA have remained stable or increased slightly over time:

Atlantic puffin and razorbill. Three others have struggled with food availability and predation: **Arctic tern**, **roseate tern**, and great cormorant. Bald eagles have proven to be key predators at great cormorant colonies. Maine Coastal Islands National Wildlife Refuge, National Audubon, and the Gulf of Maine Seabird Working Group conduct rigorous annual monitoring and colony management for Maine’s remarkable assemblage of island nesting seabirds.

- A new **grasshopper sparrow** nesting area was documented in Maine during 2020, and two other occurrences were discovered from 2017 to 2019. Prior to that, only five grasslands in Maine had any grasshopper sparrow activity since 1987, when the species was first listed as Endangered. Still, most sites need active habitat management and statewide population abundance is not increasing. Maine represents the northernmost limit of this species’ range.
- Record numbers of **peregrine falcons**, 39 pairs, nested in Maine during 2019. Peregrines that nest further north in Canada and Greenland always pass through Maine during fall migration, but the state’s breeding population disappeared from 1962 to 1986. During the period of 1984 to 1996, MDIFW reintroduced a total of 154 young falcons from captive breeding programs operated by The Peregrine Fund. Acadia National Park, Baxter State Park, Maine Bureau of Parks and Lands, and White Mountain National Forest were key partners in restoring the peregrine to Maine after its 24-year absence. Peregrines now nest in Maine’s urban areas as well as remote cliffs.



An Atlantic puffin with a flock of razorbills



Northern long-eared bat in flight catching a moth. Photo by Merlin Tuttle.

Mammals

- Bat research is underway in Maine on several fronts. Key partnerships with Acadia National Park, University of Maine, and Biodiversity Research Institute are focused on three cave bats listed under Maine ESA in 2015: **northern long-eared bat**, **little brown bat**, and **eastern small-footed bat**. MDIFW surveys have recently focused on the tri-colored bat, which will also be under consideration for both state and federal listing. In 2019, the Department established long-term acoustic monitoring stations across the state to monitor population trends.
- Substantial efforts continue in Maine and elsewhere in the Northeast to enhance habitats and bolster populations of **New England cottontails**. Suitable habitat for this species is patchily distributed in southern Maine but fragmented and limited overall, and population numbers have steadily declined. The state's current stronghold is in Cape Elizabeth, where the Sprague Family Corp. has periodically treated its lands to maintain shrublands and young forests with high stem density that this species needs. Elsewhere, remnant populations are isolated. Genetics research shows evidence of in-breeding, but reintroductions show potential for restoration.
- Maine is the only state in the Northeast that still has **northern bog lemmings**, and they have only been found at five localities across the Maine mountains. The species was listed as Threatened under Maine ESA in 1987, but has not yet received federal listing status. A researcher at the University of New England is developing tests to evaluate environmental traces of DNA that may greatly boost the efficiency of our searches for this elusive species.

Reptiles and Amphibians

- Regional conservation plans have been developed for the **Blanding's turtle** and **spotted turtle** in the Northeast. Both turtles were initially listed as Threatened in Maine during 1987, and Blanding's turtles were reclassified as Endangered in 1997. Federal listing petitions for each species are under review. These turtles often venture into upland areas from their freshwater wetland haunts, and fragmentation of upland areas by roads and developments jeopardizes local populations. Road mortality monitoring and cautionary signage are ongoing. A roadway with uniquely high mortality in southernmost York County now has wildlife fencing to divert turtles to a safer location. Survey efforts in the mid-coast region recently uncovered isolated spotted turtle populations deserving of conservation attention.
- **Box turtles** have been state-listed as Endangered since 1987. Several were discovered in Cumberland County during the 1980s, and a few single individuals have appeared in scattered localities since. Some of these are clearly released pets from elsewhere in the species' range. Turtles are long-lived and should not be relocated from their home range. Pet box turtles are not behaviorally adapted for life in the wild, may carry diseases, and are illegal to possess in Maine without a special permit.
- **Northern black racers** were listed as Endangered in Maine in 1987. These agile snakes favor open woods or shrubby areas with sandy soils. MDIFW staff have implanted radio transmitters to better improve our understanding of these snakes' movements and their overall habitat requirements. In the Kennebec Plains Wildlife Management Area, we have initiated habitat restoration to help improve black racer habitat conditions.



Black racer photo by Phillip deMaynadier



An Edwards hairstreak. Photo by Trevor Persons.

Invertebrates

- Conservation of invertebrates is an overwhelming challenge given the number of species and paucity of information. Staff have methodically worked through taxonomic groups composed of at-risk species in the Northeast to gather baseline data on species distributions and relative abundance. These groups include **freshwater mussels; dragonflies and damselflies; butterflies and moths; tiger beetles; and bumble bees**, among others. We often recruit citizen scientists to help extend our Department's capacity to gather knowledge about these and other understudied elements of our state's biodiversity.
- Freshwater mussels in Atlantic Slope drainages often have a small range in waters that have been compromised by dams (which fragment habitat) or that have experienced water quality problems from runoff and pollutants. Three freshwater mussel species are listed as Threatened in Maine: brook floater, tidewater **mucket**, and **yellow lampmussel**. Ironically, Maine is one of the best brook floater strongholds range-wide, and has contributed individuals to develop captive propagation programs in hatcheries for population restoration efforts elsewhere.
- Two mayflies that occur only in the Northeast are listed as Threatened in Maine: **Roaring Brook mayfly and Tomah mayfly**. As is often the case, the conservation focus that followed listing of these species has led to more survey efforts, additional discoveries, and improved habitat protections by partners helping to implement MDIFW's recommended best management practices.

- With 158 species in Maine, dragonflies and damselflies (Order: Odonata) are diverse and conspicuous sentinels of water quality. Two are classified as Threatened under Maine ESA (**boreal snaketail and ringed boghaunter**) and one is listed as Endangered (**rapids clubtail**). Six other species that reside in the state are not listed but have elevated conservation concern across the Northeast and are being monitored carefully. Maine is actively collaborating with the New Brunswick Museum to produce a comprehensive summary of the biology, distribution, and status of all Odonata in the Acadian region (Maine, New Brunswick, Nova Scotia, and Prince Edward Island).



Two boghaunters mating. Photo by Terry Chick.



Program funding is also a challenge!

State wildlife agencies were initially established to manage game species and sport fisheries, and were supported by federal aid programs. In Maine, license fees generate matching state funds. The Pittman-Robertson Act (1937) and Dingell-Johnson Act (1950) each generated dedicated income to carry out management for wildlife and fisheries, respectively.

Awareness and public interest in endangered species conservation now require traditional “fish and game” agencies to take on broader responsibilities for which there are no comparable funding programs. In 2020, Recovering America’s Wildlife Act (H.R. 3742) was passed in the House Committee on Natural Resources. If enacted, this legislation would stabilize and increase funding for at-risk species. In a challenging legislative year, the bill has not worked its way through Congress. If you value Maine’s diverse wildlife heritage, consider voicing your support to our Congressional delegation.

In the interim, most states typically seek voluntary contributions in the absence of general fund support. **The three major options that generate revenue for Maine’s Endangered and Nongame Wildlife Fund are:**

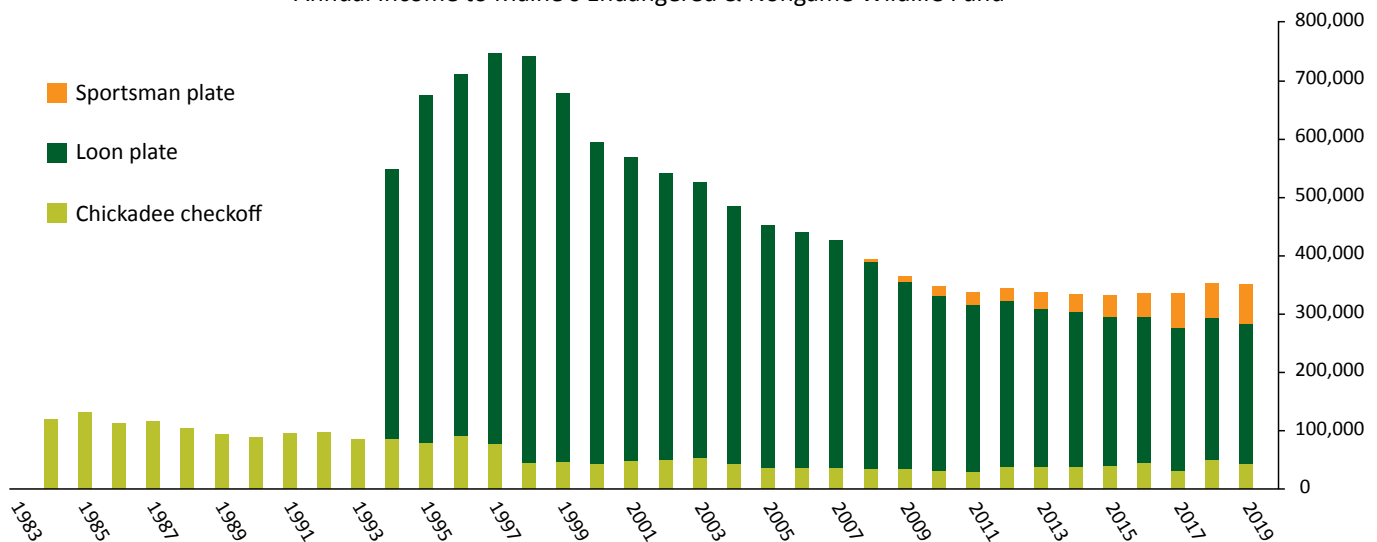
- The **Chickadee Checkoff** is an option on individual state income tax returns filed in Maine; see Schedule CP. Total revenue since 1984 now exceeds \$2,340,000. These funds are often used to leverage other grants. If only half of our taxpayers contributed the \$5 minimum on the Chickadee Checkoff, annual revenue would increase 500%.

- The **Loon Plate** is a vehicle license plate that has been available in Maine since 1994. Forty percent of the extra registration fee is deposited into the Endangered and Nongame Wildlife Fund, and the remainder supports state parks. The Loon Plate program generated more than \$10,670,000 for the Fund in its first 26 years, representing 80% of all the state income for this program. Other specialty plates that fund special programs have steadily reduced loon plate purchases.
- The **Sportsman Plate** was first issued in 2008. The entire extra registration fee goes to MDIFW programs, but only 10% of the \$18/plate renewal cost is earmarked for the Endangered and Nongame Wildlife Fund. Revenue in the first 11 years has totaled more than \$393,000.

We are grateful for these contributions, which enabled the startup of the Department’s endangered species programs. Donations naturally decline over time as each of these funding strategies (check-offs and license plates) are also utilized by competing state interests. Recent public surveys confirm that the vast majority of the public strongly supports E/T conservation carried out by MDIFW, but only a small minority are offering financial support to Maine’s Endangered and Nongame Wildlife Program.

Until funding support for endangered and at-risk nongame species improves, staff must triage efforts for our most vulnerable species. Endangered species conservation is now a necessary part of 21st century wildlife management. However, all parties agree that we should focus on at-risk species before they are highly jeopardized and in need of E/T listing. Maine and other state wildlife agencies have developed Action Plans that identify all “Species of Greatest Conservation Need,” but program funds remain well below program needs.

Annual Income to Maine's Endangered & Nongame Wildlife Fund





2019-20 RESEARCH & MANAGEMENT REPORT

Beginning with Habitat

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.

Beginning with Habitat

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- » Bird Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management

Compiled and edited by Diana Harper and Lauren McPherson

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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 BEGINNING WITH HABITAT GROUP



Amanda Cross, Ph.D.
Beginning with Habitat Coordinator
State Wildlife Action Plan Coordinator

Amanda supervises the Beginning with Habitat program, coordinates Maine's Wildlife Action Plan, facilitates meetings, provides climate change and landscape planning technical expertise, and engages with the community and conservation partners.



Michele Warner
Cartographer

Michele creates and maintains paper and digital map packages for towns, land trusts and landowners. She also maintains and provides current data to online mapping services and assists staff and the department with GIS-related needs such as digitizing data, technical support, updating databases, updating the statewide conserved lands layer, and making maps for specialized projects.

Andrew Johnson
Interim Private Lands Wildlife Biologist
WMI Contractor

Andrew provides technical assistance to landowners and service providers who manage land for at-risk fish and wildlife.

Bill Hancock
GIS Support, Contractor

Bill retired as the BwH Cartographer in 2019, and now provides supplemental support to staff on projects as needed.



BEGINNING WITH HABITAT



BEGINNING WITH HABITAT

Program Overview

Amanda Cross and Michele Warner

Beginning with Habitat (BwH) is a partnership among public agencies, non-profit organizations, and landowner representatives that provides comprehensive, transparent, and consistent local and landscape-scale natural resource information to Maine’s municipalities, landowners, and land trusts.

Maine’s premier natural landscape planning entity

The program was created in 2000 to collect, connect, and consolidate the wealth of habitat information being produced by separate federal, state, and local agencies as well as non-governmental organizations. From our office within the Maine Department of Inland Fisheries and Wildlife (MDIFW), we create comprehensive packages for each Maine municipality and regional planning area, as well as landowners and land trusts, with a goal of helping Maine’s communities and groups build conservation and management into their long-term plans. Each package includes multi-layer maps, information about native habitats, and localized conservation strategies. We also provide technical assistance to help put this data to use.

Mitigating climate change

Today’s land conservation efforts are tightly connected with climate change. Recent estimates from the Maine Climate Council suggest Maine’s forests sequester about 75 percent of our state’s annual carbon emissions; but unfortunately, we lose around 10,000 acres of natural and working lands every year. When valuable habitats are developed, vulnerable wildlife species find it more difficult to survive now. And when they’re developed in a fragmented manner, species lose their ability to move on the landscape in response to climate change.

Smart planning makes a difference

By using best management practices and minimizing development in areas with rare species habitats and large blocks of unfragmented forests, as well as riparian areas along streams and rivers, we can conserve enough habitat to support 80-95% of Maine’s vertebrates and numerous other species. BwH helps communities and landowners identify exactly how to make that happen. Ultimately, this empowers decision-makers to guide growth and management in such a way that 50 years from now Maine’s quality of place, including fishing, hunting, wildlife watching, and outdoor recreation – and all the economic activity it brings to our state – will endure.

BWH AT A GLANCE IN THE LAST YEAR



Created 220 maps for Municipal Comprehensive Plans



Compiled comprehensive plan data packages for 44 municipalities



Created 134 custom digital map packages



Supported over 530 conservation planning efforts by land trusts, municipalities, and landowners



Led more than 20 community natural resource presentations and workshops



Reviewed 10 Municipal Comprehensive Plans



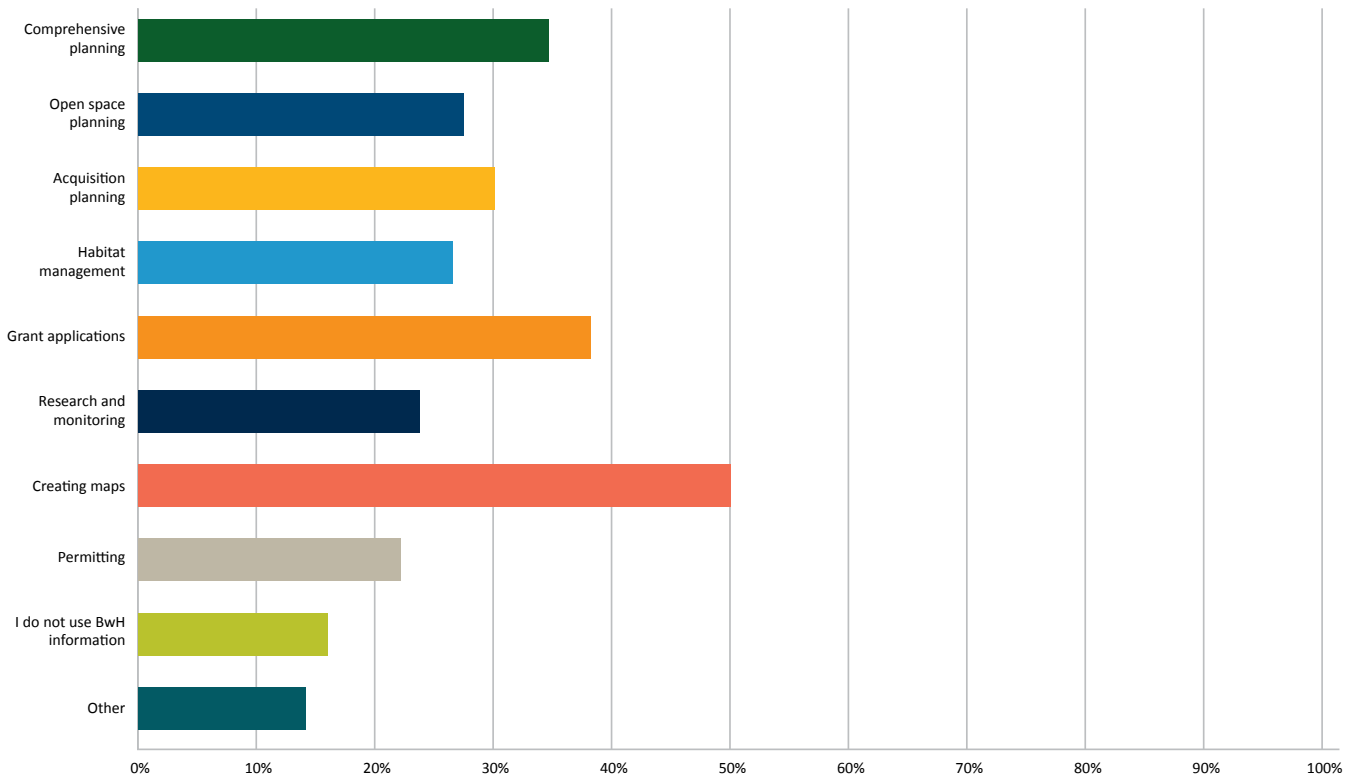
Two busy decades behind us...

This year marks the 20th anniversary of the program, establishing BwH as the longest-running partnership of its kind in the Northeast U.S. In our two decades of work, our small team at MDIFW has provided natural resource information to almost every incorporated municipality in Maine; visited, mapped, identified, and explored local habitats with many land trusts and conservation commissions; and supported numerous local, statewide, and regional planning efforts. A recent survey of our land trust and municipal users highlights the many ways communities use BwH data.

...And big plans ahead

As we enter our next decade, we are updating our website and data packages with new species and climate change information and growing the resources and tools we offer private landowners. While COVID-19 halted our in-person offerings, we are adapting our workshops and presentations to an online format. We hope this will allow us to partner with even more conservation stewards working to ensure a healthy Maine for wildlife and people alike.

HOW DO YOU USE BWH INFORMATION?



Below are some of the projects our team has been leading over the past year. We encourage you to visit our website beginningwithhabitat.org for more information. And please reach out to us Maine.BWH@maine.gov if we can help you, your community, or your organization with any natural resource planning and mapping needs.



American goldfinch. Photo by Michele Warner.



Child with wood frog mass. Photo by Amanda Cross.



Child with salamander. Photo by Amanda Cross.



Vernal pool presentation. Photo by Chuck Dinsmore.

Beginning with Habitat and Climate Change

Amanda Cross

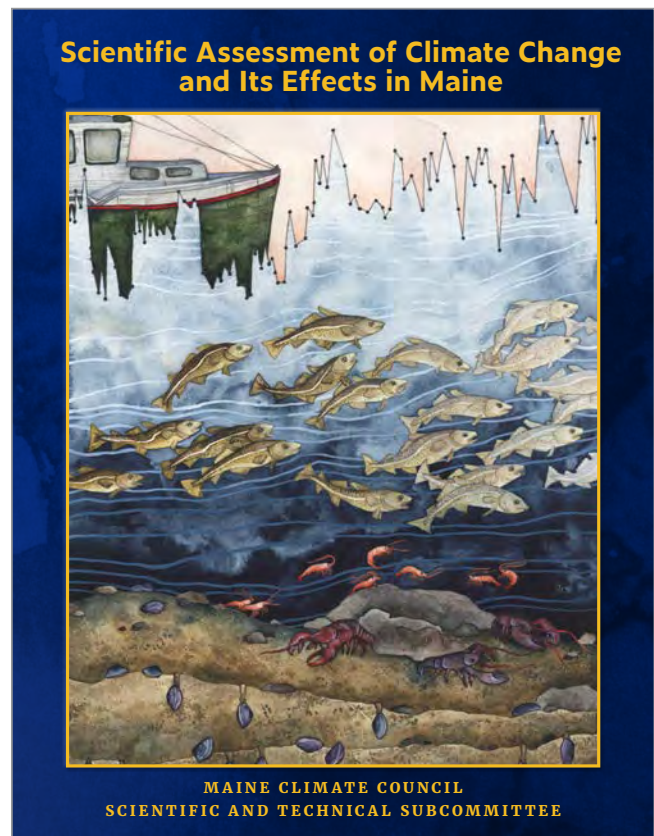
Maine is a biodiverse ecological transition area, where temperate ecosystems characteristic of southern New England give way to northern boreal systems often associated with southern Canada. Climate change is already having dramatic effects on this biodiversity, with nearly one-third of Maine’s at-risk species already being affected by warming winters, changing precipitation patterns, and exacerbated disease and pest outbreaks. These factors have presented multiple threats to iconic Maine species such as furbish lousewort, moose, Canada lynx, common loon, boreal chickadee, eastern brook trout, and Atlantic puffin, as well as many other lesser-known species. And climate change has caused other species, including red-bellied woodpeckers, tufted titmice, opossum, gray fox, and arctic fritillary, to expand their ranges in Maine.

Over the last year, BwH has provided our scientific and landscape planning expertise to two major climate change efforts: The Maine Climate Council’s Scientific and Technical Subcommittee (STS) and the Coastal and Marine Workgroup and the New England Governors-Eastern Canadian Premiers Connectivity Workgroup.

The **Maine Climate Council** is charged with developing a Climate Action Plan by December 1, 2020 that identifies strategies for achieving state carbon neutrality by 2045, among other goals (see climatecouncil.maine.gov for more information).

The Council’s Science and Technical Subcommittee (STS), on which we serve, is tasked with providing the latest information on direct and indirect effects of climate change on ecosystems, human communities, and other sectors. This information is used by the Climate Council’s six working groups’ to inform their consideration of climate mitigation and adaptation recommendations. One of these workgroups on which we serve, the Coastal and Marine Workgroup, identified multiple natural climate solutions (such as conserving eelgrass beds and salt marshes) to store carbon, protect vulnerable human communities and infrastructure, and provide wildlife and plant habitat. We also provided input to the Natural and Working Lands Workgroup on strategies for protecting biodiversity, connecting habitats, and conserving working and natural ecosystems.

The STS also has the unique charge of identifying methods and protocols to mitigate direct and indirect effects of climate change on fish and wildlife species. As co-author with Maine Audubon on the Biodiversity chapter of the recently published STS Report, *Scientific Assessment of Climate Change and Its Effects in Maine*, we provided a comprehensive assessment of the effects of climate change on Maine’s species, from eastern brook trout to moose. Among the methods and protocols recommended in our report are strategies BwH has promoted for two decades, including maintaining forests as forests (both working and natural lands), conserving and connecting large blocks of intact habitat, and supporting community resiliency planning programs.



‘Scientific Assessment of Climate Change and Its Effects in Maine’. Cover art by University of Maine alumnus Jill Pelto.

In 2016, the **New England Governors and Eastern Canadian Premiers** signed [*Resolution 40-3 on Ecological Connectivity, Adaptation to Climate Change, and Biodiversity Conservation*](#). Recognizing that ‘the rich diversity of forests, waters, and landscapes of this region, as well as the diverse array of fish and wildlife they support, are the foundation to our economic health, cultural identity and way of life, and to our high quality of living,’ the Resolution directs states and provinces to form an international Ecological Connectivity Working Group. This Working Group, on which BwH staff have served since 2018, aims to identify ways in which ecological connectivity can be bolstered in transportation and land use planning, scientific research, conservation, and land management. During this past year, we completed recommendations and a final scientific assessment detailing the multiple benefits of habitat connectivity and best practices for supporting a connected landscape.



Above is an example of a wildlife habitat connector installed by the Maine Department of Transportation (MaineDOT) as part of the Caribou Bypass (Route 161) Project. Photo by MaineDOT.

Focus Areas

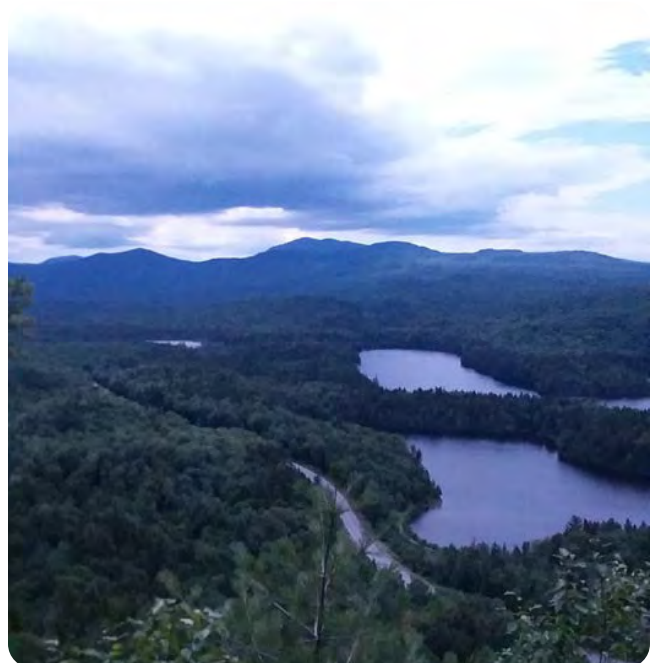
Amanda Cross

BwH Focus Areas are natural areas of statewide ecological significance that contain unusually rich concentrations of at-risk species and habitats. These areas, identified by biologists from the Maine Natural Areas Program (MNAP), Maine Department of Inland Fisheries and Wildlife (MDIFW), Maine Department of Marine Resources (DMR), U.S. Fish and Wildlife Service (USFWS), The Nature Conservancy (TNC), Maine Audubon, and Maine Coast Heritage Trust (MCHT), support rare plants, animals, and natural communities; high quality common natural communities; significant wildlife habitats; and their intersections with large blocks of undeveloped habitat.

We draw Focus Area boundaries based on the species and natural communities that occur within them and the landscape conditions that support the species, habitat, and community types’ long-term viability. To date, collaborative efforts by state, federal, and conservation organization biologists have resulted in the designation of 140 Focus Areas statewide.

Focus Areas help drive conservation in Maine in many ways, from informing land trust acquisition priorities to affecting scoring in land conservation grants (e.g., Land for Maine’s Future). However, Focus Areas have not been comprehensively reviewed in close to ten years and may not adequately address current and emerging conservation

needs, particularly opportunities for management and restoration on private lands and opportunities to mitigate climate change vulnerability and bolster resiliency. To that end, BwH is working with our conservation partners to review and revise our Focus Areas. This will be a 13-month process conducted in close collaboration with land trusts, municipalities, regional planning organizations, and other stakeholders. Look for the revised Focus Areas on our maps by October 2021.



Looking southeast from the U.S.-Canada border to the 78,600-acre Bigelow Mountain – Flagstaff Lake – North Branch Dead River Focus Area.

Cartography

Michele Warner

BwH is collaborating with MDIFW’s Information and Education Division and partners to revise our current website and toolbox of online resources. The new website, featuring easier navigation and additional resources, is scheduled to be launched in November 2020. In the meantime, you can still view all of our current resources at beginningwithhabitat.org.

MapViewer

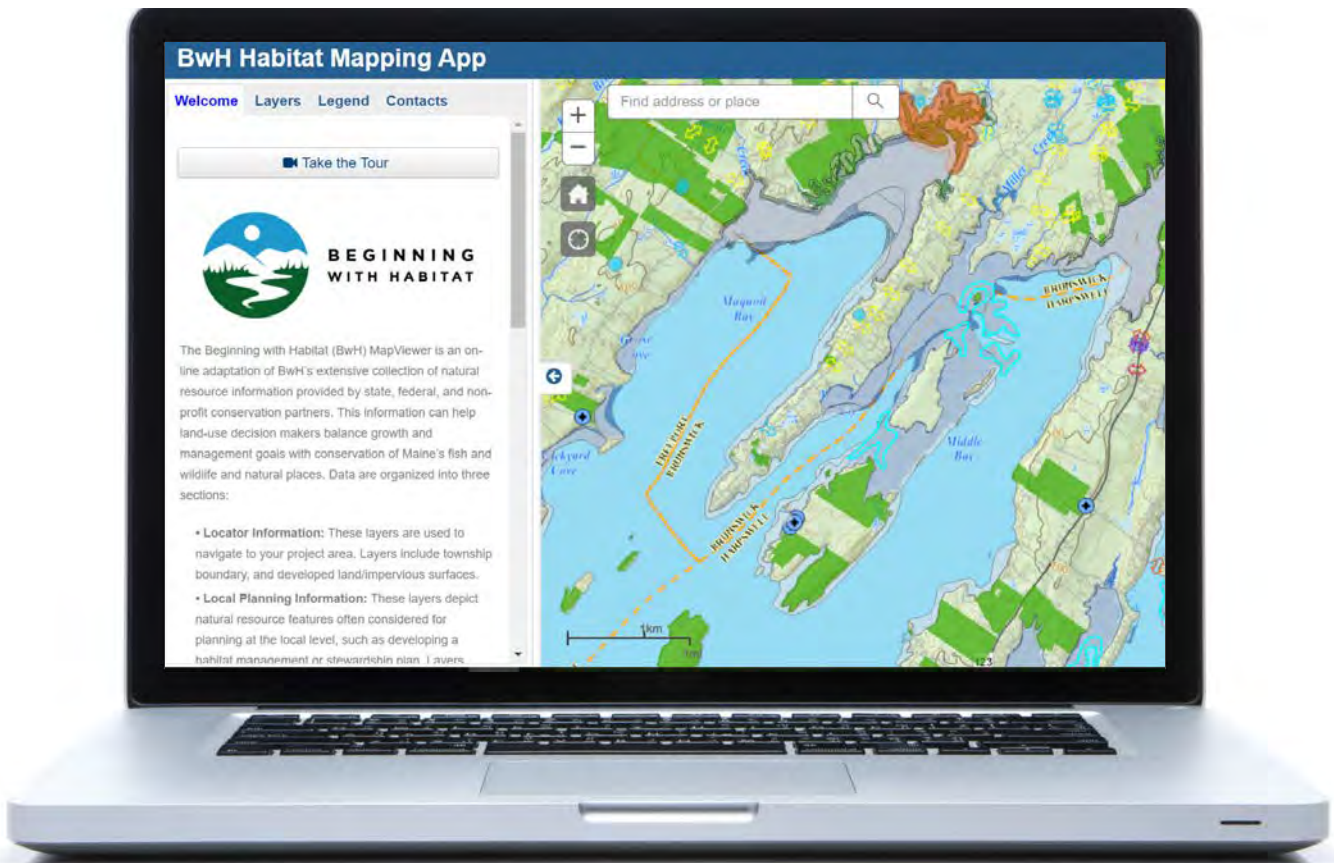
The BwH MapViewer is an online adaptation of BwH’s extensive collection of natural resource information generated by various state, federal, and non-profit conservation partners. With all the data sources collected and curated by BwH, this tool can help Maine’s land-use decision makers, from municipalities to private landowners, balance their growth and management goals with conservation of fish, wildlife, and natural places.

Currently, we offer three online interactive maps:

- **Map 1** depicts major surface water features and drainage areas, associated shoreline habitats and riparian zones, and aquifers and wells that supply public drinking water.
- **Map 2** depicts known rare, threatened, or endangered plant and animal occurrences, as well as ‘Significant Wildlife Habitat’, ‘Essential Wildlife Habitat’, and other important wildlife habitats.
- **Map 3** depicts the State of Maine’s conserved lands database including lands in federal, state, and nonprofit ownership.

Our updated MapViewer moves the data and information from the three existing online maps into one map, making it easier for planners to simultaneously view all the resources in an area rather than toggling between multiple online viewers. We are making additional updates to the MapViewer including improved layer organization, a streamlined print map layout, and the ability to take a ‘learn how to’ tour. The updated version is currently in peer review and will be launched by the end of November 2020.

SCREENSHOT OF DRAFT NEW MAPVIEWER BELOW DEPICTING NATURAL RESOURCES IN THE HARPSWELL/BRUNSWICK AREA



Undeveloped Blocks

Bill Hancock

An updated GIS layer for Maine's undeveloped blocks is now in final peer review. Undeveloped blocks are the areas of habitat left in the state that have not been converted to roads, houses, or other developed surfaces. Upon its last update in 2015, the layer delineated 29,800 square miles as undeveloped. The new layer delineates 28,800 square miles as such. (It is important to note that some of these undeveloped blocks span the border with New Hampshire, Quebec, and New Brunswick, so the total area is not strictly in Maine.)

Some reasons for this 1,000-square-mile decline include the availability of new building footprint and E911 address data layers, the exclusion of gravel pits and other barren areas, and the exclusion of blocks smaller than 10 acres. Further modeling of interior core undeveloped habitat should make this layer even more valuable for conservation planning.

A companion layer showing developed areas in Maine was also updated and is in final review. Both layers are intended for use at the town scale of 1:24000. Look for these layers to join the BwH MapViewer and data packages in late 2020.

Undeveloped blocks surrounding the Madison-Anson town center, delineated below in light green. Further buffering to increase the distance from roads and houses could highlight the interior habitat so important to many wildlife species.



New Private Lands Wildlife Biologist Position

Andrew Johnson

During its first 20 years, BwH primarily worked with municipalities and land trusts to inform conservation planning, but we have always recognized that private landowners are just as important to the conservation of our state's natural resources and our wildlife and fisheries heritage. Over 95% of Maine is privately owned; so if MDIFW is to achieve its wildlife goals, we must help Maine's landowners in their roles as stewards of Maine's fish and wildlife habitats.

BwH is growing to address this need. A Private Lands Wildlife Biologist position was added to the team in Spring 2020, and we are also in the process of revamping and expanding our website to include landowner resources. The BwH MapViewer, which already allows you to see the rare animals, plants, natural communities and habitats known to be in your area, is undergoing updates that will improve user-friendliness and empower and guide landowners in the management of their property.



Photo by Michele Warner

In addition to our mapped resources, the Private Lands Wildlife Biologist will help connect interested landowners to the many existing resources and programs designed to help our state meet its wildlife conservation goals. Do you own a forest and want to help wildlife? Call your local District Forester at the Maine Forest Service for a free site visit to learn what opportunities your land offers, or explore Maine Audubon's Forestry for Maine Birds materials. Do you have a grassland and want to manage it in a wildlife-friendly manner? There is a program for that too: Ag Allies, based out of the Somerset County Soil and Water Conservation District. MDIFW has helped advise the habitat management that these and other programs promote, and we would love to introduce you to these outstanding resources.

We also encourage you to check out the BwH website regularly for updates. As the new Private Lands Wildlife Biologist position becomes established, they will also be available to match interested landowners with habitat management guidance curated to their lands and goals... so stay tuned!

STATE WILDLIFE ACTION PLAN

Program Overview

Maine's 2015-2025 Wildlife Action Plan is our state's blueprint for conserving our most vulnerable fish and wildlife species. MDIFW partnered with over 100 conservation partners in 2014-2015 to develop the Action Plan, and together we identified 378 at-risk species (also known as Species of Greatest Conservation Need) and over 600 conservation actions we can take to help them. At-risk species are those fish and wildlife whose populations are becoming unhealthy or are showing signs of decline due to pressures such as climate change, habitat fragmentation and loss, or disease. Only 51 of our at-risk species are currently listed as Threatened or Endangered under Maine's Endangered

Species Act, so the Action Plan is designed to promote voluntary, non-regulatory actions that can be taken now to prevent the 327 remaining species from declining to the point where regulatory intervention is needed.

The Action Plan and BwH are inextricably linked. The Action Plan identifies statewide at-risk species and habitat priorities, and BwH provides landscape and local planning information on these priorities to users across the state. We also track Action Plan implementation, work with MDIFW staff to periodically review and revise Action Plan priorities, coordinate with other Northeastern states to address regional needs, and assist partners in integrating Action Plan objectives with their own project goals.

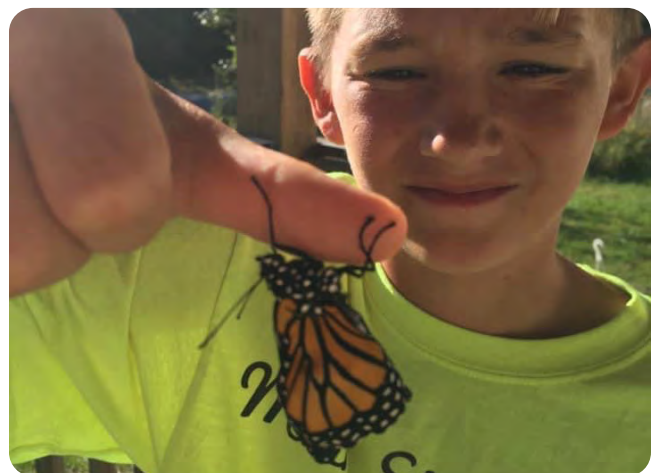


Wood turtle and tiger cobblestone beetle (both SGCN priority 1 species). Photos by Jonathan Mays.

Species of Greatest Conservation Need Factsheets

Michele Warner

Beginning with Habitat is working with MDIFW's biologists, species specialists, and outreach staff to update our Department's at-risk species (also known as Species of Greatest Conservation Need in our State Wildlife Action Plan – see below) factsheets. These factsheets can assist a wide array of users with conservation and management planning and education, including what each of us can do to help conserve Maine's at-risk species.



Child with Monarch. Photo by Michele Warner.

The SWAP CAT

Maine’s State Wildlife Action Plan Conservation Action Tracker (SWAP CAT) was launched in 2019 to track Maine’s progress toward fulfilling the Action Plan’s goals (see mainewildlifeactionplan.com). Since the Action Plan is intended to help guide fish and wildlife conservation across Maine, we wanted to be able to document and give credit to everyone taking action for at-risk species, from landowners removing invasive species to state agencies conducting research. There are two main goals of the SWAP CAT:

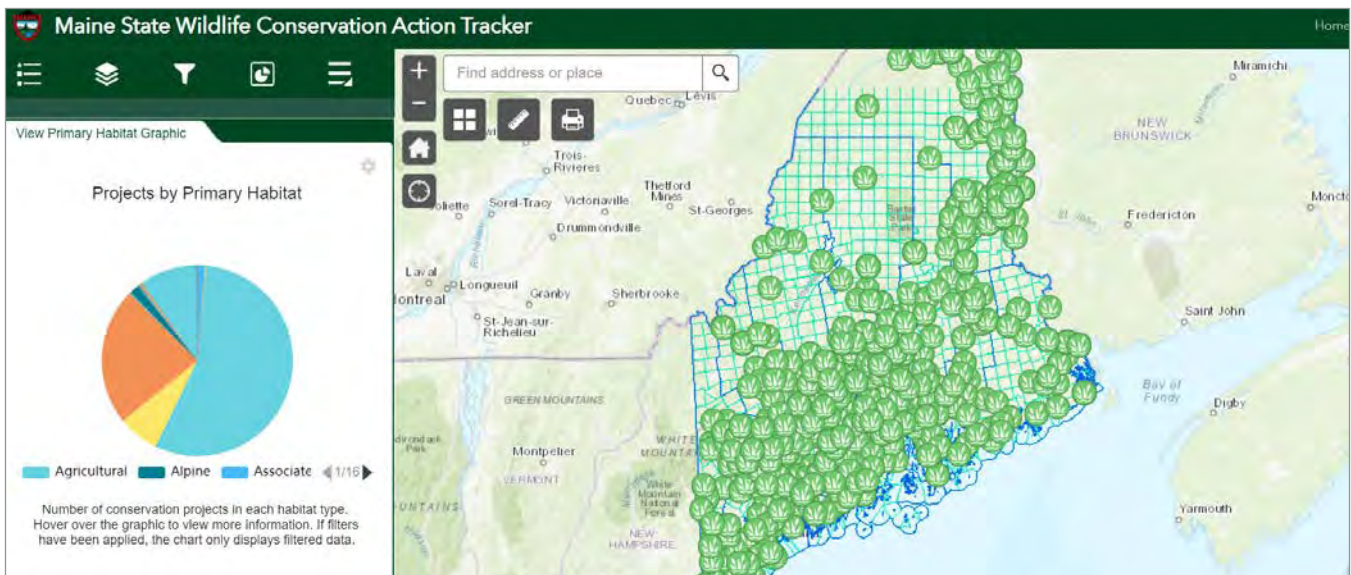
1. Document Action Plan-related conservation measures taken by all partners statewide to help with progress monitoring and reporting
2. Provide Action Plan information to partners so that they can identify synergies to help leverage conservation funding

The SWAP CAT is the first tool of its kind, and was developed over a year-long planning effort with MDIFW staff and partners. Since its launch, over 8,500 projects have been entered into the SWAP CAT. These projects cover nearly every corner of the state and directly address 43 at-risk species and 35 habitats.



Screenshot of the SWAP CAT homepage with tracking dashboard

Several query functions are built into the SWAP CAT, allowing users to quickly determine the habitat types, species, or stressors that projects in the database are addressing (most benefit multiple habitats and species). All data in the SWAP CAT is contributed by willing project partners, and data can be exported and queried further by users on their own. We are always accepting new projects, and each contribution is eligible to be featured in the Project Spotlight portion of the SWAP CAT homepage.



Screenshot of a built-in query depicting projects by primary habitat type they are addressing and spatial distribution of projects across the state.



2019-20
RESEARCH &
MANAGEMENT
REPORT

**Habitat
Conservation & Management**

Download additional sections at
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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.

Habitat Conservation & Management

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Compiled and edited by Diana Harper and Lauren McPherson

Maine Department of Inland Fisheries & Wildlife

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Project Funding

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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.



HABITAT CONSERVATION & MANAGEMENT



What We Do

Habitat Group creates and maintains the Wildlife Division's database of wildlife observations and habitats. We provide this data to municipalities and organizations for numerous purposes including regulatory reviews, oil spill planning, species management, conservation planning, and education, and we also develop custom applications to make the data available to Department staff, other state agencies, conservation partners, and the public.

Each of these uses requires a different type of data, and often it's just a portion of what we have available. For example, regulatory maps are political/social compromises – they include only about half of the habitat in Maine and are based on legal definitions. In the regulatory world, an area is either regulated or unregulated, so while a habitat may in reality evolve or exist on a gradient, the maps remain black and white.

By contrast, oil spill response, species management, and conservation planning efforts focus on relative values, which vary with environmental gradients, proximity to other habitats, disturbances, and other elements of the landscape.

On a day-to-day basis, we provide a range of technical support, primarily with mapping and wildlife/habitat databases, but also with general network and server issues. Unlike other Wildlife Research and Assessment Section (WRAS) groups, which often work on numerous, specific projects with a beginning and an end, much of Habitat Group's work involves maintaining, enhancing, and creating new ways to leverage existing data sets.



MEET THE HABITAT GROUP



Donald Katnik, Ph.D.
**Habitat Group Leader/Oil
Spill Response Coordinator**

Supervises Group activities and coordinates habitat-related projects with other Department staff and other state and federal agencies. Coordinates oil spill response planning efforts for the Department, including training, identifying and prioritizing sensitive areas, and developing spill response plans. Represents the Department in Natural Resource Damage Assessments.



Jason Czapiga
GIS Coordinator

Maintains the Department's Habitat Mapping Application used for permit reviews and the vernal pool database. Develops and maintains databases to track species permitting and Species of Greatest Conservation Need in the State Wildlife Action Plan. Represents the Department's GIS needs on the state GIS Council. Oversees GIS needs within the Habitat Group. Provides assistance to Department staff on a wide range of technical issues and data needs.



Amy Meehan
**Wildlife Biologist and
GIS Specialist**

Collects wildlife habitat data from regional wildlife biologists and others. Creates and maintains computer databases. Conducts field inventories of wildlife habitat and provides Geographic Information Systems (GIS) support for a variety of projects.



MaryEllen Wickett, Ph.D.
Wildlife Biologist and Senior Programmer Analyst

Creates and maintains customized applications and tools for accessing and using the Department's fish and wildlife habitat data both within and outside the agency. Creates, analyzes, and maintains wildlife, habitat, and harvest databases. Provides technical support and habitat data analyses for landscape planning efforts and development of species' habitat models.



Becca Settele
Wildlife Biologist

Assists with creating and maintaining databases of wildlife observations and habitats, particularly significant wildlife habitats. This includes mapping wildlife observations and habitats based on mapping protocols developed with species specialists. Aids in vernal pool review and entry. Assists the Department's Environmental Review program with reviewing project applications filed under state, federal, and local regulatory jurisdictions. Coordinates project reviews among Department staff to ensure consistency with the Department's objectives.

New Interactive Story on Maine's Bald Eagle Recovery

Amy Meehan

Most people are aware of the near extinction of the Bald Eagle in North America, mainly from by-products of the pesticide DDT that thinned their eggs' shells. But how many people know what was done to recover the population?

The Bald Eagle was removed from the Federal Endangered Species list in 2007 and from Maine's Endangered Species list in 2009. The Maine Department of Inland Fisheries and Wildlife completed its last statewide aerial survey of Bald Eagle nests in 2018, and we are happy to report that the state now boasts 734 nesting pairs of eagles, up from a low of 21 nesting pairs in 1967.

Maine citizens enthusiastically supported recovery efforts and became part of the solution – not just bringing the eagle back “from the brink,” but also safeguarding bald eagle habitat into the future through land donations, bargain sales, conservation easements, and cooperative agreements. This is the story a new MDIFW map application endeavors to tell, in a fun and interactive way!

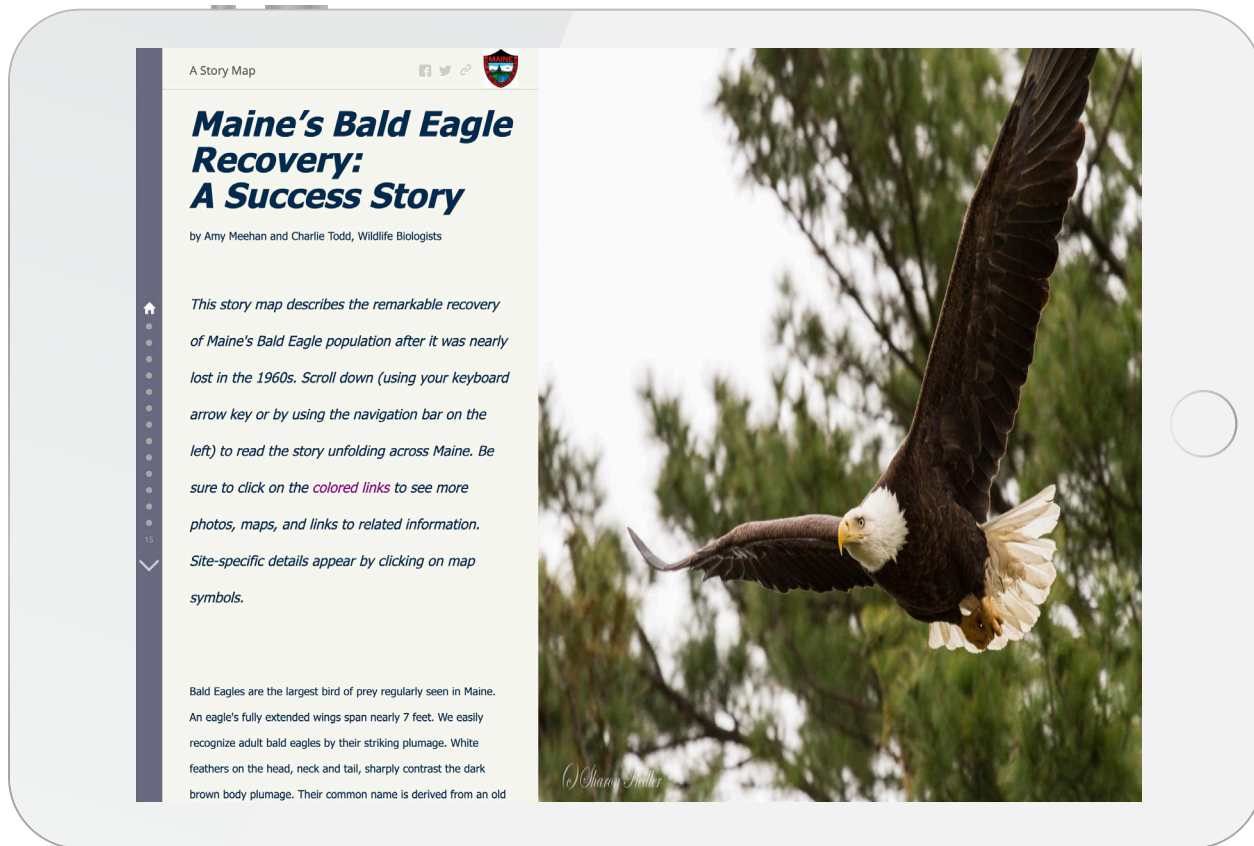
To do so, we used a new storytelling software called Story Maps, which allows you to blend spatial data (including custom maps) with background information, context, and entertaining content like photos, videos, and more.

The Bald Eagle Story Map tells the remarkable story of the eagle's recovery in Maine and how it was accomplished, with fun anecdotes along the way including Maine's oldest eagle, eagle nests with triplets and even quadruplets (!), Maine's largest eagle nest, and the story of an eagle who liked to wander far from home (over 980 miles!).

Colored links lead to further information, photos, graphs, and maps. This is a great resource for schools, teachers, and anyone with an interest in Maine's wildlife resources.

To view Maine's Bald Eagle Recovery Story Map, visit the link below — and be sure to scroll all the way to the end to see an animated version of the recovery!

<https://arcg.is/1eCTG5>



Oiled Wildlife Response Program

Don Katnik

The Oiled Wildlife Response Program, one of the Department's lesser-known programs, involves preparing for and responding to oil spills that impact wildlife.

A lot of petroleum is moved by tanker ships, and it quickly spreads on water if accidentally released. Birds, especially those that live near water (shorebirds, wading birds, and waterfowl), are particularly vulnerable to these spills, as a very small amount of petroleum can damage their feathers, destroying their natural waterproofing and quickly leading to hypothermia.

Worst-case scenario: an oil spill during an infectious disease outbreak

As with many crisis response programs, with oil spill planning we always hope for the best, but prepare for the worst. Planning ahead is key—we need to think about these potential issues now, not in the middle of a crisis, so that we can develop alternate strategies.

This year, that has meant planning for the worst-case scenario of an oil spill during this COVID-19 pandemic, with virtually all Department staff physical distancing and working from home.

We have already taken the first step, adding new Infectious Disease Guidelines to MDIFW's *Oiled Wildlife Response Plan*.

This new section steps through the possible actions we might take during a normal response and assesses what we could still do, what we could do with modifications, and what we could not do during an infectious disease outbreak like COVID-19. Most response activities fall into the do with modifications category, and include:

CONSISTENT TEAMS

Safely capturing a live animal is a challenging task that requires several people; and for that reason, our staff normally work in teams. Under current social distancing guidelines, we would have to modify how we assemble those teams. Normally, we could switch out team members as needed based on staff availability; but during an infectious disease outbreak, we would need to limit the number of different people each individual works with—so the people on a bird capture team, for example, would only work with each other throughout the response and would stay isolated from all other staff.

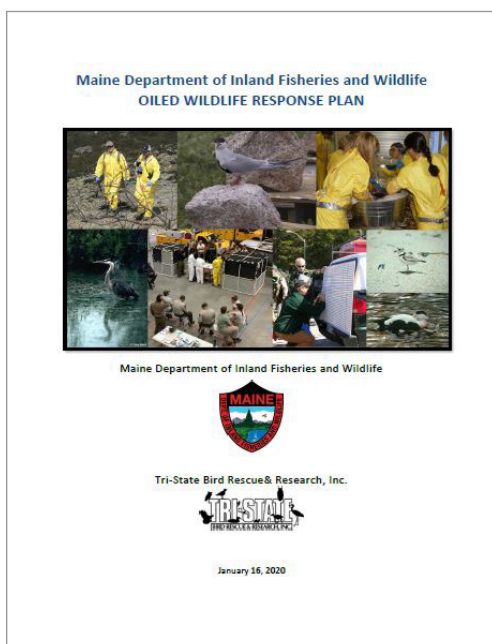
ADVANCED PPE PROCUREMENT

Fortunately, the use of Personal Protective Equipment (PPE) like gloves and masks is already standard practice in an oil spill response because of the hazardous nature of petroleum products. By planning ahead, we can avoid PPE procurement problems that we might otherwise face during an infectious disease outbreak.

PILOT PROTECTION

During a normal response, Game Warden Pilots and wildlife biologists conduct aerial surveys to identify oiled wildlife and groups of wildlife that might become oiled. The Department only has a few Game Warden pilots, though, and we need to protect them from infection so that they remain available for critical operations like Search & Rescue. Since there is no way to social distance in a small airplane, we would have to forego aerial oiled wildlife surveys in an infectious disease situation. We might try using drones instead, but there are limitations to the practicality of that approach. Many birds mistake drones for predators and will flee from them, which is not something we want them to do.

The next step will take place at our annual one-day oil spill response training, where we'll discuss these strategies and prepare to implement them in that "worst-case scenario" crisis we hope will never happen.





2019 Oil Spill Response Training: Focusing on the Flats

Last year's annual training for oil spill response focused on tidal flats — the areas along the Maine coast where tens of thousands of shorebirds stop to refuel during the long migration between their summer/nesting areas in Canada and the Arctic and their wintering areas in Central and South America.

Migrating shorebirds feed constantly while in Maine, and have a very limited timeframe to do so. Any disruption of that feeding time (such as an oil spill in the wrong place at the wrong time) could be catastrophic, so the Department trained for that possibility.

Through that training, we identified a need for individual *Shorebird Area Response Plans* for each of the 900 different areas in Maine used by migrating shorebirds.

In most cases, oil spill responders deployed to survey a shorebird area will have never been there. To do the best job possible, they need to know where the area is, how to get there, how to access the tidal flats, where vehicles can be parked/staged, and what types of equipment (e.g., canoe, kayak, motor boat, ATV) they can use, not to mention what species of birds they are likely to encounter.

We leveraged technology to efficiently create plans for all 900 individual areas. We created a database to store the information, maps, and photos for each area and developed a custom computer program to assemble that information into the response plan documents. After adding new information into the database, a click of a button will update all of the plans.

New Way to View Big Game Harvest Data

Amy Meehan, Jason Czapiga, MaryEllen Wickett

Ever been frustrated looking at the yearly harvest map because the numbers are so small? Have trouble reading the town names? Well, now the Maine Department of Inland Fisheries and Wildlife has a better way to display harvest information — the MDIFW Big Game Harvest Dashboard! (Figure 1).

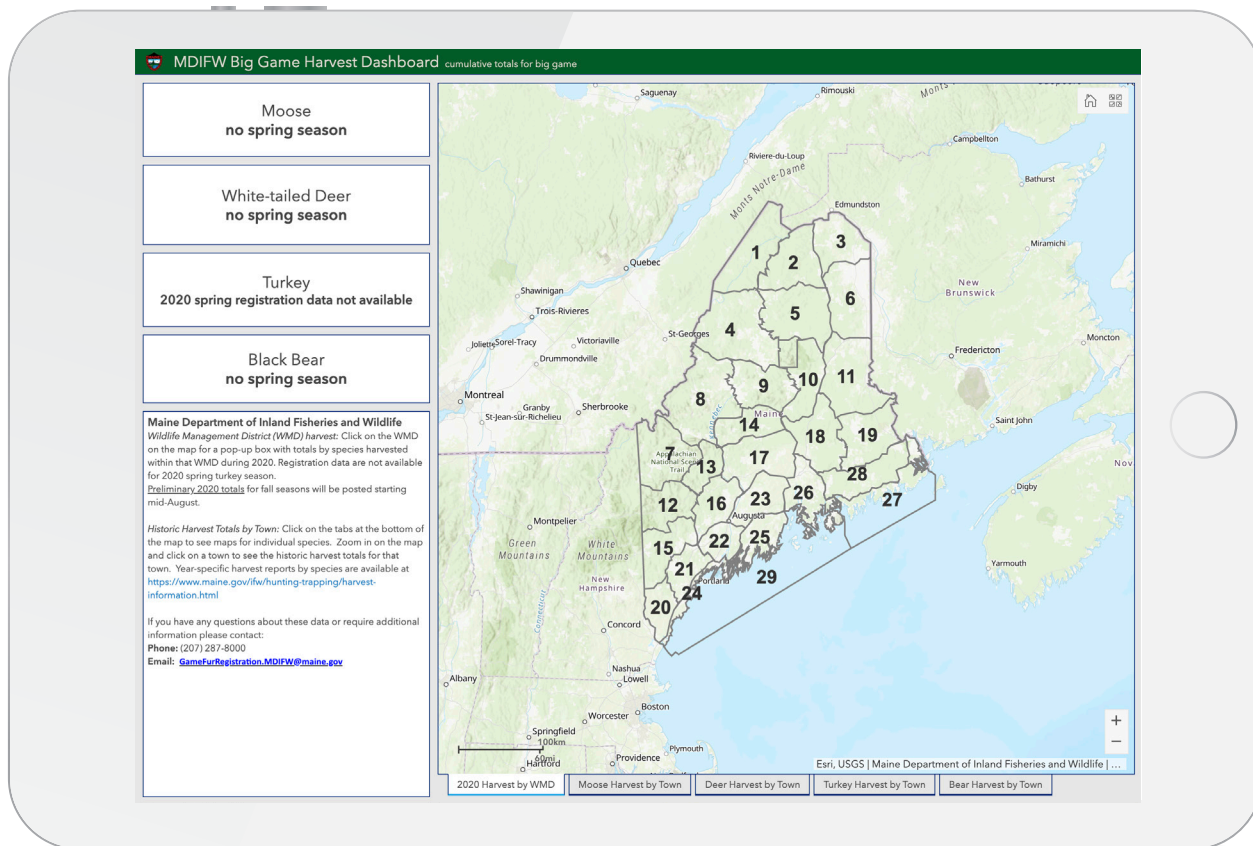
When you open the dashboard, you will see a map of Maine’s Wildlife Management Districts (WMDs). Boxes on the upper left will show you the cumulative (this season to date) harvest registration data for each big game species (Moose, White-tailed Deer, Wild Turkey, and Black Bear), updated daily during the season. Click on any WMD to view that same data on a local level.

You can also view historical harvest data for each species by town. Just click on the tab at the bottom of the map window for your species of interest, then zoom in on the map using your mouse wheel or the +/- buttons on the map. To avoid map clutter, town names will not appear until the map is zoomed in to a certain scale. Click on the town of interest to view its harvest totals dating back to 2005.

The PDF Big Game Harvest maps are still available here: maine.gov/ifw/hunting-trapping/harvest-information.html

FIGURE 1. MDIFW BIG GAME HARVEST DASHBOARD.

maine.maps.arcgis.com/apps/opstdashboard/index.html#/bd9753317d3740d78146a96f5a095985





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MEET THE BIRD GROUP



Brad Allen, Wildlife Biologist and Bird Group Leader

Brad oversees bird group activities and budgets and continues to investigate the lives and times of the common eider, focusing currently on a collaborative duckling survival study. Brad also coordinates Department interests in seabird research and management activities.



Erynn Call, Ph.D. Wildlife Biologist

Erynn focuses on the ecology and management of Maine's raptors. Her current research centers on rivers and river-associated birds, including bald eagles and ospreys. An ongoing, but recently modified, citizen science river bird monitoring program will offer a greater understanding of habitat relationships, presence and removal of dams, and the importance of sea-run fishes to raptors. Other work includes review and collaboration on various raptor research and monitoring efforts of industry, universities, federal agencies, and nonprofits organizations.



Danielle D'Auria Wildlife Biologist

Danielle is the Department's species expert on marsh birds, wading birds, common loons, and black terns. Over the past six years, she has also devoted a great deal of effort to heron surveys, heron research, and coordination of a volunteer monitoring program called HERON. Her other field-related duties include marsh bird surveys and research, black tern surveys, and inland seabird surveys.



Adrienne Leppold, Ph.D.
Wildlife Biologist

Adrienne's responsibilities include the development and implementation of programs to assess the status of songbirds in Maine. Adrienne is also tasked with providing technical assistance and advice to the Wildlife Management Section regarding a wide range of bird conservation issues. Adrienne is currently directing the Maine Bird Atlas, a five-year effort partnering community scientists with professional biologists to document the abundance and distribution of all breeding and wintering birds across the entire state. She is also working on two research projects involving rusty blackbirds and Bicknell's thrush.



Kelsey Sullivan
Wildlife Biologist

Kelsey coordinates MDIFW's waterfowl banding programs, surveys, and research to assess the status of game bird populations in Maine. Game bird species that Kelsey is responsible for include ruffed grouse, American woodcock, wild turkeys, waterfowl, and Canada geese. He is Maine's representative on the Atlantic Flyway Council Technical Section.

See the [Game Species Conservation & Management](#) section of the report to learn about Game Bird Conservation & Management.

VOLUNTEERS AND PARTNERS

The Bird Group would like to thank the following dedicated individuals who have assisted us with our bird conservation and management tasks over the last year:

Evan Adams	Matt Gonnerman	Marek Plater	Coastal Bird Volunteers
Jeff Beach	Wing Goodale	Mark Pokras	Maine Bird Atlas Regional Coordinators and over 1,500 Bird Atlas Volunteers
Sara Beck	Brooke Hafford	Kevin Regan	John Brzorad and 1000 Herons
Adrianna Bessenaire	Bill Hancock	Deanne Richmond	Heron Observation Network volunteers
Louis Bevier	Tracy Hart	Tony Roberts	Maine Peregrine Falcon Program partners and volunteers
Erik Blomberg	Doug Hitchcox	Amber Roth	Maine River Bird Project volunteers
David Brinker	Todd Jackson	Kate Ruskin	Private landowners who have granted us access to their property for surveys and monitoring.
Houston Cady	Patrick Keenan	Jeff Saucier	
Bill Carll	Michelle Kneeland	Lucas Savoy	
Ashley Clark	Cyndy Loftin	Stephanie Shea	
Olivia Choi	Allen Milton	Bill Sheehan	
Brittany Currier	Laura Minich-Zitski	Cole Teimann	
Kelcy Deagle	Glen Mittelhauser	Lindsay Tudor	
Chris DeSorbo	Jen Nadeau and Mia Pierce	Joe Wiley	
Bob Duchesne	Kate O'Brien	Sarah Yates	
Chris Dwyer	Brian Olsen	Diane Winn, Marc Payne and others at Avian Haven	
Bill Freudenberger	Logan Parker		

BIRD CONSERVATION AND MANAGEMENT UPDATES

Maine Winters are for the Birds!

Adrienne Leppold

When people ask me what my favorite bird is, the simplest reply for me is Chickadee. I have other favorites, of course; but for me, chickadees have a lot to offer. I just can't help but appreciate this bold and fierce creature packaged in such a small, cute body. As if that wasn't enough, even on the stillest, quietest, and bleakest of winter days, chickadees also always seem to be there to remind me I'm never truly alone (I prefer to translate their "deedeede" calls as a welcome "hello," regardless of the actual intent. Thank goodness for language barriers).

Chickadees, however, are just one of many species that can be found in Maine in winter. As many already know, the [Maine Bird Atlas](#) is working to document birds during the breeding season, but there is also a winter companion piece that aims to determine exactly

how many species of birds occur in Maine during the winter and where they can be found. A few community science projects contribute to documenting winter bird distribution, including Christmas Bird Count and Project FeederWatch, but the Atlas is the first attempt at creating a statewide understanding of winter birds and building a comprehensive baseline database for future comparisons. In fact, Maine is somewhat pioneering this effort, as we only know of five other states have ever completed or attempted a winter Atlas.

Given that local weather conditions and changes in food availability throughout the season can affect the distribution and abundance of winter birds around the state, we have separated the winter season into early (Dec. 14 – Jan. 31) and late (Feb. 1 – March 15) winter survey periods.

From seaducks to snowy owls and from southern Maine specialties like Eastern Bluebird and Yellow-rumped Warbler to irruptive finch species from the north like Crossbills and Evening Grosbeaks, the first couple years of



Black-capped (left) and Boreal (right) Chickadees. Photo by D. Hitchcox.

winter Maine Bird Atlas surveys have documented a total of 191 species wintering in the state (two of which are actually chickadees - Boreal and Black-capped).

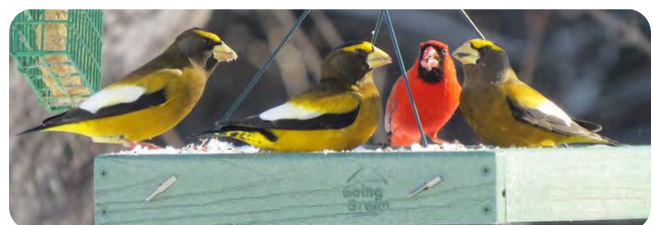
Last year, both Red and White-winged Crossbills were abundant throughout the state, with breeding observations for these species getting reported as early as mid-January (depending on resources, crossbills can breed year-round).

By tracking changes in occurrence and abundance of winter species, we can monitor species' full annual cycles. Ultimately, this will allow us to better understand and manage widespread and persistent threats to bird populations.

Looking ahead, we expect the 2020-2021 winter to be especially good in Maine for northern seed-eating species forced south due to poor seed crops in the north. Large flocks of Pine Siskins, Purple Finches, and even the rarer Evening Grosbeak are already being reported throughout the state.

So, [clean your feeders](#) (congregations of birds at feeders can be breeding grounds for disease), stock up on bird seed for the winter, and starting December 14th, log your winter observations for the Maine Bird Atlas.

Find more information about the atlas in the Black-capped Chronicle (project newsletter), [eBird](#), or [Facebook page](#), with full details at maine.gov/birdatlas.

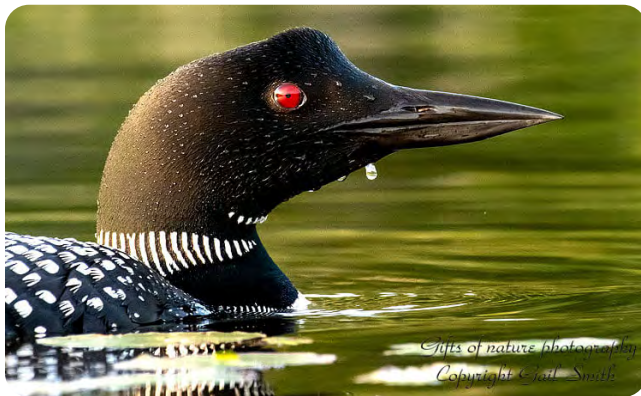


Male Evening Grosbeaks and Northern Cardinal on feeder. Photo by T. Hoffelder.

Anglers Make the Switch to Lead-Free Tackle – On Us!

The common loon is an unrivaled natural treasure. Not only does it represent the wildness of Maine that attracts so many to live or vacation here, but its dependence on clear, cold water and healthy fish populations also makes the loon an important biological indicator.

While Maine's common loon population is quite robust, a long-term mortality study has shown that lead poisoning from the ingestion of lead fishing tackle is one of the leading causes of death among adults, causing 13-20% of deaths in recent years. These preventable deaths are occurring in adults that are otherwise very healthy with no other ailments (Kneeland 2018).



Adult common loon. Photo by Gail Smith.

Over the years, legislation, educational efforts, and proactive lead tackle exchange programs have worked to reduce lead poisoning in loons and other fish-eating birds. Current Maine state law bans the use and sale of lead sinkers and lead-headed jigs weighing one ounce or less or measuring 2½" or less.

But given the recent mortality data, we have more work to do. Recognizing the need to continue education regarding this issue and to provide opportunities for the public to do the right thing and rid their tackle boxes of lead objects, MDIFW and Maine Audubon launched a lead tackle buyback program in 2020.



Over 43 lbs. of lead fishing tackle have been turned in for vouchers thus far.

Beginning in April, we partnered with participating local retailers to provide anglers who turned in at least one ounce of lead tackle with a \$10 voucher to use toward the purchase of non-lead tackle at the same store. Funding provided by the Maine Outdoor Heritage Fund, The Maine Sportsman, and magazine publisher Will Lund will allow the distribution of up to 350 vouchers now through December 2021.

Thus far, we have ongoing partnerships with three retailers — Dag's Bait Shop in Auburn, Indian Hill Trading Post in Greenville, and BackWoods Bait and Tackle in Chesterville — and we hope to add more to the list.

Retailers may also choose to join the partnership by holding one-time events during which they encourage attendees to turn at least an ounce of lead tackle in exchange for a \$10 voucher. This proved to be extremely successful at Kittery Trading Post's Septemberfest, during which they collected 41 pounds of lead tackle and issued 71 vouchers. Considering each individual was only required to turn in a minimum of an ounce (thus 71 ounces or 4.4 lbs), this event really helped to Get the Lead Out!

In addition to the lead tackle buyback program, MDIFW is continuing to investigate the occurrence of lead poisoning in loons by collecting dead loons and conducting necropsies to determine the cause of death. From 1990-2017, lead poisoning was the overall leading cause of death, accounting for 25% of 480 collected adults (Grade et al. 2019). Prior to the implementation of the 2002 limited lead tackle ban (1990-2002) lead poisoning accounted for 32% of adult deaths (Gallo 2013). Over the period of 2003-2016 which follows the 2002 ban, and that spans the introduction of Fish Lead Free outreach in 2013, lead poisoning was found to be responsible for approximately 21% of common loon deaths (MacDonald 2018). The good news is that the percentage of adult common loon deaths due to lead poisoning has decreased each year from 2016-2018, from 19.2% in 2016 to 15.0% in 2017, and 13.0% in 2018 (Kneeland 2019). We just finished up the necropsies for 28 adults collected in 2019 and found that lead poisoning accounted for 18%, trauma accounted for 29%, and fungal respiratory disease accounted for 21%. We plan to continue necropsies through 2022 and hope that lead poisoning will continue to decrease over time as less and less lead is being used by anglers.



MDIFW contractor, Brooke MacDonald, conducts a necropsy on an adult loon.

This project was funded by the Maine Outdoor Heritage Fund, State Wildlife Grants, Maine Birder Band funds, The Maine Sportsman, and magazine publisher Will Lund.

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You can help us understand and reduce lead poisoning in loons by:

- Turning in your lead tackle to a participating retailer. Check fishleadfree.org/me for the most recent list of participating retailers, as well as a list of retailers who sell lead-free alternatives (make sure to check with these retailers to be sure they are open for business).
- Making sure you and your friends know the law: the use and sale of lead sinkers and lead-headed jigs weighing one ounce or less or measuring 2½" or less is prohibited.
- Reporting any dead loons found to MDIFW or Maine Audubon.



Maine's Peregrine Falcon Program

Erynn Call

History of Recovery

In the 1960s, the peregrine falcon had vanished from the continental United States. This was due to widespread use of the pesticide DDT, which caused eggshells to thin and subsequently crush under an incubating adult's weight. After the peregrine was listed as federally endangered in 1970, recovery efforts began. These included a ban on DDT as well as captive breeding and reintroduction programs. This approach was successful, and peregrines were federally delisted in 1999.

However, despite meeting recovery criteria at the Federal level, some eastern states including Maine still had concerns, and include peregrines on their state endangered and threatened species lists.

The peregrines currently listed as endangered species in Maine are a genetic mix of the many birds from the captive breeding program. These birds were identified only by species because of the mix of subspecies and races from around the world. In Maine, a total of 144 birds were released from 1984 to 1997. This reintroduced population breeds within the state and generally does not migrate.

In contrast, the Tundra subspecies does not breed in Maine but does migrate and travels through in April and May, and mid-September through October. It was federally delisted in 1994, is not currently state listed, and their numbers continue to increase.

The American subspecies was historically found in Maine before disappearing completely from the state due to DDT.

The recovery of peregrines in Maine and the entire Northeast has been promising. Maine biologists documented the first post-recovery nest in 1987; and by 2002 documented at least 15 breeding pairs.

Biologists placed colored leg bands with unique letter-number combinations on young peregrines, enabling observers to identify and "re-sight" them using a spotting scope, and to document long-range movements of individuals between states.



Photo by Peter Green.

Partnerships

Monitoring of pairs during the breeding season is key to documenting and managing the recovery of peregrines, but it has been difficult to achieve on a comprehensive statewide level. Challenging access to some nest sites and the overall time required to monitor these have resulted in a patchwork of information on breeding peregrines.

To address this, and to gain a better picture of how these falcons are faring in the state, MDIFW through the Maine Peregrine Program recently coordinated a broad collaborative effort. Contributors included MDIFW biologists, Acadia National Park (National Park Service), U.S. Fish and Wildlife Service, Baxter State Park, Grafton Notch State Park, Camden State Park, Mount Kineo State Park, White Mountain National Forest, Maine State Parks, Bureau of Public Lands, Maine Department of Transportation, USDA Wildlife Services, N.H. Audubon, numerous citizen scientists, recreational birders and photographers, rock climbers, Avian Haven Rehabilitation Center, University of Maine – Orono, Dragon Cement Products, ND Paper, Sappi North America, Lane Construction, Crooker Construction, Bath Iron Works, and Central Maine Power Company.

MDIFW also worked with [The Little Egg Foundation](#), a nonprofit that focuses on providing support to wildlife managers. One of their efforts is a software platform called NestStory, which allows citizen scientists to enter their survey data and then organizes it for wildlife biologists. This has created huge efficiencies in our statewide data entry and management process, allow our team to spend more time in the field and less at a desk.

Current Status

During the 2019 and 2020 breeding seasons (mid-March through mid-August), we monitored peregrines using a standard survey protocol. We will complete a similar effort in 2021 and will base future years of monitoring on a plan that is currently under development. This long-range strategic plan will include goals to attain stable peregrine populations in Maine and contribute to metapopulation stability throughout the Northeast.

TABLE. 1. RECENT MAINE PEREGRINE FALCON BREEDING SEASON MONITORING RESULTS.

	2019	2020
TERRITORIAL PAIRS	38	37
NESTING PAIRS	23	29
SUCCESSFUL NESTS	20	26
CHICKS	53	62
FLEDGLINGS ^a	49	49
FLEDGLINGS IN FLIGHT	15	25
PRODUCTIVITY ^b	1.29	1.32

^aChicks surviving to ≥ 28 days

^bFledglings per territorial pair

How to Help

You can join the effort to support Maine’s peregrine falcons in the following ways:

- Report single peregrine observations during the breeding season (March 15 – Aug 15) to [Maine eBird](#) and/or contact erynn.call@maine.gov to get involved in repeated visits to specific breeding sites as part the statewide monitoring effort.
- Help build better nests. Urban breeding peregrine pairs often benefit from improved nest structure through placement of a nest tray or box filled with gravel. If you (or your local birding/conservation chapter) would like to help usher this process along in partnership with MDIFW and private business owners, please contact erynn.call@maine.gov.
- Donate to the [The Little Egg Foundation](#), [Maine Birder Band](#), or the [Chickadee Check-off](#).



Illustration by Michael Boardman.

Population Monitoring and Management of Piping Plovers in Maine

R. Bradford Allen

The piping plover is designated as an Endangered Species under Maine's Endangered Species Act and a Threatened Species under the federal Endangered Species Act.

The Maine Department of Inland Fisheries and Wildlife (MDIFW) supports Maine Audubon (MA) in a piping plover recovery program that involves negotiating landowner agreements, coordinating with municipalities and partners, erecting and moving fences around nesting areas, conducting public outreach, training volunteers, and ultimately monitoring and managing these endangered birds on 25 public and private beaches.

While MA is the face of the program, MDIFW regional biologists oversee and work cooperatively with a larger team that includes USFWS refuge and endangered species staff, managers at Maine's state-owned public beaches, USDA Wildlife Services, certain municipal staff, and hundreds of volunteers. Without a doubt, this plover recovery program is one of the most hands-on bird conservation projects in the state, and it has paid off.

Due to the intense management teamwork on our beaches, Maine's plover population has increased in size and distribution in recent years and our plovers have exhibited high productivity compared with those in other Atlantic coast states.

How the Program Works

Biologists and law enforcement work together strategically on monitoring and outreach. With plovers now nesting at a record 22 sites, we are developing relationships with individual communities to enhance their long-term commitments to monitoring and outreach, including increased education and law enforcement patrols on the beaches. This type of community conservation engagement reduces the risk of localized losses, but it also requires continued funding.

Whenever landowners will allow it, we use stake-and-twine fencing and nest enclosures to protect eggs and incubating adults from predators. USDA - APHIS Wildlife Services contractors also conduct predation management at sites with chronic predation problems.

We also work closely with the USFWS - Maine Field Office and other state and federal agencies on beach nourishment and other policies that influence the dynamic nature of beach ecosystems. Previous attempts to diminish management scope and intensity resulted in short term setbacks in numbers and breeding success.





2020: New Challenges, Unprecedented Success

The COVID-19 pandemic brought its challenges to the program in 2020, with social distancing policies requiring biologists and beach monitors to modify how they carpool, train volunteers, monitor birds, manage nests, and deal with beachgoers.

On some beaches, early spring closures allowed birds to select nesting sites unhindered by beachgoers; but unfortunately, some of those sites saw high foot traffic when the beaches opened back up. With the pandemic sparking a renewed public interest in open spaces and fresh air, beachgoer numbers surged over the summer. In response, MA biologist Francesca Gundrum and her colleagues reached out to birding communities for support, developed new educational materials, and connected with the public via TV interviews and news articles.

New Records

Despite intense recreational use of their finite sand beach habitats, Maine's plovers achieved record nesting and chick production numbers in 2019 (89 nesting pairs, 175 fledglings); and in 2020, they set an even higher standard. According to MA Coastal Birds Program coordinator Laura Minich-Zitske and her team of biologists, Maine beaches hosted a new record of 98 nesting pairs who fledged 199 chicks – nearly two per pair. This productivity level has only been seen once in the past 25 years and is well above the 1.5 chicks/pair threshold needed to sustain the population.

Other 2020 season highlights from Minich-Zitske include:

- 14 piping plovers nested on Popham Beach this year – the most we have ever had on one beach.
- Ogunquit Beach fledged an incredible 30 chicks – the most of any beach since monitoring began in 1981.
- A record high of four beaches fledged over 20 chicks.
- Parsons Beach, Goose Rocks, and Ram Island Farm all saw fledging numbers that haven't been recorded in over a decade.

Minich-Zitske attributes this year's success to the collective and intensive management effort, plus a little bit of luck.

Despite some strange weather, only one plover nest was over-washed this year. Past storm tides during the nesting season have had devastating results.

Looking Ahead

Despite improvements in Maine's piping plover populations, we still have work to do. In 2021, we will keep working cooperatively with neighboring states and provinces, whose local efforts work in concert with ours, to implement the USFWS Atlantic Coast Recovery Plan. Given the program's recent strategic emphasis on local awareness and participation, we will continue to increase public education and offer MDIFW Warden Service patrol support to the local volunteers who monitor plovers and notify beach users of restricted activities. We thank MA for taking the lead and pulling off a fantastic season in 2020, and look forward to continued success.

MDIFW again utilized Pittman - Robertson funds to support these efforts this year.



2019-20
RESEARCH &
MANAGEMENT
REPORT

**Game Species
Conservation & Management**

Download additional sections 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.

Game Species Conservation & Management

Game Mammal Conservation & Management

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- » Non-Game Mammals Conservation & Management
- » Beginning with Habitat Updates
- » Bird Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management

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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.



MAMMAL CONSERVATION & MANAGEMENT

The Mammal Group develops and oversees Maine’s mammal monitoring and management programs, assists with permit reviews, and provides technical assistance to policy makers and the public. We address public and departmental informational needs by designing and implementing research programs, assisting with strategic planning, contributing to the Department’s environmental

education efforts, and responding to public information requests. We also make regulatory recommendations on hunting and trapping of mammals to the Wildlife Division Director. We conduct all regulatory recommendations, planning, and research in close cooperation with regional wildlife biologists in the Wildlife Management section.

MEET THE GAME MAMMAL GROUP



Wally Jakubas, Ph.D.
Wildlife Biologist and Mammal Group Leader

Wally supervises Mammal Group personnel, helps design, plan, and implement research projects and management programs, writes and manages Mammal Group contracts, and facilitates the daily work of Mammal Group biologists. He works with a dedicated team of biologists to restore the endangered New England cottontail population in Maine and in other states, and is the departmental spokesperson on New England cottontail, wolf, and cougar issues. He is an external member of the graduate faculties of the University of Maine and University of New Hampshire.



Nathan Bieber
Wildlife Biologist
Deer

Nathan oversees deer management system implementation, working closely with a team of regional biologists to make recommendations for allocating Any-Deer Permits and analyze hunter harvest and biological data. He also organizes MDIFW’s chronic wasting disease monitoring efforts and serves as the departmental spokesperson on white-tailed deer issues. Nathan and the Cervid Working Group are updating the deer management system to address the priorities described in the Department’s new Big Game Management Plan. He is also currently collaborating with a team of biologists on a deer winter survival study in Maine and New Brunswick.



Randy Cross
Wildlife Biologist
Black Bear

Randy oversees field work for collecting reproductive, survival, and density information on black bears. Randy supervises field crews that handle hibernating bears and the trapping and collaring of bears with GPS and VHF collars. Each year, Randy talks to hundreds of people about bear biology and natural history during his fieldwork. In the office, Randy compiles field data and oversees the processing and aging of moose, deer, and bear teeth. Randy, Jen, and the Bear Working Group are currently updating the bear management system to address the priorities described in the Department’s new Big Game Management Plan.



Lee Kantar
Wildlife Biologist
Moose

Lee oversees Maine’s moose management program. Lee’s work involves conducting aerial moose surveys, collecting and analyzing biological information from moose, making hunting permit recommendations, and serving as the departmental spokesperson on moose. Lee is heading up Maine’s portion of a moose survival study in cooperation with the University of New Hampshire and the New Hampshire and Vermont wildlife departments. The primary goal of this study is to determine which factors are affecting moose survival rates and how these factors are affecting moose population growth. Lee and the Cervid Working Group are currently updating the moose management system to address the priorities described in the Department’s new Big Game Management Plan.



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 and fisher populations and a study to develop a new DNA survey technique for northern bog lemmings. She shares bat management responsibilities with Sarah Boyden, Assistant Regional Biologist in MDIFW’s Strong Office.

MAMMAL GROUP CONTRACT WORKERS AND VOLUNTEERS

Deer Project

- Connor White
- Anneliese Washakowski
- Ryan Bechtold
- Adri Bessenaire
- Laura Williams
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- Derek Benedix
- Justine Rumaker
- Jordan Darley
- Tony Holzhauser
- Mikaela Kropp

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- Holly Bates
- Gerry Lavigne
- Tim Lentz
- Roger Milligan
- Paul Campbell
- Braden Richard
- Eldon McLean
- Bill Carll
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- Nick Bartholomew
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- Jake Feener
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- Evan Whidden
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Lynx Project

- Katherine Trickey

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- Tessa Shanteler
- Rebecca Cusick
- Sequoia Dixson
- Bradley Wilson
- Jeff Norment
- Carter Barthelman
- Nick Bartholomew
- Lisa Feener
- Bryn Evans



WHITE-TAILED DEER

Nathan Bieber

2018-2019 Deer Harvest

Season Dates and Structure

During the 2018 and 2019 seasons, Maine offered five different structured hunting seasons (Expanded Archery, Regular Archery, General Firearms, and two Muzzleloader seasons), giving hunters a total of 79 days each year to pursue white-tailed deer.



Harvest Information & Biological Data

PERMIT ALLOCATION

Total Allocation

In 2018, 84,745 Any-Deer Permits (ADP) were distributed among 22 Wildlife Management Districts (WMDs) to meet the adult doe harvest objective of 8,759. In 2019, 68,145 Any-Deer Permits (ADP) were distributed among 20 Wildlife Management Districts (WMDs) and two deer management subunits to meet the adult doe harvest objective of 7,966.

Allocation per WMD

Because many hunters elect not to harvest a doe or not to hunt, MDIFW applies an expansion factor to each WMD to ensure enough ADPs are issued to meet the district's doe removal goals. This expansion factor results in more permits being issued than the number of does expected to be harvested. An expansion factor of 10, for example, indicates that MDIFW must issue 10 permits to harvest one adult doe. The average statewide expansion factor is usually between six and seven with higher expansion factors in WMDs central and southern Maine WMDs.

2018

ADP allocations ranged from zero permits in WMDs 1, 4, 5, 10, 11, 19, and 28 to 12,375 in WMD 23.

The WMDs receiving the most ADPs per square mile were:

- WMD 24 40 permits/mi²
- WMD 22 25 permits/mi²
- WMD 21 22 permits/mi²
- WMD 20 16 permits/mi²
- WMD 23 16 permits/mi²

2019

ADP allocations ranged from zero permits in WMDs 1, 4, 5, 7, 10-13, and 19 to 9,750 in WMD 23.

The WMDs receiving the most ADPs per square mile of huntable habitat were:

- WMD 24 29 permits/mi²
- WMD 22 22 permits/mi²
- WMD 21 17 permits/mi²
- WMD 23 13 permits/mi²
- WMD 25 11 permits/mi²



Hunter Profiles

2018

Number of people who applied for ADPs:

Total	85,601
Residents.....	80,057
Nonresidents	5,544
Landowners	9,952
Superpack Permittees	2,605
Junior Hunters.....	7,574

2019

Number of people who applied for ADPs:

Total	77,214
Residents.....	72,187
Nonresidents	5,027
Landowners	8,985
Superpack Permittees	2,775
Junior Hunters.....	7,320



DEER MANAGEMENT SUBUNITS

In 2019, as part of an effort to mitigate some of the impacts associated with locally overabundant deer, MDIFW began issuing bonus antlerless deer permits in parts of some WMDs, referred to as deer management subunits. Bonus permits allow hunters to harvest one additional antlerless deer (i.e. a hunter may harvest a buck on their regular hunting permit and an antlerless deer on their bonus permit).

These deer management subunits consist of groups of towns experiencing high levels of deer-human conflict, such as deer-vehicle collisions, nuisance deer reports, and cases of Lyme disease. Subunits are impermanent but are intended to persist for at least five years, at which point MDIFW will reevaluate whether a subunit designation is still appropriate for the area. MDIFW created two deer

management subunits for the 2019 deer hunting seasons: Subunit 25a, consisting of the towns of Georgetown and Arrowsic in WMD 25, and Subunit 26a, consisting of portions of the towns of Brewer, Bucksport, Castine, Dedham, Holden, Orland, Orrington, Penobscot, and Verona in WMD 26. We will evaluate the need for additional subunits each year.

OVERALL HARVEST

Maine’s deer hunters registered 32,451 deer during the 2018 hunting seasons and 28,323 during the 2019 hunting seasons (Tables 1, 2). Overall, 5,218 more deer were harvested in 2018 than in 2017, representing a 19% increase. The trend reversed in 2019, with a 4,128-deer difference representing a 12% decrease. Approximately 84% of the 2018 and 85% of the 2019 deer harvest occurred during the four-week firearms season.



TABLE 1. STATEWIDE SEX AND AGE COMPOSITION OF THE 2018 DEER HARVEST IN MAINE BY SEASON AND WEEK.

SEASON	ADULT		FAWN		TOTAL DEER	TOTAL ANTLERLESS DEER	PERCENT BY SEASON AND WEEK		
	BUCK	DOE	BUCK	DOE			TOTAL	ADULT BUCK	ANTLERLESS
ARCHERY	853	921	191	203	2,168	1,315	7	5	9
Expanded	508	655	139	153	1,455	947	5	3	7
Oct	345	266	52	50	713	368	2	2	2
YOUTH DAY	345	436	125	124	1,030	685	3	2	5
REGULAR FIREARMS	15,858	7,716	1,999	1,672	27,245	11,387	84	87	80
Opening Sat	1,318	728	191	168	2,405	1,087	7	7	8
Oct 29 - Nov 3	2,598	1,504	366	312	4,780	2,182	15	15	15
Nov 5 - 10	2,882	1,275	371	290	4,818	1,936	15	16	14
Nov 12 - 17	4,017	1,696	448	361	6,522	2,505	20	22	17
Nov 19 - 24	5,043	2,513	623	541	8,720	3,677	27	27	26
MUZZLELOADER	1,134	614	127	128	2,003	869	6	6	6
Nov 26 - Dec 1	591	233	58	46	928	337	3	3	2
Dec 3 - 8	543	381	69	82	1,075	532	3	3	4
UNKNOWN	3	0	2	0	5	2	-	-	-
TOTAL	18,193	9,687	2,444	2,127	32,451	14,258	100	100	100

Corrections applied for errors in sex-age. Estimated error rates are applied independently for each table, so estimates will vary. 5 records with no season recorded.



Maine’s deer hunters registered 32,451 deer during the 2018 hunting seasons and 28,323 during the 2019 hunting seasons.



TABLE 1.1 STATEWIDE SEX AND AGE COMPOSITION OF THE 2019 DEER HARVEST IN MAINE BY SEASON AND WEEK.

SEASON	ADULT		FAWN		TOTAL DEER	TOTAL ANTLERLESS DEER	PERCENT BY SEASON AND WEEK		
	BUCK	DOE	BUCK	DOE			TOTAL	ADULT BUCK	ANTLERLESS
ARCHERY	979	915	116	170	2,180	1,201	7	5	14
Expanded	626	714	92	143	1,575	949	5	3	11
Oct	353	201	24	27	605	252	2	2	3
YOUTH DAY	419	285	51	45	800	381	3	2	5
REGULAR FIREARMS	17,958	4,653	832	741	24,184	6,226	86	90	75
Opening Sat	2,914	669	134	108	3,825	911	14	14	11
Nov 4 - 9	5,331	1,196	230	183	6,940	1,609	24	27	19
Nov 11 - 16	4,310	1,003	188	169	5,670	1,360	20	22	16
Nov 18 - 23	2,860	742	122	110	3,834	974	14	14	12
Nov 25 - 30	2,543	1,043	158	171	3,915	1,372	14	13	17
MUZZLELOADER	680	373	50	56	1,159	479	4	3	6
Dec 2 - 7	455	190	28	28	701	246	2	2	3
Dec 9 - 14	225	183	22	28	458	233	2	1	3
TOTAL	20,036	6,226	1,049	1,012	28,323	8,287	100	100	100

Corrections applied for errors in sex-age. Estimated error rates are applied independently for each table, so estimates will vary. 5 records with no season recorded.



2018

TABLE 2. SEX AND AGE COMPOSITION AND HARVEST TOTALS FOR THE 2018 DEER HARVEST IN MAINE BY WILDLIFE MANAGEMENT DISTRICT.

WMD	ADULT		FAWN		TOTAL		HARVEST PER 100 ADULT BUCKS		HARVEST PER 100 SQ MILES HABITAT		
	BUCK	DOE	BUCK	DOE	ANTLERLESS DEER	ALL DEER	DOES	ANTLERLESS	ADULT BUCKS	ALL	ADULT DOES
1	111	1	0	0	1	112	1	1	8	8	0
2	87	10	4	2	16	103	11	18	8	9	1
3	78	9	8	4	21	99	12	27	9	11	1
4	113	1	0	0	1	114	1	1	6	6	0
5	106	0	0	0	0	106	0	0	7	7	0
6	249	52	15	10	77	326	21	31	17	23	4
7	432	75	20	13	108	540	17	25	31	39	5
8	321	61	15	12	88	409	19	27	16	21	3
9	101	13	4	2	19	120	13	19	11	13	1
10	133	0	0	0	0	133	0	0	14	14	0
11	336	4	1	0	5	341	1	1	20	21	0
12	673	114	32	25	171	844	17	25	73	92	12
13	561	137	37	28	202	763	24	36	100	135	24
14	341	56	14	11	81	422	16	24	47	58	8
15	1,301	647	186	142	975	2,276	50	75	139	244	69
16	1,414	925	240	219	1,384	2,798	65	98	183	362	120
17	2,212	1,478	329	314	2,121	4,333	67	96	165	324	110
18	329	41	16	8	65	394	12	20	27	32	3
19	171	0	0	0	0	171	0	0	15	15	0
20	1,023	838	243	198	1,279	2,302	82	125	176	397	144
21	1,123	919	234	209	1,362	2,485	82	121	233	516	191
22	1,180	1,077	295	261	1,633	2,813	91	138	272	649	249
23	1,545	1,155	266	239	1,660	3,205	75	107	198	410	148
24	523	516	122	121	759	1,282	99	145	239	585	235
25	1,353	980	198	190	1,368	2,721	72	101	193	388	140
26	1,287	228	66	47	341	1,628	18	26	143	181	25
27	493	78	21	17	116	609	16	24	67	83	11
28	314	8	0	1	9	323	3	3	29	30	1
29	327	236	60	51	347	674	72	106	225	464	163
UNKNOWN	4		1			5					
STATEWIDE	18,241	9,659	2,427	2,124	14,209	32,451	53	78	63	113	34

Corrections applied for errors in sex-age. Estimated rates are applied independently for each table, so estimates will vary. 5 records with no WMD recorded.



2019

TABLE 2.1 SEX AND AGE COMPOSITION AND HARVEST TOTALS FOR THE 2019 DEER HARVEST IN MAINE BY WILDLIFE MANAGEMENT DISTRICT.

WMD	ADULT		FAWN		TOTAL		HARVEST PER 100 ADULT BUCKS		HARVEST PER 100 SQ MILES HABITAT		
	BUCK	DOE	BUCK	DOE	ANTLERLESS DEER	ALL DEER	ADULT DOES	ANTLERLESS	ADULT BUCKS	ALL	ADULT DOES
1	71	1	0	0	1	72	1	1	5	5	0
2	55	5	2	1	8	63	9	15	5	5	0
3	61	8	2	1	11	72	13	18	7	8	1
4	68	2	0	0	2	70	3	3	3	4	0
5	81	1	0	0	1	82	1	1	5	5	0
6	245	49	9	7	65	310	20	27	17	22	3
7	372	0	0	0	0	372	0	0	27	27	0
8	261	10	3	1	14	275	4	5	13	14	1
9	84	8	1	1	10	94	10	12	9	10	1
10	114	1	0	0	1	115	1	1	12	12	0
11	324	3	0	0	3	327	1	1	20	20	0
12	597	9	1	0	10	607	2	2	65	66	1
13	541	8	0	1	9	550	1	2	96	98	1
14	300	15	4	2	21	321	5	7	41	44	2
15	1,370	323	50	49	422	1,792	24	31	147	192	35
16	1,575	557	92	88	737	2,312	35	47	204	300	72
17	2,329	945	142	149	1,236	3,565	41	53	174	266	71
18	391	38	10	7	55	446	10	14	32	36	3
19	151	0	0	0	0	151	0	0	13	13	0
20	1,283	469	75	75	619	1,902	37	48	221	328	81
21	1,252	472	80	76	628	1,880	38	50	260	391	98
22	1,354	719	144	134	997	2,351	53	74	313	543	166
23	1,914	748	105	125	978	2,892	39	51	245	370	96
24	669	517	86	92	695	1,364	77	104	305	622	236
25	1,815	673	109	103	885	2,700	37	49	259	385	96
26	1,463	261	40	40	341	1,804	18	23	163	200	29
27	604	81	15	10	106	710	13	18	82	97	11
28	385	24	6	3	33	418	6	9	36	39	2
29	364	253	43	46	342	706	70	94	251	486	174
STATEWIDE	20,093	6,200	1,019	1,011	8,230	28,323	31	41	70	98	22

Corrections applied for errors in sex-age. Estimated rates are applied independently for each table, so estimates will vary.
5 records with no WMD recorded.



BUCK HARVEST

The statewide antlered (adult) buck harvest totaled 18,241 in 2018, a 0.2% decrease from the 2017 hunting season. In 2019, that number increased by 10.1% to 20,093 (Table 2.1). In 2018 and 2019, excluding WMD 29, the three WMDs producing the most bucks per square mile were (in descending order) districts 22, 24, and 21. In 2018, the 4th and 5th slots went to 23 and 25 respectively; and in 2019, it was reversed — 25 and 23.

ANTLERLESS HARVEST

Overall, 14,209 antlerless deer were registered by hunters in 2018 and 8,230 in 2019. In 2018, the statewide total harvest of adult (yearling and older) does was 9,659, which was above the Department's doe harvest objective of 8,759. This was the first time in over a decade that we met or exceeded our statewide doe harvest objective. Adult doe harvests have been on average ~19.5% below objective over the last decade, and the 2019 statewide harvest of adult does, at 6,200, was more on par with that pattern, falling short of the Department's doe harvest objective of 7,966.

The additional antlerless harvest was composed of 2,427 male and 2,124 female fawns in 2018 and 1,019 male and 1,011 female fawns in 2019.

YOUTH HARVEST

Youth day 2018 took place on Saturday, October 20, resulting in the harvest of 345 adult bucks and 685 antlerless deer (an overall 16% better harvest than 2017). Youth day 2019 took place on Saturday, October 26, resulting in the harvest of 419 adult bucks and 381 antlerless deer (22% less in total than in 2018).

HARVEST BY MAINE RESIDENTS

Maine residents harvested 30,319 deer in 2018 and 26,328 in 2019, representing 93% of the total deer harvest both years (Tables 3-5). Percentage of resident kills by season were: Youth Day (97.8% in 2018 and 98.3% in 2019), Archery (97.1% in 2018 and 96.8% in 2019), Muzzleloader (95.9% in 2018 and 95.3% in 2019), and Firearms (92.8% in 2018 and 92.3% in 2019, Table 3). During both years, the areas producing the most nonresident deer kills were along the western Maine-Canada border (Tables 4 and 5).

**TABLE 3. 2018 MAINE DEER HARVEST BY SEASON AND RESIDENCY.**

SEASON AND WEEK	RESIDENTS	NONRESIDENTS	UNKNOWN	TOTAL	PERCENT BY RESIDENTS
ARCHERY	2,104	62	0	2,166	97.1%
Expanded	1,418	32	0	1,450	97.8%
Oct	686	30	0	716	95.8%
YOUTH DAY	997	22	0	1,019	97.8%
REGULAR FIREARMS	25,294	1,962	2	27,258	92.8%
Opening Sat	2,412	8	0	2,420	99.7%
Oct 29 - Nov 3	4,476	300	0	4,776	93.7%
Nov 5 - 10	4,397	416	0	4,813	91.4%
Nov 12 - 17	5,816	707	0	6,523	89.2%
Nov 19 - 24	8,193	531	2	8,726	93.9%
MUZZLELOADER	1,922	81	0	2,003	95.9%
Nov 26 - Dec 1	871	57	0	928	93.9%
Dec 3 - 8	1,051	24	0	1,075	97.8%
UNKNOWN	2	3	0	5	-
TOTAL	30,319	2,130	2	32,451	93.4%



2019

TABLE 3.1 2019 MAINE DEER HARVEST BY SEASON AND RESIDENCY.

SEASON AND WEEK	RESIDENTS	NONRESIDENTS	UNKNOWN	TOTAL	PERCENT BY RESIDENTS
ARCHERY	2,110	69	1	2,180	96.8%
Expanded	1,533	41	1	1,575	97.3%
Oct	577	28	0	605	95.4%
YOUTH DAY	786	14	0	800	98.3%
REGULAR FIREARMS	22,327	1,852	5	24,184	92.3%
Opening Sat	3,807	17	1	3,825	99.5%
Nov 4 - 9	6,329	610	1	6,940	91.2%
Nov 11 - 16	5,137	532	1	5,670	90.6%
Nov 18 - 23	3,435	397	2	3,834	89.6%
Nov 25 - 30	3,619	296	0	3,915	92.4%
MUZZLELOADER	1,105	54	0	1,159	95.3%
Dec 2 - 7	658	43	0	701	93.9%
Dec 9 - 14	447	11	0	458	97.6%
TOTAL	26,328	1,989	6	28,323	93.0%



2018

TABLE 4. 2018 MAINE DEER HARVEST BY COUNTY AND RESIDENCY.

COUNTY OF KILL	RESIDENTS	NONRESIDENTS	UNKNOWN	TOTAL	PERCENT BY RESIDENTS
ANDROSCOGGIN	2,077	32	0	2,109	98.5%
AROOSTOOK	796	127	0	923	86.2%
CUMBERLAND	2,566	78	1	2,645	97.0%
FRANKLIN	1,236	142	0	1,378	89.7%
HANCOCK	1,219	49	0	1,268	96.1%
KENNEBEC	3,399	106	0	3,505	97.0%
KNOX	1,458	59	0	1,517	96.1%
LINCOLN	1,170	24	0	1,194	98.0%
OXFORD	2,021	319	0	2,340	86.4%
PENOBSCOT	3,213	223	1	3,437	93.5%
PISCATAQUIS	987	207	0	1,194	82.7%
SAGADAHOC	1,285	20	0	1,305	98.5%
SOMERSET	2,794	381	0	3,175	88.0%
WALDO	1,968	130	0	2,098	93.8%
WASHINGTON	886	48	0	934	94.9%
YORK	3,241	182	0	3,423	94.7%
UNKNOWN	3	3	0	6	-
TOTAL	30,319	2,130	2	32,451	93.4%



2019

TABLE 4.1 2019 MAINE DEER HARVEST BY COUNTY AND RESIDENCY.

COUNTY OF KILL	RESIDENTS	NONRESIDENTS	UNKNOWN	TOTAL	PERCENT BY RESIDENTS
ANDROSCOGGIN	1,607	36	0	1,643	97.8%
AROOSTOOK	678	109	1	788	86.0%
CUMBERLAND	2,223	65	2	2,290	97.1%
FRANKLIN	893	128	0	1,021	87.5%
HANCOCK	1,400	66	0	1,466	95.5%
KENNEBEC	2,879	101	0	2,980	96.6%
KNOX	1,397	65	1	1,463	95.5%
LINCOLN	1,129	33	0	1,162	97.2%
OXFORD	1,522	250	1	1,773	85.8%
PENOBSCOT	2,847	220	0	3,067	92.8%
PISCATAQUIS	739	166	0	905	81.7%
SAGADAHOC	1,118	27	0	1,145	97.6%
SOMERSET	2,183	323	0	2,506	87.1%
WALDO	1,927	182	0	2,109	91.4%
WASHINGTON	1,024	58	0	1,082	94.6%
YORK	2,762	160	1	2,923	94.5%
TOTAL	26,328	1,989	6	28,323	93.0%



2018

TABLE 5. 2018 MAINE DEER HARVEST BY WILDLIFE MANAGEMENT DISTRICT AND RESIDENCY.

WMD	RESIDENTS		NONRESIDENTS		UNKNOWN	TOTAL
	NUMBER	PERCENT	NUMBER	PERCENT		
1	76	67.9%	36	32.1%	0	112
2	83	80.6%	20	19.4%	0	103
3	95	96.0%	4	4.0%	0	99
4	68	59.6%	46	40.4%	0	114
5	71	67.0%	35	33.0%	0	106
6	314	96.3%	12	3.7%	0	326
7	342	63.3%	198	36.7%	0	540
8	266	65.0%	143	35.0%	0	409
9	89	74.2%	31	25.8%	0	120
10	111	83.5%	22	16.5%	0	133
11	282	82.7%	59	17.3%	0	341
12	755	89.5%	89	10.5%	0	844
13	701	91.9%	62	8.1%	0	763
14	349	82.7%	73	17.3%	0	422
15	2,098	92.2%	177	7.8%	1	2,276
16	2,706	96.7%	92	3.3%	0	2,798
17	3,976	91.8%	357	8.2%	0	4,333
18	370	93.9%	24	6.1%	0	394
19	145	84.8%	26	15.2%	0	171
20	2,159	93.8%	143	6.2%	0	2,302
21	2,439	98.1%	46	1.9%	0	2,485
22	2,772	98.5%	41	1.5%	0	2,813
23	3,030	94.5%	175	5.5%	0	3,205
24	1,251	97.6%	31	2.4%	0	1,282
25	2,636	96.9%	85	3.1%	0	2,721
26	1,590	97.7%	37	2.3%	1	1,628
27	594	97.5%	15	2.5%	0	609
28	309	95.7%	14	4.3%	0	323
29	640	95.0%	34	5.0%	0	674
UNKNOWN	2	-	3	-	0	5
TOTAL	30,319	93.4%	2,130	6.6%	2	32,451



2019

TABLE 5.1 2019 MAINE DEER HARVEST BY WILDLIFE MANAGEMENT DISTRICT AND RESIDENCY.

WMD	RESIDENTS		NONRESIDENTS		UNKNOWN	TOTAL
	NUMBER	PERCENT	NUMBER	PERCENT		
1	51	70.8%	21	29.2%		72
2	54	85.7%	9	14.3%		63
3	72	100.0%		0.0%		72
4	38	54.3%	32	45.7%		70
5	49	59.8%	33	40.2%		82
6	288	92.9%	22	7.1%		310
7	230	61.8%	142	38.2%		372
8	163	59.3%	112	40.7%		275
9	70	74.5%	24	25.5%		94
10	97	84.3%	18	15.7%		115
11	266	81.3%	60	18.3%	1	327
12	549	90.4%	58	9.6%		607
13	474	86.2%	76	13.8%		550
14	260	81.0%	61	19.0%		321
15	1,619	90.3%	172	9.6%	1	1,792
16	2,210	95.6%	102	4.4%		2,312
17	3,261	91.5%	304	8.5%		3,565
18	406	91.0%	40	9.0%		446
19	134	88.7%	17	11.3%		151
20	1,783	93.7%	118	6.2%	1	1,902
21	1,852	98.5%	26	1.4%	2	1,880
22	2,305	98.0%	46	2.0%		2,351
23	2,669	92.3%	223	7.7%		2,892
24	1,332	97.7%	32	2.3%		1,364
25	2,594	96.1%	105	3.9%	1	2,700
26	1,744	96.7%	60	3.3%		1,804
27	688	96.9%	22	3.1%		710
28	400	95.7%	18	4.3%		418
29	670	94.9%	36	5.1%		706
TOTAL	26,328	93.0%	1,989	7.0%	2	28,323

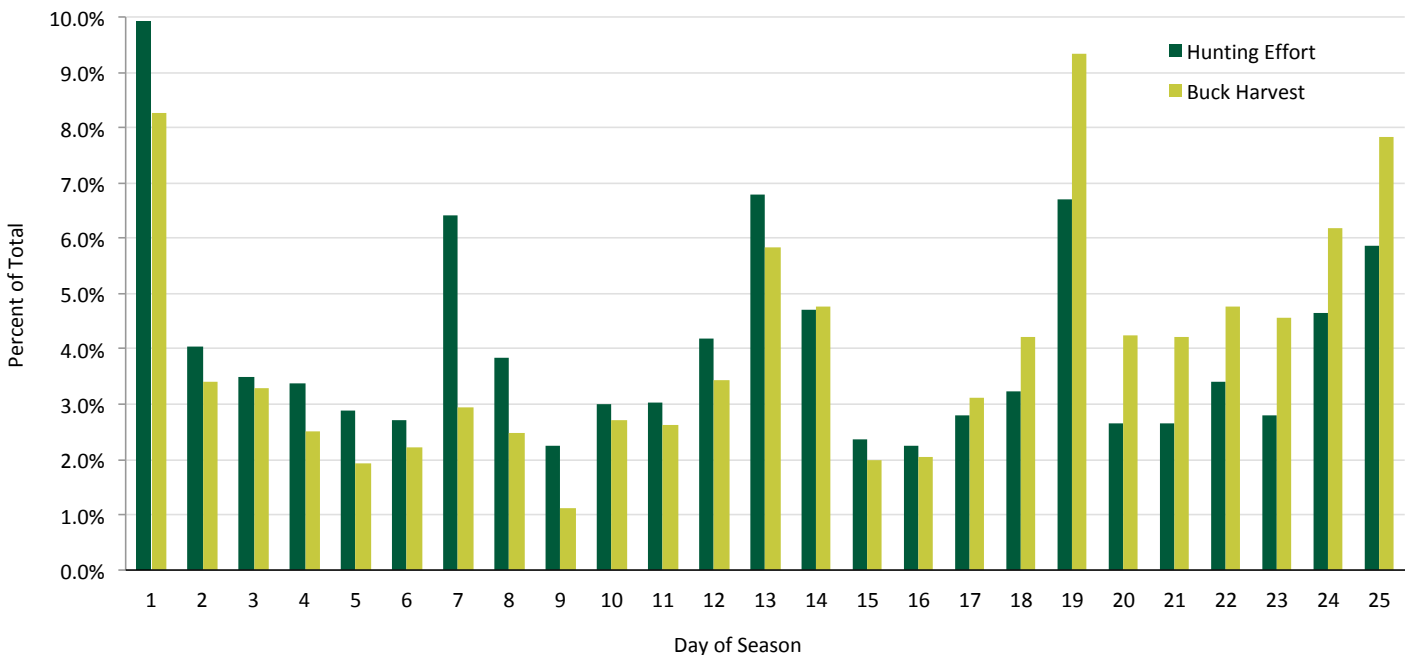


HUNTER PARTICIPATION

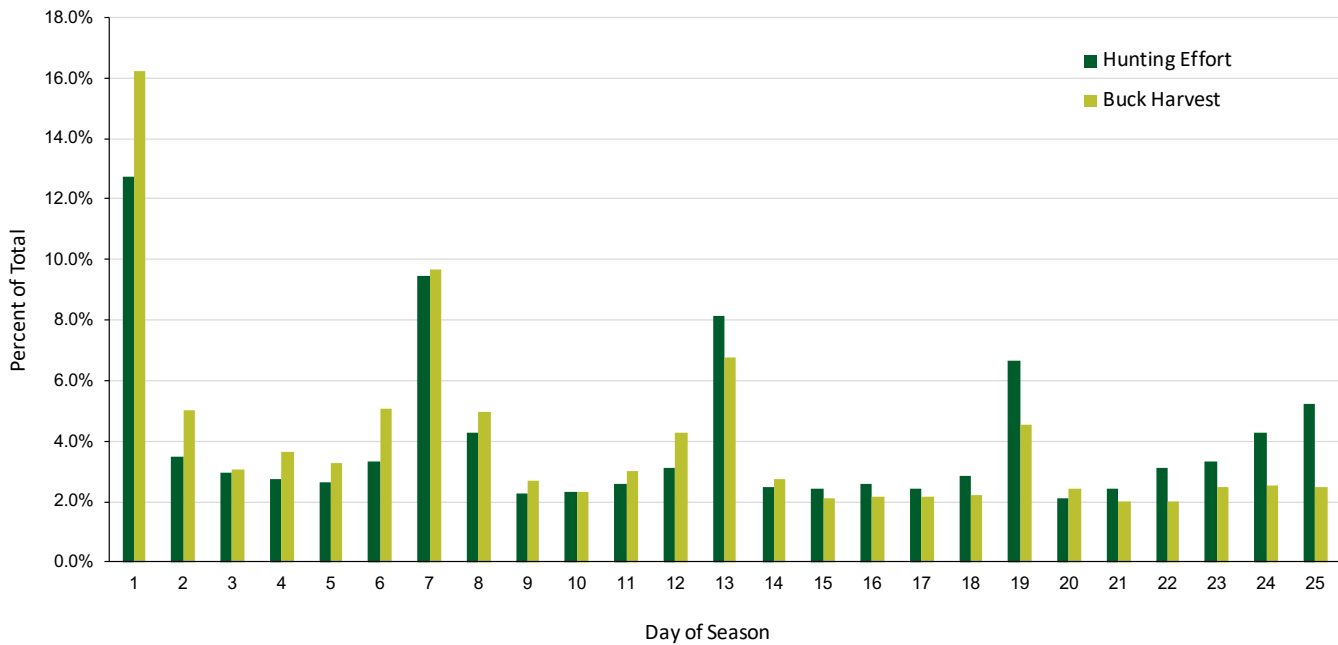
In 2018, there were 208,692 hunters in possession of an appropriate license to hunt deer. This was a 0.6% decline from 2017. Roughly 12% of these licenses belonged to nonresident or alien hunters. An estimated 168,000 hunters hunted deer statewide in 2018, which means hunter density statewide was ~5.8 hunters per square mile of deer habitat. Note that not all hunters that purchase a license or otherwise possess a license choose to hunt. During the 2018 regular firearms season for deer, Maine deer hunters spent an average of 8.4 days and 4.3 hours per day pursuing deer. This means that the average hunter spent ~36 hours in the field pursuing deer during the firearms season. Distribution of effort was slightly unusual in 2018, likely owing to heavy precipitation events on several Saturdays early in the season (Figure 1). Relative to the amount of effort invested, harvest was lower than usual for the first few Saturdays. Ideal conditions later in the season led to an increase in harvest relative to effort during the last week and a half of the season.

During the regular firearms season for deer, Maine deer hunters spent an average of 6.9 days and 4.9 hours per day pursuing deer. This means that the average hunter spent ~34 hours in the field pursuing deer during the firearms season. Distribution of effort followed a typical pattern with high hunting effort resulting in high buck harvest (Figure 1.1). Of note, however, the buck harvest relative to effort invested was higher than usual on Residents' Day with just under 13% of hunting effort resulting in over 16% of the total buck harvest during the firearms season. Buck harvest relative to effort invested was also a bit lower than usual over the Thanksgiving weekend. We typically see increased harvest over this holiday, but that was not the case in 2019.

2018 **FIGURE 1. PERCENTAGE OF HUNTING EFFORT (HOURS) AND BUCK HARVEST BY DAY DURING MAINE'S 2018 REGULAR FIREARMS SEASON FOR DEER. DAYS 1, 7, 13, 19, AND 25 WERE SATURDAYS.**



2019 **FIGURE 1.1 PERCENTAGE OF HUNTING EFFORT (HOURS) AND BUCK HARVEST BY DAY DURING MAINE'S 2019 REGULAR FIREARMS SEASON FOR DEER. DAYS 1, 7, 13, 19, AND 25 WERE SATURDAYS.**



BIOLOGICAL DATA

MDIFW sampled more than 8,146 white-tailed deer during the 2018 hunting season and 6,693 during the 2019 season to assess the status and health of the state’s deer populations. Some of the characteristics we monitored included yearling antler beam diameters (YABD), yearling frequencies in the harvest, age structure, estimated sex ratios, and mortality rates.

The antler diameter of yearling bucks in a WMD can help us identify when white-tailed deer have become overly abundant in that district. When there are too many deer in an area, the amount of forage available decreases, limiting availability of preferred foods and preventing deer from achieving optimum nutrition and peak antler growth. An average antler beam diameter between 15.5 to 16.8 mm indicates that a deer population is likely in balance with the availability of forage. If measurements are larger, there is enough forage available for the population to grow. If the measurements are smaller, the animals have become too abundant in the WMD and have reduced the availability of quality forage.

In 2018, Maine’s yearling bucks expressed overall good health with a statewide average beam diameter of 17.7 mm and WMD averages between 16.1 mm to 18.8 mm. The same was true in 2019, with yearling bucks showing a statewide average beam diameter of 16.3 mm and YABD ranging between 15.7 and 18.4 in WMDs with at least 20 samples.

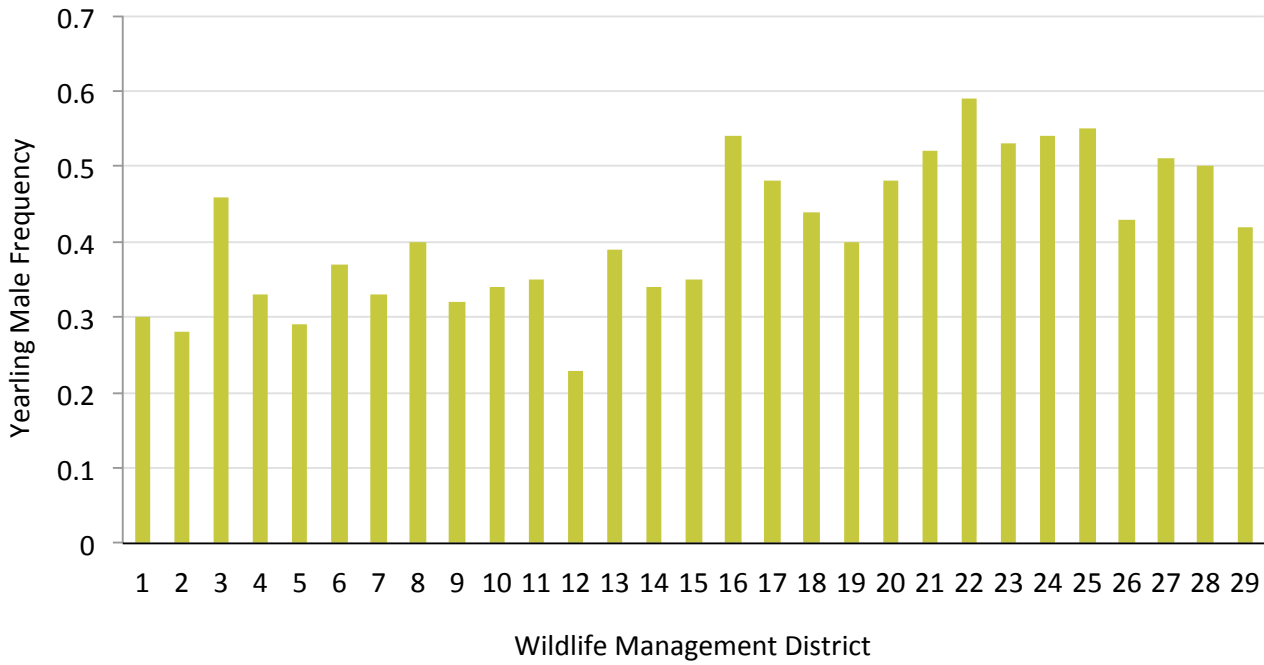
Research has shown that the percentage of yearling bucks within the adult buck harvest can be used as an estimate of all-cause annual mortality for male white-tailed deer. Statewide in 2018, 40% of the male harvest was made up of yearling bucks (Figure 2). Statewide in 2019, 36% of the male harvest was comprised of yearling bucks with yearling buck percent ranging from 25% in WMD 12 to 58% in WMD 22 (Figure 2.1). Because data are often limited, particularly in northern WMDs, pooled data may be used. Increased confidence in yearling frequencies and advanced age structure data is obtained by extracting incisor teeth from a sub-sample of deer throughout the state. Most of these teeth are analyzed to determine precise age in a laboratory, and these results typically take ~6 months to produce.

MDIFW monitors sex ratios (doe:buck) in all Maine WMDs. A sex ratio skewed towards does can be preferable in areas of desired population growth, but breeding success may begin to decline if the doe:buck ratio exceeds ~4:1. In 2018, Maine’s WMDs averaged 1.9 adult does per adult buck and ranged from 1.1 to 3.1 (Figure 3). In 2019, estimated sex ratios in Maine’s WMDs ranged from 1.0 to 3.0 (Figure 3.1). Weighted by proportion of harvest in each WMD, Maine’s statewide adult doe:adult buck ratio was ~2.3 to 1 in 2018 and ~2.2 to 1 in 2019.



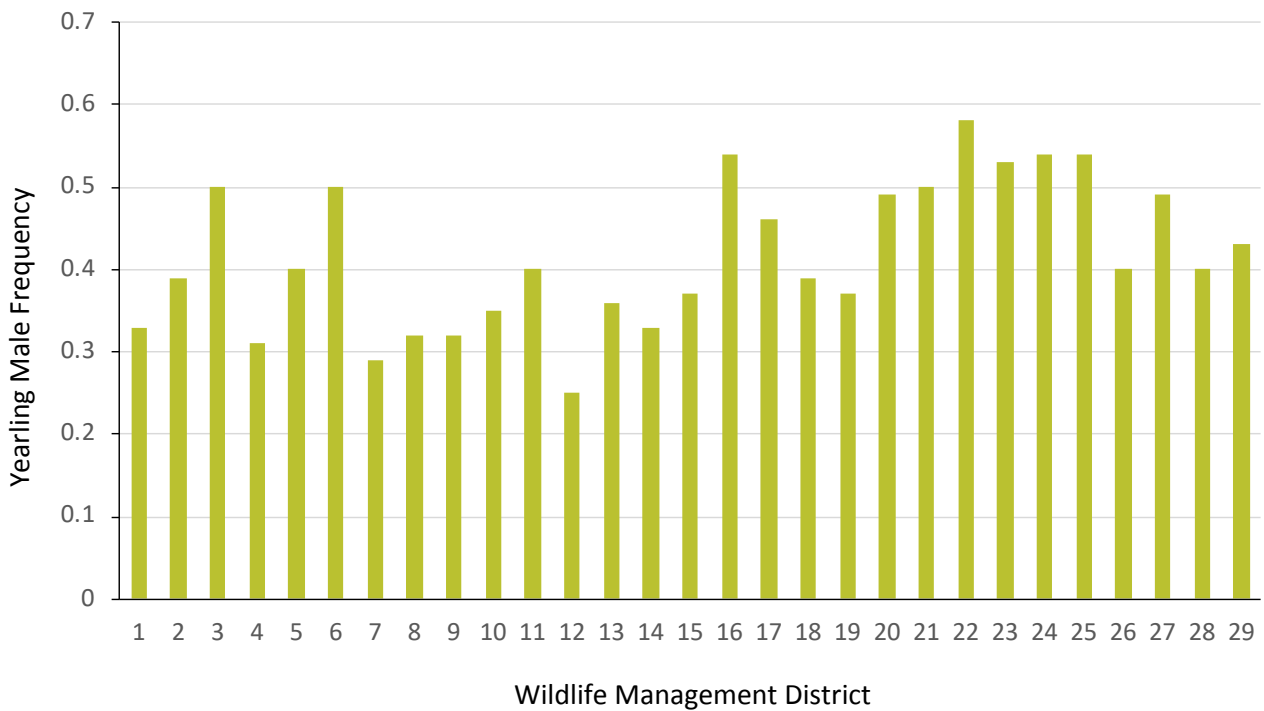
♂ 2018

FIGURE 2. YEARLING MALE FREQUENCY IN THE 2018 DEER HARVEST IN MAINE.



♂ 2019

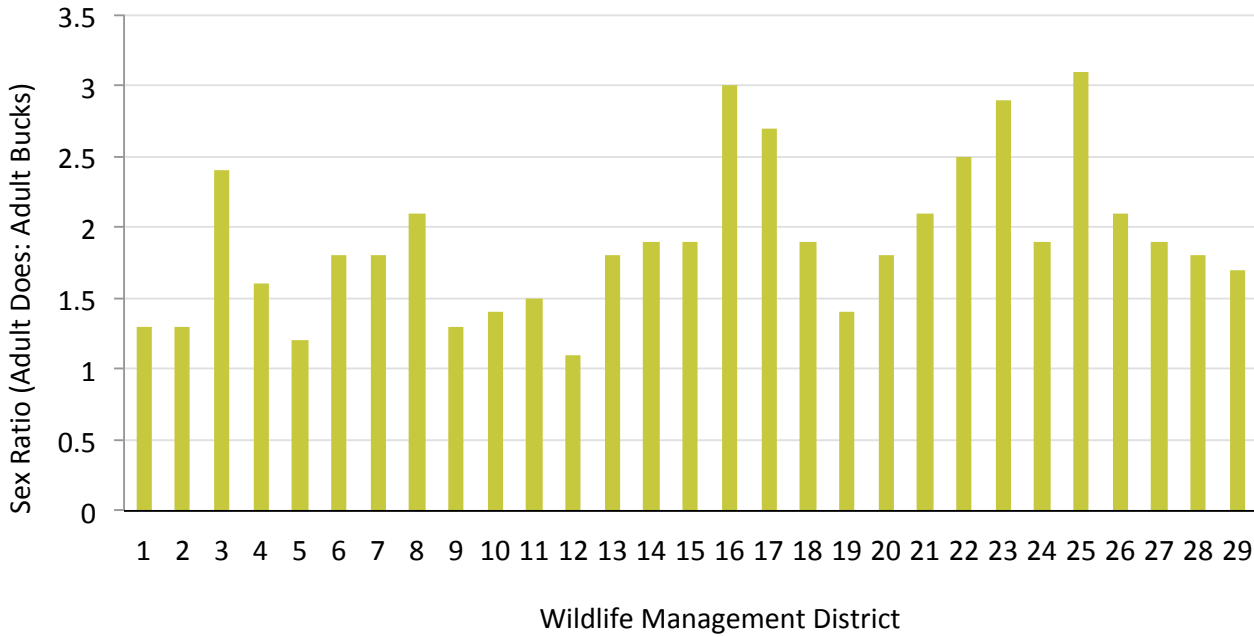
FIGURE 2.1. YEARLING MALE FREQUENCY IN THE 2019 DEER HARVEST IN MAINE.





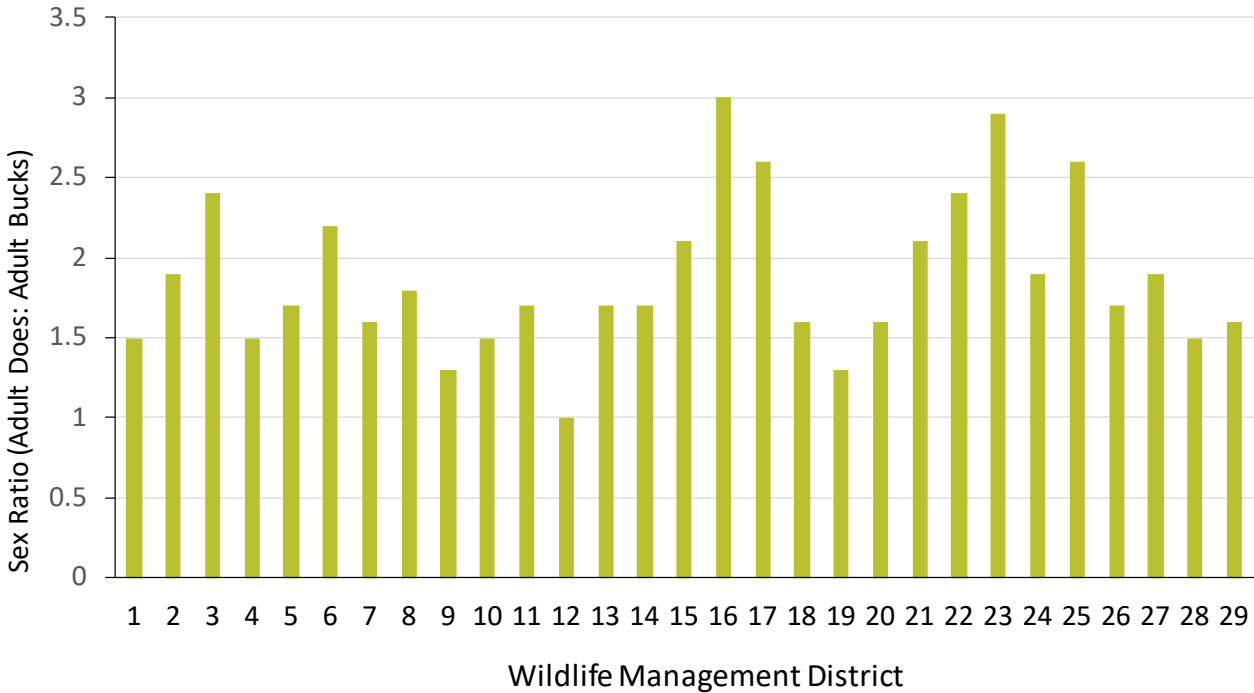
2018

FIGURE 3. ESTIMATED SEX RATIO OF DEER IN MAINE'S WILDLIFE MANAGEMENT DISTRICTS IN 2018.



2019

FIGURE 3.1 ESTIMATED SEX RATIO OF DEER IN MAINE'S WILDLIFE MANAGEMENT DISTRICTS IN 2019.

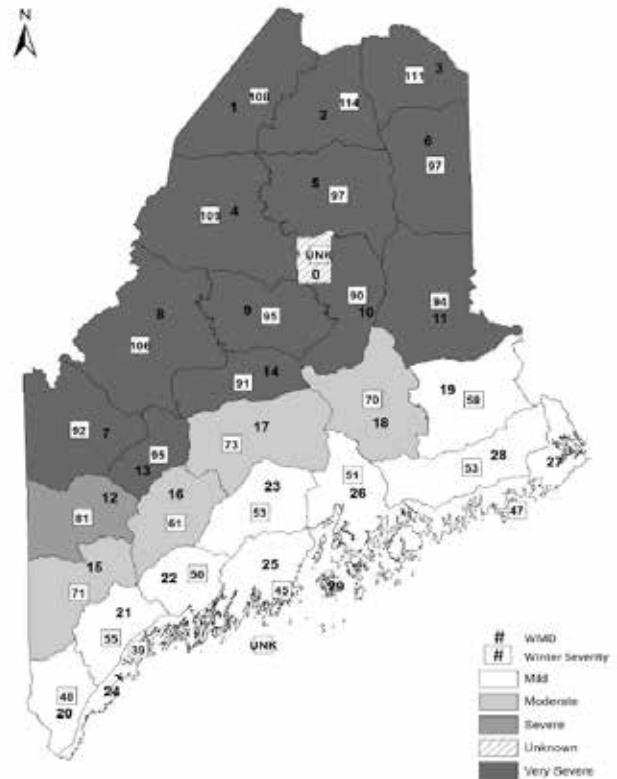


WINTER SEVERITY

Each year, MDIFW monitors temperature, snow depth, and deer sinking depth at monitoring stations around the state. This information is used to calculate a winter severity index (WSI) for each WMD in the state. Past MDIFW research has related WSI to observed winter mortality rates (WMR) in deer by conducting dead deer surveys in deer wintering areas, and this relationship between WSI and WMR is one consideration made each year when issuing ADP.

The statewide WSI for 2018-2019 was 77, which ranks in our severe winter category (Mild < 60, Moderate 60-74, Severe 75-89, Very Severe 90+). Variation between WMDs was very high this winter with our highest WSI value being recorded in WMD 2 where WSI was 114 and our lowest value recorded in WMD 24 where WSI was 39. WSI was in the very severe category in the northern half of the state and moderated south through Maine where much of southern and coastal Maine experienced mild winter conditions.

FIGURE 4. WINTER SEVERITY INDEX (WSI) VALUES FOR MAINE WMDs THROUGH THE 2018-2019 WINTER.





Deer Winter Mortality Study

Background

Since 2015, MDIFW has been capturing and GPS-collaring white-tailed deer to monitor survival rates and impacts of winter severity, movements, and causes of mortality. The study has grown over the years and now includes four study sites: WMD 1 near Allagash, WMD 5 near the Scraggly Lake Maine Public Reserved Land, WMD 6 throughout, and WMD 17 throughout. Achieving a better understanding of how environmental factors influence deer survival through winter will aid MDIFW in decision making and permit allocation processes each year.

Progress

To date, 204 unique deer have been collared: 42 in WMD 1, 10 in WMD 5, 83 in WMD 6, and 69 in WMD 17. The 2019-2020 season was the sixth year for the project.

During the past two seasons, efforts have been focused in WMDs 1, 5, and 6. 2018-2019 marked the first season of capture in WMD 5, where crews spent ~1 month exploring the study site, assessing its suitability for capture, and conducting preliminary capture efforts. The WMD 5 site was added to bolster the number of study animals that do not receive any sort of supplemental feed during the winter (deer in our WMD 6 and 17 study sites have access to supplemental feed in winter, typically from wildlife feeders or crop spillage).

In 2019-2020, we spent one week in December in WMD 6 and deployed 13 collars there with a small team. After the remainder of the team arrived to work for the season, we focused our efforts on WMDs 1 and 5, continuing trapping activities through late March. We collared 20 new deer in WMD 1 and 20 in WMD 5 as well.

Capture efforts will likely conclude next year when we wrap up work in WMD 5. It has proven difficult to achieve desired sample sizes in WMDs 1 and 5, so capture efforts will focus on these study sites for the remainder of the study.

Disease Monitoring in Maine's Deer and Moose

Chronic Wasting Disease

BACKGROUND

Chronic wasting disease (CWD) is a fatal brain disease that impacts white-tailed deer, mule deer, caribou, moose, and

elk. It is similar to mad cow disease, which occurs in cattle, and it has a 100% mortality rate in deer.

CWD has been found in wild deer populations in 24 U.S. states and two Canadian provinces, but it has not yet been found in Maine. CWD can persist in the environment outside of a host for many years, and recent research has shown that plants can uptake the disease agent and subsequently become a potential disease vector.

There is currently no evidence that CWD can or has been transferred to humans, but similar diseases in humans do exist, and the disease has been transmitted to primates in a laboratory setting.

WHAT MDIFW IS DOING

MDIFW has monitored white-tailed deer for CWD since 1999, during which time we have screened over 11,000 wild deer. In 2019, we collected 524 samples for lab testing: 499 from white-tailed deer, 21 from moose, and 4 from miscellaneous cervids. As a precaution, MDIFW does not translocate deer from other states into Maine, and we prohibit the transportation of unprocessed deer carcasses and/or parts into Maine from all states and provinces other than New Hampshire. MDIFW is currently drafting a response plan for CWD, which will outline steps and protocols to follow if CWD is detected in an adjacent jurisdiction or in Maine.

WHAT YOU CAN DO

Prevent the spread: You can help prevent the spread of disease in the deer population by using multiple small feed sites if you feed deer, and by relocating these sites periodically. Also, refrain from using urine-based lures, and instead use an alternative such as synthetic urine.

Report the signs: Contact your regional wildlife biologist or warden if an animal shows clinical signs of illness, such as loss of fear of humans, drooling, and/or excessive weight loss.

Protect yourself: When processing a harvested deer, take precautionary steps such as using latex gloves and sterilizing your equipment afterward. Also, avoid consuming the brain and spinal tissues. Even though CWD has not yet been identified in humans, these steps reduce the risk of transmitting any cervid-borne disease

This work is supported by the federal Pittman-Robertson program, state revenues from the sales of hunting licenses, and volunteer assistance.



MOOSE

Lee Kantar

2018-2019 Moose Harvest

Season Dates and Structure

The 2018 and 2019 season frameworks allowed Maine moose hunters to hunt for six days either in September and October.





Season Dates

2018

WMDs 1-6

Sep 24-29

Oct 8-13

Oct 22-27

WMDs 15-16

Oct 27*-Nov 24

2019

WMDs 1-6

Sep 23-28

Oct 14-19

Oct 28-Nov 2

WMDs 15-16

Nov 2*-Nov 30

Statistics

2018

1,888
moose were
registered

2019

1,949
moose were
registered

Moose Permits and Applicants

TOTAL MOOSE PERMITS

The annual allocation of moose hunting permits is developed in response to the Big Game Management Plan (BGMP) for moose. Permit levels changed in 11 WMDs from 2017 to 2018, resulting in an increase of 420 permits issued statewide (2,500 total). From 2018 to 2019, they also changed in 11 WMDs, resulting in an increase of 320 permits issued statewide (2,820 total). Permit changes reflect the implementation of the BGMP which includes an increase in cow permits in the core range to promote a healthier moose population, additional WMDs open during the September season, and increased bull-hunting opportunity in the northwest portion of the core range.

Moose hunting permits are allocated to qualified applicants in a random computerized lottery, and additional permits may be issued to prior-year permittees who deferred a year due to illness, armed service, or similar situations

ANTLERLESS-ONLY PERMITS (AOPS)

In 2018, a total of 450 Antlerless-Only Permits (AOPs) were allotted to six WMDs (1-6). In 2019, a total of 650 AOPs were allocated to the same six WMDs.

Moose health is directly tied to the productivity of cows. A healthier moose population has heavier cows that reproduce at an earlier age, reproduce more frequently, and have a higher probability of calving twins. Over the last 30 years, productivity in Maine moose has declined. Moose populations that exist at lower densities tend to have higher rates of productivity.

ANY-MOOSE PERMITS (AMPS)

Any-moose Permits (AMPs; bull, cow or calf) are allocated to areas of southern Maine where moose densities are lower and allow for a small harvest. To honor southern Maine landowners' recommendations, this season coincides with the November firearms season for deer.



Statewide Statistics for 2018 and 2019

1,888 moose were registered in 2018 (Table 1) and 1,949 were registered in 2019 (Table 1.1).



2018

TABLE 1. 2018 MAINE MOOSE SEASON REGISTERED KILL BY WMD, SEASON, PERMIT TYPE, AND SUCCESS RATE.

WMD	SEASON	PERMIT TYPE	# OF PERMITS	2018 REGISTRATIONS		WMD	SEASON	PERMIT TYPE	# OF PERMITS	2018 REGISTRATIONS	
				KILL	SUCCESS RATE					KILL	SUCCESS RATE
1	SEP	BOP	150	130	87%	10	SEP	BOP	30	21	70%
	OCT	BOP	150	128	85%		OCT	BOP	30	17	57%
	2nd OCT	AOP	100	86	86%		*WMD Subtotals		60	38	63%
	*WMD Subtotals		400	344	86%		SEP	BOP	25	18	72%
2	SEP	BOP	125	104	83%	11	OCT	BOP	25	22	88%
	OCT	BOP	125	98	78%		*WMD Subtotals		50	40	80%
	2nd OCT	AOP	100	80	80%		12	OCT	BOP	35	23
	*WMD Subtotals		350	282	81%	*WMD Subtotals			35	23	66%
3	SEP	BOP	75	64	85%	13	OCT	BOP	35	11	31%
	OCT	BOP	75	64	85%		*WMD Subtotals		35	11	31%
	2nd OCT	AOP	75	65	87%		14	OCT	BOP	35	21
	*WMD Subtotals		225	193	86%	WMD Subtotals			35	21	60%
4	SEP	BOP	150	116	77%	15	NOV	AMP-B		3	NA
	OCT	BOP	100	71	71%		NOV	AMP-C		3	NA
	2nd OCT	AOP	100	78	78%		WMD Subtotals		25	6	24%
	*WMD Subtotals		350	265	76%	16	NOV	AMP-B		1	NA
SEP	BOP	100	86	86%	NOV		AMP-C		0	NA	
OCT	BOP	50	37	74%	WMD Subtotals			20	1	5%	
5	2nd OCT	AOP	50	34	68%	17	OCT	BOP	20	6	30%
	*WMD Subtotals		200	157	79%		WMD Subtotals		20	6	30%
	SEP	BOP	100	80	80%		18	SEP	BOP	20	12
	OCT	BOP	50	37	74%	OCT		BOP	20	12	60%
2nd OCT	AOP	25	19	76%	*WMD Subtotals			40	24	60%	
*WMD Subtotals		175	136	78%	19	SEP	BOP	45	25	56%	
OCT	BOP	125	94	75%		OCT	BOP	30	12	40%	
*WMD Subtotals		125	94	75%		*WMD Subtotals		75	37	49%	
8	OCT	BOP	175	140	80%	27/28	SEP	BOP	15	9	60%
	*WMD Subtotals		175	140	80%		OCT	BOP	15	5	33%
9	OCT	BOP	75	56	75%	WMD Subtotals		30	14	47%	
	WMD Subtotals		75	56	75%	OVERALL WMD TOTALS		2,500	1,888	76%	

BOP = Bull Only Permit – The holder may kill one male moose of any age.
 AOP = Antlerless Only Permit – The holder may kill a cow, a calf, or a bull w/antlers shorter than its ears.
 AMP = Any Moose Permit – The holder may kill any moose.
 *Does not include additions to total permit allocation through deferment, hunt of a lifetime, and auction.



2019

TABLE 1.1 2019 MAINE MOOSE SEASON REGISTERED KILL BY WMD, SEASON, PERMIT TYPE, AND SUCCESS RATE.

WMD	SEASON	PERMIT TYPE	# OF PERMITS	2019 REGISTRATIONS	
				KILL	SUCCESS RATE
1	SEP	BOP	175	105	60%
	OCT	BOP	175	125	71%
	2nd OCT	AOP	125	95	76%
	*WMD Subtotals		475	325	68%
2	SEP	BOP	125	88	70%
	OCT	BOP	125	101	81%
	2nd OCT	AOP	125	95	76%
	*WMD Subtotals		375	284	76%
3	SEP	BOP	75	53	71%
	OCT	BOP	75	66	88%
	2nd OCT	AOP	100	69	69%
	*WMD Subtotals		250	188	75%
4	SEP	BOP	150	92	61%
	OCT	BOP	150	96	64%
	2nd OCT	AOP	150	80	53%
	*WMD Subtotals		450	268	60%
5	SEP	BOP	100	83	83%
	OCT	BOP	100	78	78%
	2nd OCT	AOP	100	59	59%
	*WMD Subtotals		300	220	73%
6	SEP	BOP	100	67	67%
	OCT	BOP	50	39	78%
	2nd OCT	AOP	50	35	70%
	*WMD Subtotals		200	141	71%
7	OCT	BOP	125	93	74%
	*WMD Subtotals		125	93	74%
8	OCT	BOP	175	125	71%
	*WMD Subtotals		175	125	71%
9	OCT	BOP	100	83	83%
	WMD Subtotals		100	83	83%
10	SEP	BOP	30	22	73%
	OCT	BOP	30	23	77%
	*WMD Subtotals		60	45	75%
11	SEP	BOP	25	11	44%
	OCT	BOP	25	21	84%
	*WMD Subtotals		50	32	64%
12	OCT	BOP	25	15	60%
	*WMD Subtotals		25	15	60%
13	OCT	BOP	15	8	53%
	*WMD Subtotals		15	8	53%
14	OCT	BOP	30	25	83%
	WMD Subtotals		30	25	83%
15	NOV	AMP-B		2	NA
	NOV	AMP-C		3	NA
	WMD Subtotals		25	5	20%
16	NOV	AMP-B		2	NA
	NOV	AMP-C		2	NA
	WMD Subtotals		15	4	27%
17	OCT	BOP	10	7	70%
	WMD Subtotals		10	7	70%
18	SEP	BOP	20	10	50%
	OCT	BOP	20	10	50%
	*WMD Subtotals		40	20	50%
19	SEP	BOP	30	20	67%
	OCT	BOP	30	21	70%
	*WMD Subtotals		60	41	68%
27/28	SEP	BOP	20	9	45%
	OCT	BOP	20	10	50%
	WMD Subtotals		40	19	48%
OVERALL WMD TOTALS			2,820	1,948	69%

1 Bull was registered with no data for total harvest = 1,949

BOP = Bull Only Permit – The holder may kill one male moose of any age.

AOP = Antlerless Only Permit – The holder may kill a cow, a calf, or a bull w/antlers shorter than its ears.

AMP = Any Moose Permit – The holder may kill any moose.

*Does not include additions to total permit allocation through deferment, hunt of a lifetime, and auction.

2018-2019 Bull Harvest

TOTAL HARVEST, AGE DISTRIBUTION

Among the 1,541 antlered bulls killed during the Sept/Oct 2018 season (a total of 203 more than the 2017 harvest of 1,338), biologists aged 1,377 of them by counting the cementum annuli on a tooth extracted from the animal.

Ages were distributed as follows:

- 1½ years old (yearlings sporting their first set of antlers): 12% (171)
- 2½ years old: 24% (328)
- 3½ years old: 13% (178)
- Mature bulls (aged at 4½ to 18½ years): 40% (700)

Among the 1,519 antlered bulls killed during the Sept/Oct 2019 season (a total of 22 less than the 2018 harvest of 1,541), biologists aged 1,308 of them by counting the cementum annuli on a tooth extracted from the animal.

Ages were distributed as follows:

- 1½ years old (yearlings sporting their first set of antlers): 6% (76)
- 2½ years old: 25% (330)
- 3½ years old: 19% (246)
- Mature bulls (aged at 4½ to 18½ years): 34% (655)

AVERAGE WEIGHT

On average, breeding bulls lose approximately 15% of their body mass during the rut (September to October). In 2018, this translated to an 8% decrease in average dressed weights from the September to October seasons (715 in Sept. vs. 657 in Oct.). In 2019, the decrease was 9% (714 in Sept. vs. 647 in Oct.).

RECORD WEIGHT

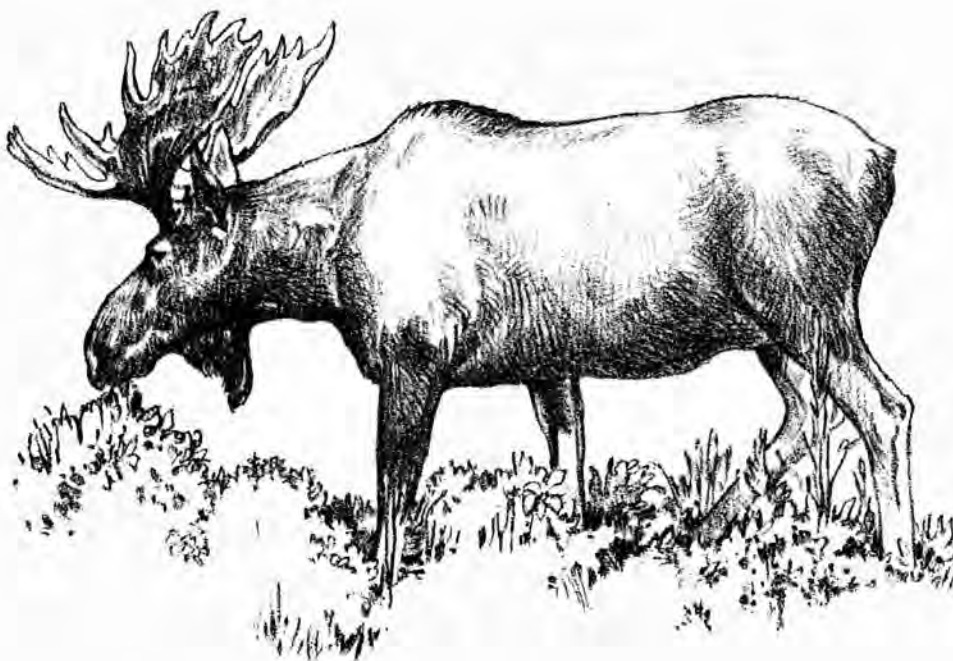
In 2018, the heaviest bull weighed in at 1,077 lbs. field dressed (no digestive tract, heart, lungs, or liver). He was 5½ years old and was killed in WMD 18 during the September season. In 2019, the heaviest bull was 1,011 lbs. field dressed. He was 9½ years old and was killed in WMD 3 during the September season.

RECORD ANTLER SPREAD

In 2018, the largest antler spread was 67 inches with 15 legal points. He was 8½ years old. In 2019, the largest antler spread was 67 inches with 24 legal points. He was 12½ years old.

ANTLER STATS

In 2018, 16% of the antlered bulls sported cervicorn antlers (antlers without a defined palm), 50% were yearlings, and 11% were mature bulls (>4 years old). The oldest was 11½ years old. In 2019, 23% of the antlered bulls had cervicorn antlers, 33% were yearlings, and 21% were mature bulls (>4 years old). The oldest was 12½ years old.





Antlerless Harvest

TOTAL HARVEST

In 2018, the statewide harvest of adult (yearling and older) cows was 343 (up from 149 in 2017). In addition, 24 calves (15 males and 9 females) were harvested for a total harvest of 367 antlerless moose, including those taken as part of the AMPs issued within the southern zones.

In 2019, the statewide harvest of adult (yearling and older) cows was 383 (just slightly higher than 2018). In addition, 47 calves (26 males and 21 females) were harvested for a total harvest of 430 antlerless moose, including those taken as part of the AMPs issued within the southern zones.

MOOSE REPRODUCTIVE DATA

Antlerless permits during the second October season allow MDIFW to collect reproductive data critical to assessing and monitoring moose population health and growth. In 2018, hunters in WMDs 1-6 removed and brought in 117 sets of moose ovaries for examination by biological staff. In 2019, they brought in 110.

Typically, a moose cow does not become pregnant until 2½ years old. At that point, her fertility and the number of offspring she will produce depend upon her body weight and condition – factors influenced strongly by diseases, parasites such as the winter tick, and the amount of available forage (food).

Of the cow moose examined in 2018 that were older than 2½ years, 83% were pregnant. In 2019, 95% were.

MDIFW biologists can forecast a cow's reproduction rates by looking at corpora lutea, which are identifiable structures within the ovaries that indicate ovulation and potential pregnancy rates. In 2018, there were 0.85 corpora lutea per cow for cows older than 3½ years – a significant decline from 2017 representing poor reproductive rates (number of calves being born to a cow). In 2019, the number increased significantly to 1.03 corpora lutea per cow for cows older than 2½ years, signaling improved reproductive rates.

We continue to evaluate the role of winter ticks and their impact on moose fitness, including their role in depressed reproductive rates.

Hunter Participation, Residency, & Success Rate

In 2018, 2,259 residents and 241 nonresidents won permits to hunt moose. In 2019, 2,565 residents and 278 nonresidents won permits. In both years, most nonresidents were successful in their hunt (86% success rate in 2018 and 92% in 2019). In 2018, out-of-state hunters came from 33 states (as far away as Guam), and in 2019 they came from 36 states as far away as Alaska and one Canadian Province. Both years, more out-of-state hunters came from Pennsylvania than any other state (20% in 2018 and 14% in 2019).

In 2018, resident success rates were 75%; and when combined with the outstanding success by out-of-staters, made the total success rate 76%. In 2019, the resident success rate was 66% and the total success rate was 69%. The higher success rates of out-of-state hunters, as compared to residents, may be attributed to the higher proportion of out-of-state hunters using registered Maine Guides for their hunt. Success rates over the last 10 years have been around 80%.

In 2018, conditions for September and October were seasonable and included measurable snow in some areas. In 2019, they were highly variable, with September starting out warm and wet. Unseasonable conditions typically lead to lower success rates.

In 2020, there will be four separate moose hunting periods in Maine.

- The September season will run from Sep 28 – Oct 3 in WMDs 1-6, 10,11,19, and 27/28.
- The October season will run from Oct 12-17 in WMDs 1-14, 17-19, and 27/28.
- In WMDs 15 and 16, the season will coincide with November's deer season, which runs from Nov 2 through Nov 28. Opening day for Mainers will be on Saturday, Oct 31.
- WMDs 1-6 will have a cow moose hunt from Oct 26 through Oct 31.

Lastly, moose hunters who have a permit to hunt WMD 27 or WMD 28 can hunt in either WMD.



Comprehensive Moose Management in Maine

In the winter of 2010-11, the Department began conducting aerial surveys to estimate moose abundance and composition (bull, cow, and calf) across Maine's core range of moose (roughly a line from Grafton Notch to Calais). This aerial survey data, combined with reproductive data from female moose (ovaries) and age data from moose teeth (removed at registration stations), is providing biologists with a more complete picture of Maine's moose population size and composition than ever before. Biologists and regulators, like the Commissioner's Advisory Council, use these data to align moose permit levels with publicly-derived management goals, which include moose viewing and hunting (both weighed equally).

Moose Adult Cow and Calf Survival Study

The size of Maine's moose population is not static, and it fluctuates in response to many factors, including calf birth and adult survival rates. In cooperation and collaboration with the University of New Hampshire, New Hampshire Fish and Game, and the University of Maine-Animal Health Lab, we're currently conducting a study that monitors calf and adult survival rates and closely examines mortality sources.

The study began in the winter of 2014 and was designed to continue for a minimum of five years. We launched the study in western Maine (WMD 8), and, in 2016, we added a second study area in northern Maine (WMD 2).

Since 2014, we have captured 600 moose and fitted them with GPS collars. These collars enable us to track moose locations and movements over time, and to be notified via text/email message if a moose dies.

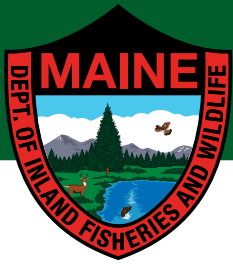
We observe adult cows each spring and summer to determine reproduction and survival of calves; for each collared moose, we collect detailed health information, including an assessment of blood parameters, parasite loads, body condition, and winter tick loads.

This information is providing our researchers with an unprecedented, in-depth look at moose health, including the impact of parasites on survival and reproduction. That winter, we fit another 70 calves with GPS collars as part of this ongoing research.

Adaptive Management Unit

This past winter, we fit an additional 60 calves in WMD 4 with GPS collars to compare calf survival with those in WMDs 2 and 8. This new unit will be monitored for the coming years to look at potential winter tick impacts in this remote section of Maine. The Department, with public input, is carefully considering dividing WMD 4 in two halves. One half would see an increase in moose permits to determine if reducing moose in a subunit can break the winter tick cycle and reduce calf mortality.

This work is supported by the federal Pittman-Robertson program, state revenues from the sales of hunting licenses, and volunteer assistance



BLACK BEAR

Jennifer Vashon and Randy Cross

The Maine black bear is an iconic symbol of Maine's forests and one of our wildlife success stories. Once relegated to no more than a nuisance, the black bear has risen in stature to one of our state's most valued animals.



Today, Maine’s expansive northern, eastern, and western forest supports one of the largest black bear populations in the lower-48 states (**Figure 1**). This population is valued by hunters and wildlife watchers alike. MDIFW strives to balance biological and social needs by basing management decisions on the bear monitoring, harvest, and conflict data we gather.

Monitoring

MDIFW’s black bear monitoring program is one of the most extensive and longest-running programs of its type in the U.S. For the last 45 years, Department biologists have captured and tracked over 3,000 bears to determine their health and condition, estimate how many cubs are born each year, and determine annual cause-specific mortality rates.

Population Management

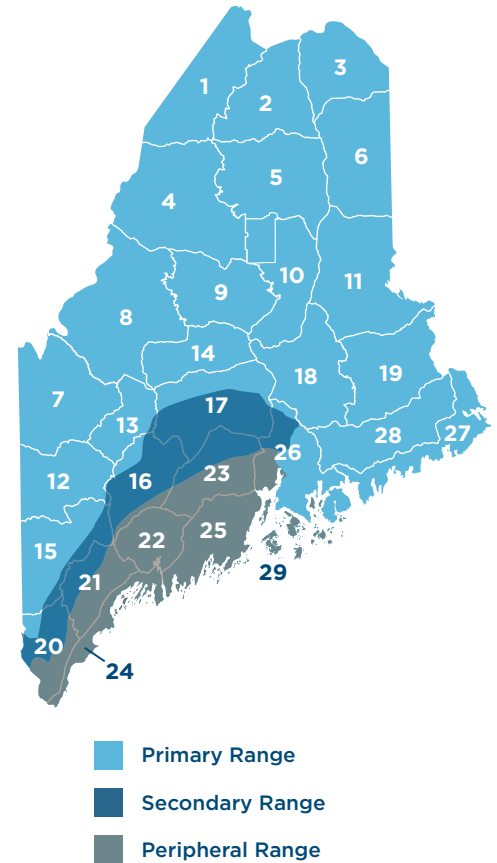
To maintain the bear population at a healthy and socially-acceptable level, the Department’s primary tool is hunting. Since 2005, Maine’s black bear population has steadily increased. The population grew from 23,000 in 2004 to ~36,000 in 2015, and annual harvest levels remain below what would be needed to stabilize it.

Maine offers a variety of traditional bear hunting methods, but the odds of taking a bear are low. Most (90%) bears are harvested with bait, trained bear dogs, or traps, but hunters also have the option of still-hunting or stalking, including the opportunity to take a bear while hunting deer. Success rates are just 26% for hunters using bait or trained bear dogs, <20% for trappers, and <3% for those who still-hunt or stalk bear through Maine’s dense forests.

Bear Management 2017-2027

MDIFW biologists set management goals through a strategic planning process which includes public input. In 2017, we finalized a new 10-year management plan for Maine’s big game species (deer, moose, bear, and turkey). This plan carefully considers black bears’ value to outdoor enthusiasts and the general public, as well as the likely public acceptance of an increasing bear population. In order to achieve the goal and objectives outline in the plan, there are a series of management strategies designed to ensure continued enjoyment of black bears without too many conflicts in backyards and neighborhoods.

FIGURE 1. MAINE BLACK BEAR RANGE





Living with Black Bears

Maine’s bear population is one of the largest in the country—thriving in the forests that cover more than 90% of our state’s land area.

Despite a large bear population, the number of conflicts between humans and black bears in Maine is lower than other northeastern states, averaging about 500 complaints each year. This relatively low conflict level is partially-attributed to bears being more common where human densities are lowest. However, if Maine’s bear population continues to grow and bears move into areas with higher human densities, conflicts could rise.

These conflicts, when they happen, tend to be mild in nature (the most common complaints we receive involve bears feeding at bird feeders and on garbage); but, if you live in a community that is experiencing these issues, they can be a great concern.

WHEN & WHY CONFLICTS HAPPEN




Most human-bear conflicts occur in the spring and early summer, after bears emerge from their winter dens and find it difficult to locate high-quality natural foods. As they search, they sometimes encounter food odors (bird seed, garbage, compost, and grills) that attract them to backyards and neighborhoods. Once berries begin to ripen

in late summer, bears return to wooded areas to forage and conflicts with humans decline. However, when these natural foods are not abundant, bears are more likely to continue searching for food provided by people.

SOLUTIONS

Many people expect the Department to move bears that are frequenting backyards, communities, and agricultural areas because it provides a quick fix to a problem. While this can provide a temporary solution to a property/livestock damage problem or a situation where human safety could be at risk, trapping and moving a bear is not always appropriate or effective. Bears that are trapped and transferred to a new area do not stay where they are released, and they often return or create a new problem somewhere else. Moving bears also puts them at a greater mortality risk, as they encounter more roads, other bears, and people.

Although it may seem simple to move or destroy the offending bear, the best solution is to remove or secure food, food odors, and other common bear attractants from your outdoor space every spring. If you don’t, bears will likely continue visiting. Even when bears are trapped and transferred to new areas, you should remove or secure attractants to avoid future problems. Here is a checklist that you can run through every spring:

<p>While hundreds of bear conflicts are reported each year, many can be prevented by simply removing or securing common bear attractants each spring.</p>	<p>1 REMOVE & STORE INSIDE BETWEEN APRIL 1 AND NOVEMBER 1</p>	<p>2 SECURE & CLEAN</p>
<p>BIRD SEED</p> 	<ul style="list-style-type: none"> • Take bird feeders down • Store seed and feeders indoors (you can still feed birds in the winter) 	<ul style="list-style-type: none"> • Rake up bird seed from the ground
<p>GARBAGE</p> 	<ul style="list-style-type: none"> • Store garbage cans in a building or enclosed by electric fence • Take to curb on morning of pickup 	<ul style="list-style-type: none"> • Keep outbuilding and garage doors closed at all times • Dumpster lids and doors should be kept closed and latched • Use bear-resistant dumpsters or garbage cans
<p>GRILLS</p> 	<ul style="list-style-type: none"> • Store grill inside when not in use • If you are having bear conflicts, stop grilling until bear moves on 	<ul style="list-style-type: none"> • Burn off food residue • Dispose of food wrappers and grease cups
<p>LIVESTOCK & PET FOOD</p> 	<ul style="list-style-type: none"> • Store livestock and pet food inside • Feed pets inside 	<p>If you feed your pets or livestock outside:</p> <ul style="list-style-type: none"> • Clean dishes daily • Remove leftover food daily

FOR MORE INFORMATION

We have revised our website and other outreach materials to provide additional information on what to do if you encounter a bear in your backyard, in your neighborhood, or during any outdoor activity in Maine. You can find that information, including printable/shareable PDFs, at: mefishwildlife.com/livingwithblackbears.

Black Bear Hunting and Trapping

SEASONS & PERMITS

MDIFW’s management of Maine’s black bears includes setting the season length, bag limit, and legal methods of hunting. Hunters (except for resident deer hunters during the firearm season) must purchase a bear permit, and each successful hunter must register their bear. The Department uses bear registration data to monitor harvest levels and adjust regulations as needed to meet bear harvest objectives.

The black bear hunting season opens the last Monday in August and closes the last Saturday in November, and is restricted to certain hunting methods during certain weeks.

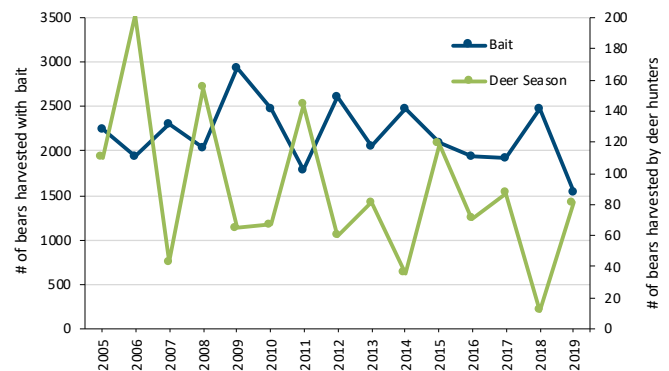
In 2018, hunting over bait was permitted from August 25 through September 22; and in 2019, it was allowed from August 24 through September 21. The hound (trained bear dogs) season overlaps with the last two weeks of the bait season, spanning September 10 to October 26, 2018 and September 9 to November 1, 2019. The annual trapping season opens September 1 and closes October 31. Hunters are allowed to hunt bears near natural food sources or by still-hunting throughout the entire three-month season. Bear hunters can take two bears if one is taken by trapping and the other by hunting.

During the 2018 and 2019 seasons, a similar number of bear hunters harvested two bears (25 in 2018 and 27 in 2019). More youth hunters successfully harvested a bear on youth day in 2018 (64) than did in 2019 (21).

ANNUAL HARVEST

Although many factors, including weather and hunter numbers, influence the black bear harvest, natural food levels play the largest role. Natural foods generally alternate in abundance from one year to the next. In a good food year, bears show less interest in bait sites and forage for plentiful foods through late fall. In a poor food year, bears show greater interest in bait and enter their winter dens early to conserve their limited fat reserves. As a result, harvest with the use of bait is typically higher in poor food years and lower in good food years, while harvest by deer hunters during the November firearm season is typically lower in poor food years and higher in good food years (Figure 2 and Figure 5).

FIGURE 2. HARVEST ALTERNATES WITH NATURAL FOODS. IN POOR FOOD YEARS, HARVEST BY BEAR HUNTERS USING BAIT IS HIGH AND HARVEST OF BEARS BY DEER HUNTERS IS LOW. TYPICALLY, A GOOD FOOD YEAR IS FOLLOWED BY A POOR FOOD YEAR.



We expected 2018 to be a poor natural food year for bears, and it was an *exceptionally* poor year. We saw a higher than average harvest over bait, with most of the annual harvest (92%) occurring by the end of September, at which point most bears made an early entrance into their winter dens. Despite the compressed timeline, hunters harvested a total of 3,314 bears (a near-record number) in 2018 (Table 1, Figure 3).

Also as expected, the 2019 season was a good food year, resulting in a lower harvest over bait. In fact, it was an exceptionally good food year for most berry and nut crops. As expected, the late-season harvest was higher than it was in 2018, but not high enough to increase the overall harvest since success rates by deer hunters remain relatively low even in a good food year. In fact, the 2019 bear harvest was nearly a record low with only 2,370 bears harvested during the entire 13-week fall season (Table 1.1, Figure 3).



2018

TABLE 1. NUMBER OF BEARS HARVESTED IN MAINE IN 2018 BY WILDLIFE MANAGEMENT DISTRICT (WMD).

WMD	METHOD OF TAKE						TOTAL HARVEST	ARCHERY ²	ASSISTED BY GUIDE	RESIDENT	NONRESIDENT
	HUNTING WITH BAIT	WHILE DEER HUNTING	HUNTING WITH DOGS	SPOT AND STALK	TRAPPING	UNKNOWN ¹					
1	134	0	29	0	5	0	168	10	148	28	140
2	133	0	32	0	1	0	166	10	158	15	151
3	154	0	11	3	2	0	170	13	138	41	129
4	194	0	19	0	0	0	213	28	162	64	150
5	107	0	50	1	2	0	160	12	145	24	136
6	184	0	24	6	7	0	221	20	151	70	151
7	126	0	45	1	5	0	177	14	107	75	102
8	196	0	71	2	12	0	281	8	180	139	142
9	95	1	22	0	2	0	120	9	79	40	80
10	106	0	28	1	2	0	137	5	111	34	103
11	169	0	70	3	3	0	245	12	194	59	186
12	128	0	45	3	11	0	187	16	80	112	75
13	42	2	16	0	1	0	61	3	34	32	29
14	48	1	32	2	0	0	83	5	68	31	52
15	65	3	34	5	5	0	112	8	21	93	19
16	3	0	1	1	0	0	5	0	1	4	1
17	41	2	10	1	6	0	60	3	16	48	12
18	165	0	27	0	8	0	200	13	126	108	92
19	120	0	67	0	2	0	189	12	171	28	161
20	16	2	6	2	0	0	26	3	2	24	2
21	3	0	0	0	0	0	3	0	0	3	0
22	0	0	0	0	0	0	0	0	0	0	0
23	2	0	0	0	0	0	2	0	0	2	0
24	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0
26	58	1	3	0	3	0	65	3	11	60	5
27	42	0	5	1	5	0	53	7	22	27	26
28	153	0	45	2	4	0	204	13	135	88	116
29	0	0	0	0	1	0	1	0	1	1	0
UNREPORTED						5	5				
STATEWIDE	2,484	12	692	34	87	5	3,314	227	2,261	1,250	2,060

¹Unknown Method = Hunter did not report the method they used to harvest their bear.

²This does not include 62 bears harvested with a crossbow.



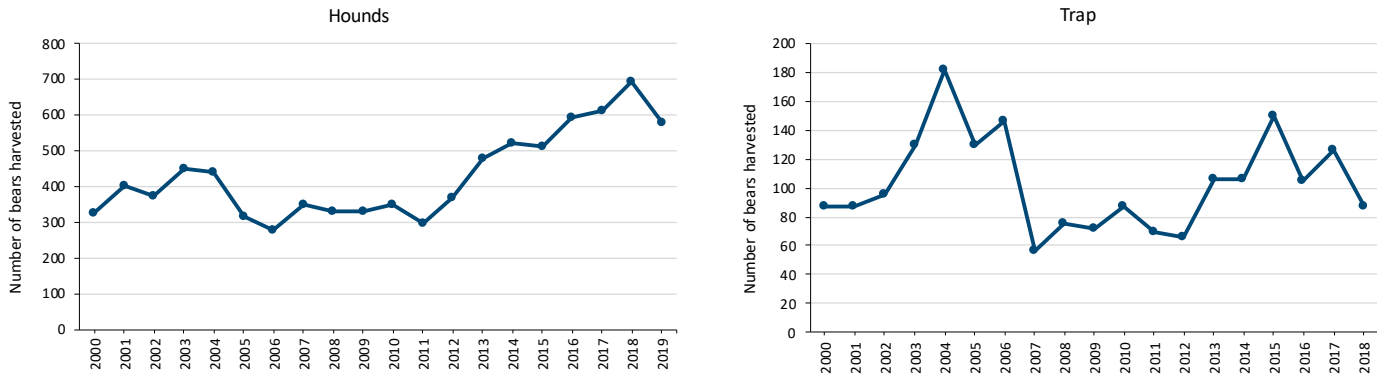
2019

TABLE 1.1 NUMBER OF BEARS HARVESTED IN MAINE IN 2019 BY WILDLIFE MANAGEMENT DISTRICT (WMD).

WMD	METHOD OF TAKE						TOTAL HARVEST	ARCHERY ²	ASSISTED BY GUIDE	RESIDENT	NONRESIDENT
	HUNTING WITH BAIT	WHILE DEER HUNTING	HUNTING WITH DOGS	SPOT AND STALK	TRAPPING	UNKNOWN ¹					
1	69	0	27	0	5	0	101	3	94	14	87
2	69	2	17	0	4	0	92	3	90	9	83
3	129	6	10	3	4	0	152	8	120	45	107
4	118	2	20	2	5	0	147	13	97	68	79
5	75	1	46	1	1	0	124	5	116	18	106
6	144	7	17	8	7	0	183	10	110	64	119
7	75	3	33	0	8	0	119	9	81	44	75
8	121	0	76	0	17	0	214	8	158	79	135
9	54	3	26	0	2	0	85	4	58	31	54
10	67	0	7	0	3	0	77	4	59	20	57
11	117	2	50	0	11	0	180	4	149	48	132
12	76	14	61	4	13	0	168	15	69	99	69
13	35	4	10	1	8	0	58	0	26	28	30
14	48	4	14	0	5	0	71	4	39	38	33
15	36	9	30	1	6	0	82	6	22	61	21
16	4	2	2	0	0	0	8	0	1	7	1
17	33	5	6	1	4	0	49	8	12	37	12
18	79	2	26	0	11	0	118	7	66	56	62
19	55	4	61	0	1	0	121	2	113	12	109
20	3	4	0	1	3	0	11	2	1	11	0
21	1	0	1	0	0	0	2	0	0	2	0
22	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0
26	28	2	0	1	11	0	42	1	3	40	2
27	23	4	7	2	5	0	41	6	13	24	17
28	88	1	32	1	3	0	125	5	86	48	77
29	0	0	0	0	0	0	0	0	0	0	0
UNREPORTED											
STATEWIDE	1,547	81	579	26	137	0	2,370	127	1,583	903	1,467

¹Unknown Method = Hunter did not report the method they used to harvest their bear.

FIGURE 3. HARVEST BY HUNTERS USING HOUNDS (TRAINED BEAR DOGS) HAS BEEN INCREASING IN RECENT YEARS, WHERE PERIODS OF HIGH HARVEST BY TRAPPERS OCCURRED FOLLOWING THE 2004 AND 2014 BEAR REFERENDUMS THAT, IF PASSED, WOULD HAVE MADE IT ILLEGAL TO HARVEST BEARS WITH BAIT, TRAINED BEAR DOGS, OR TRAPS.



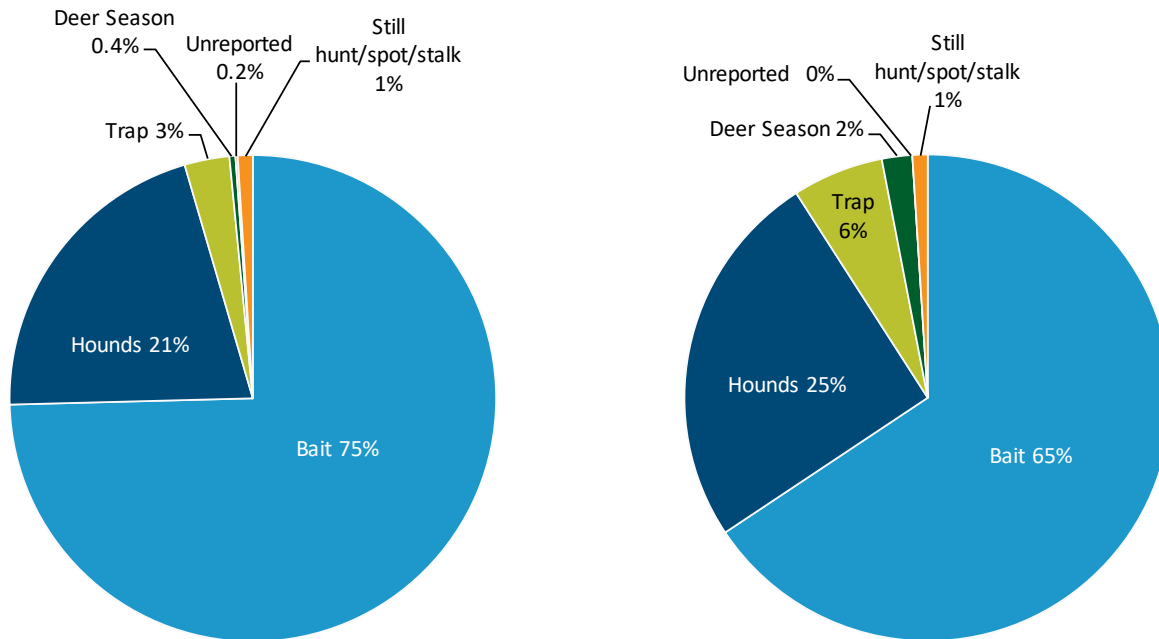
In Maine, most bears (90%) are harvested over bait or with trained bear dogs. Prior to 2012, approximately 80% of bears were harvested over bait and 10% by hunters using trained bear dogs. Since 2013, although bait remains the prominent method of harvest, a higher proportion (20%) have been harvested every year using trained bear dogs. This increase is likely in response to greater interest following a recent bear hunting referendum that, if passed, would have made hunting bears with bait, trained bear dogs, or traps illegal in Maine. We saw a similar increased interest in harvesting a bear with a trap following both the 2004 and 2014 bear referendums (Figure 3).

The role of the natural foods was clearly demonstrated in the 2018 and 2019 bear seasons. During the 2018 season, hunters harvested nearly 2,500 bears over bait, with that method accounting for 75% of the total harvest, and they harvested 692 bears with trained bear dogs, accounting for 21% of the annual harvest (Table 1 and Figure 4). Both of these harvest figures approached record highs. Later in the season, though, there was less opportunity. Due to a lack of natural foods, bears entered their winter dens early; and only 12 bears were harvested by deer hunters in November 2018 – a record low. The low number of trappers that harvested a black bear during the 2018 season was likely due to an emergency rule that limited the types of traps that could be set for bears during the 2018 season.

Conversely, in 2019, natural foods were both abundant and exceptionally diverse, giving bears a natural food source throughout the fall season. As a result, the total harvest was lower than average in 2019 with hunters only able to harvest 1,547 bears over bait (66% of the annual total) and 579 bears using trained bear dogs (Table 1.1). Hunters had more opportunity later in the 2019 season since bears were foraging longer on abundant natural foods and entered winter dens later (in some areas as late as December). Deer hunters in November harvested more bears, both in terms of the number (87) and the percentage of the total harvest it represented, but it was not high enough to offset the low harvest early in the 2019 season. An emergency rule in 2018 likely played a larger role than natural food levels on harvest by trappers. During the 2018 season, trapper effort was down following an emergency rule that limited certain traps, thus more trappers harvested bears in 2019 (137) than did in 2018 (87).



FIGURE 4. MOST BEARS IN MAINE WERE HARVESTED WITH BAIT AND HOUNDS (TRAINED BEAR DOGS) DURING THE 2018 AND 2019 SEASONS; HOWEVER, DUE TO THE ABUNDANCE OF NATURAL FOODS IN 2019, FEWER BEARS WERE HARVESTED OVER BAIT AND MORE WERE HARVESTED LATER IN THE SEASON BY DEER HUNTERS AND BEAR HUNTERS USING DOGS OR TRAPS.



Since 2005, Maine’s annual bear harvest has averaged around 3,000 animals, which is below the level needed to stabilize the bear population. As a result, Maine’s bear population has been increasing by 2% to 4% annually. Although the 2018 harvest was higher than average, the harvest remained below objectives and the bear population continues to grow and expand in Maine. The lower annual harvest in Maine is influenced by declining hunter numbers (Figure 5).

In Maine, success rate is the highest among hunters that use bait or trained bear dogs, averaging between 25% and 35% since 2005. Success is also higher among nonresidents, most of whom hire licensed professional Maine hunting guides to assist them (37% vs. 29%). Hunter success rates were higher in 2018 than 2019, with most of the harvest taking place early in the season with the aid of dogs and bait (bears were highly responsive to bait in 2018 given the scarcity of natural foods). In 2019, because bears remained out foraging on abundant food late into the season, trappers and deer hunters had higher year-to-year success rates (Figure 6).

FIGURE 5. HARVEST GENERALLY ALTERNATES FROM YEAR TO YEAR IN RESPONSE TO NATURAL FOOD ABUNDANCE.

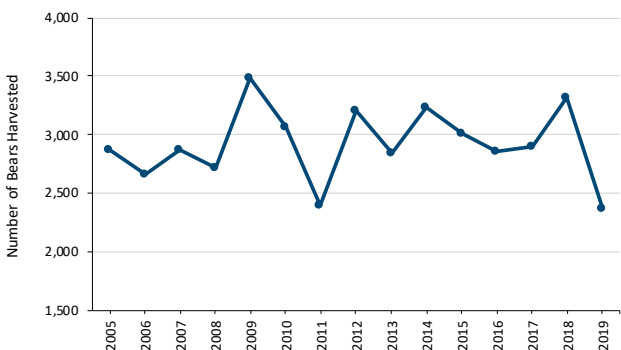
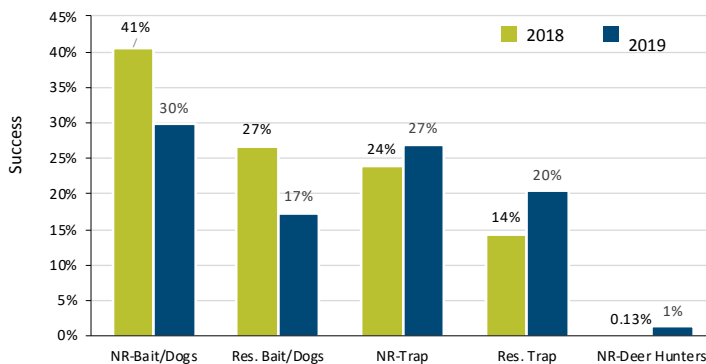


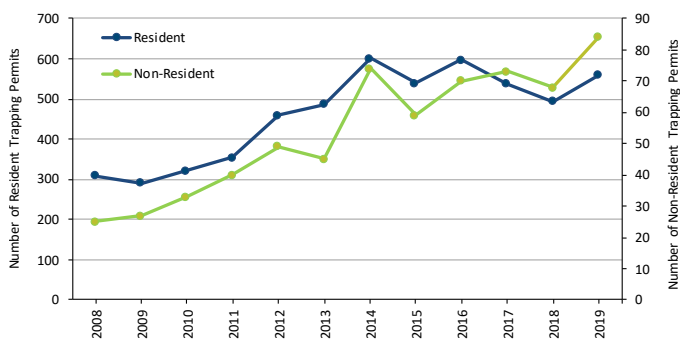
FIGURE 6. BEAR HUNTING SUCCESS RATES BASED ON PERMIT SALES BY RESIDENCE AND METHOD OF HARVEST.



BEAR TRAPPING

Trappers can harvest a bear in September or October using a cable foot restraint or a cage-style trap. Since 2008, trappers have been required to purchase a separate permit to trap a bear, and permit sales indicate rising interest, especially among residents. Trapping permit sales peaked in 2014 at 676, likely in response to a ballot initiative that, if passed, would have eliminated traps, bait, and trained bear dogs as legal harvest methods. However, in 2018, the number of bear trapping permits sold declined slightly to 494 for residents and 71 for nonresidents (Figure 7).

FIGURE 7. THE NUMBER OF RESIDENTS AND NONRESIDENTS PURCHASING A PERMIT TO TRAP BLACK BEARS IN MAINE HAS BEEN INCREASING.



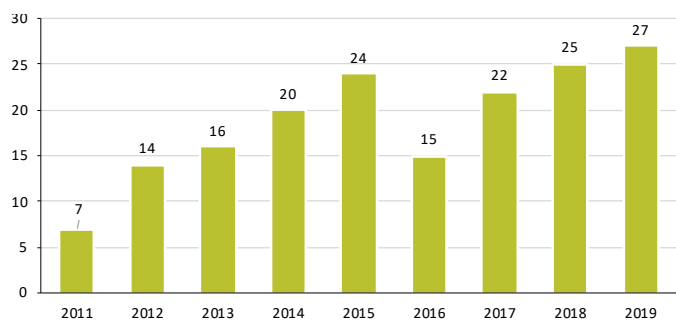
Just before the start of the 2018 bear trapping season, the Department passed an Emergency Rule limiting the types of traps that could be used to harvest black bears. The purpose of this rule was to give the Department more time to address the potential risks that certain traps could pose to bears and other animals incidentally captured in them; but it also likely resulted in lower trapper effort and harvest. During the 2018 season, 1,336 trappers harvested 87 bears – low numbers compared to each of the previous five years, during which an average of 1,485 trappers harvested anywhere between 100 and 150 bears.

In 2019, the Department passed a rule clarifying the design specifications of traps that would capture and hold bears by the foot, minimize potential injury to captured bears, and minimize non-target captures. This rule clarification likely improved trapping participation in 2019 (Figure 7), during which 1,432 trappers harvested 137 bears.

Since 2011, individuals have been allowed to harvest two bears each year if one is taken by hunting and the other by trapping. Although only a small proportion of hunters and

trappers take advantage of this opportunity, the number of individuals harvesting two bears increased incrementally each year to 24 hunters by 2015. In 2018, despite lower trapping effort, 25 hunters/trappers harvested a second bear. Similarly, 27 hunters/trappers harvested a second bear in 2019.

FIGURE 8. THE NUMBER OF HUNTERS THAT HARVEST TWO BEARS IS LIKELY LIMITED BY THE FACT THAT ONE MUST BE TAKEN IN A TRAP. SINCE THE 2011 BAG LIMIT INCREASE, AN AVERAGE OF 19 HUNTERS HAVE HARVESTED TWO BEARS IN A YEAR.



RESIDENT VS. NONRESIDENT HARVEST NUMBERS

As in past hunting seasons, nonresident hunters in 2018 and 2019 harvested most of the bears during the bait and hound (trained bear dogs) season. Conversely, resident hunters harvested most of the bears taken by spot and stalk methods, incidental to deer hunting, and in traps, but accounted for less than 200 bears in the harvest. Although the percentage of the harvest by nonresident hunters using spot and stalk methods remains low, it increased to 21% in 2018 and 15% in 2019. Similarly, the percentage of the harvest by nonresident hunters during deer hunting season, although also low, increased to 8% in 2018 and 11% in 2019.

THE INFLUENCE OF MAINE GUIDES

Most nonresidents use Maine Guides for their hunt, and that could explain their overall higher success rates leading up to deer firearm season (36% compared to 20% for Maine residents). Guides also appear to have boosted spot and stalk success, as the proportion of bears taken by spot and stalk methods with a Maine Guide also increased from 3% in 2016 to 18% in 2017 and 21% in 2018, but declined to 12% in 2019. The ease of finding bears over abundant natural foods in 2019 likely increased the success of hunters not employing a guide.



HUNTER PARTICIPATION

In 2003, permit fees were raised from \$5 to \$25 for residents and from \$25 to \$67 for nonresidents. Subsequently, bear hunting participation steeply dropped for residents and nonresidents alike. After a slight bump during the bear hunting referendum of 2004, numbers continued a steady decline before stabilizing at around 11,000 in 2009 (Figure 9).

RESIDENTS

Resident participation fell sharply with the permit fee increase. Active bear hunters were more likely to pay the fee, while those who previously purchased permits for the chance to take a bear while hunting other game largely opted out.

NONRESIDENTS

Nonresidents, who became more interested in hunting Maine black bears following the closure of the Ontario spring bear hunt in 1999, also lost some interest with the fee increase. While not as many nonresidents dropped off initially, the decline has continued, likely due to economics and increased opportunities to hunt bears in other states. This is particularly significant since nonresidents' higher success rates have a greater influence on the final harvest level (Figure 6).

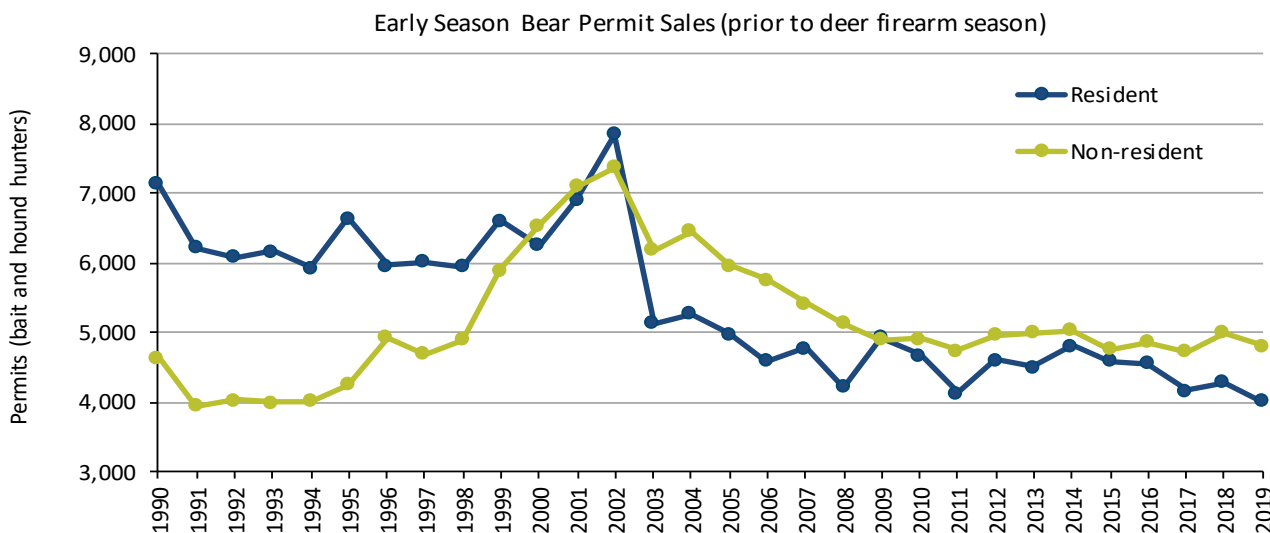
NEW PERMITS FUNDING BLACK BEAR RESEARCH AND MANAGEMENT

Since 2008, all trappers have been required to purchase a bear permit to harvest a bear, and nonresidents have also been required to purchase a permit to take a bear during deer firearms season. Funds from these permit sales are dedicated to bear research and management. Currently, we are using these funds to determine the age of harvested black bears from teeth turned in by the hunter, develop an integrated population model for bears, and evaluate the role of anthropogenic foods (including bait) on Maine's bear population. This research will allow us to improve our monitoring of trends in Maine's bear population, including its age structure and refine population estimates to better inform our management of bears.

Although the number of nonresident bear permit sales for deer hunting season has remained stable at 700 to 1,000 per year (774 in 2018 and 789 in 2019), sales of resident and nonresident bear trapping permits have been increasing. In 2014, likely due to a ballot initiative that would have made it illegal to harvest bears with bait, trained dogs, or traps, the number of resident trapping permits more than doubled from 291 to 602, and nonresident trapping permits tripled from 25 to 75. In 2018 and 2019, trapping permit sales reached 562 and 643 respectively, contributing more than \$40,000 to bear research and management.

This work is supported by the federal Pittman-Robertson program and state revenues from sales of hunting and trapping licenses.

FIGURE 9. THE DEPARTMENT DOES NOT LIMIT THE NUMBER OF BEAR HUNTING OR TRAPPING PERMITS. IN RECENT YEARS, RESIDENT AND NONRESIDENT BEAR PERMIT SALES HAVE STABILIZED TO APPROXIMATELY 10,000 WITH A SIMILAR NUMBER OF RESIDENTS AND NONRESIDENTS PURCHASING PERMITS. PRIOR TO 2003, MORE RESIDENTS PURCHASED BEAR PERMITS, LIKELY DUE TO THE LOW COST OF THE PERMIT AT THE TIME.





FURBEARERS

Shevenell Webb

Trapping and Furbearer Management

Sixteen species of furbearers live in Maine, including beaver, bobcat, coyote, fisher, gray and red fox, marten, mink, muskrat, opossum, river otter, raccoon, red squirrel, short and long tailed weasel, and skunk. Thanks to modern wildlife management principles, many of these species are more abundant now than they were 100 years ago. The harvest of these species is a regulated activity that is strictly enforced by game wardens. MDIFW continually reviews and develops science-based regulations, education programs, and capture methods to ensure the harvest is sustainable and that practices are humane.

Trapping is the primary tool used to manage and maintain healthy populations of furbearers in Maine. Regulated trapping provides many benefits to wildlife and people and is used in a variety of situations, such as research, protection and restoration of rare species, managing populations, and resolving human-wildlife conflicts.

EXAMPLES

Aiding wildlife biology - MDIFW often uses trapping and release to track and study species populations. From 1999-2011, Department biologists studied Canada lynx in northern Maine to better understand their ecology (see lynx section for further description of this project). We captured 85 lynx using foothold traps, fitted them with radio-collars, and released them unharmed.

Managing predation - Trapping and removing the surplus of predators, like raccoon and skunk, is vital to the success of maintaining and restoring some sensitive species. We use trapping to manage predation of nesting colonies of coastal seabirds including the Atlantic Puffin, Roseate Tern, and the Common Eider; and the trapping of nest predators has helped to recover rare species including Piping Plover and Least Tern, who were on the brink of being lost from Maine's sandy beaches. In another example, research has documented mink and river otter populations increasing on islands located close to shore and negatively impacting



seabird nesting success and survival of seabird chicks and adults; but trapping has helped to protect and restore those islands' seabird populations.

Resolving human-wildlife conflicts - Furbearer harvest can also help mitigate human-wildlife conflicts.

Rabies is a disease that can be transmitted by all mammals but is most commonly found in raccoon, skunk, and fox. High populations of these species can result in disease outbreaks that can be a risk to humans, pets, and livestock. Trapping can help maintain healthy wildlife populations and remove sick animals if needed.

Beaver are nature's greatest engineers, but their activities can cause damage to roads, forests, and ornamental trees. Maine's abundant wetlands, rivers and lakes support a healthy beaver population, and trapping helps manage local beaver problems, balancing the maintenance of roads, properties, and beavers on the landscape.

MODERN-DAY TRAPPING

The Wildlife Society, American Association of Wildlife Veterinarians, and American Veterinary Medical Association support trapping as a valuable wildlife management tool. Maine law requires that new trappers complete a trapper education course, which covers the most up-to-date information on humane trapping tools and techniques. For over 20 years, state wildlife agencies have worked closely with the U.S. Department of Agriculture, state trapping associations, and veterinarians to develop best management practices (BMP's) for trapping. This program has established high quality standards for modern day trapping to be efficient, selective, practical, safe, and humane. Wildlife biologists and trappers support BMP's because they are passionate about the welfare of wildlife. To learn more about trapping regulations and furbearer management, please visit maine.gov/ifw or furbearermanagement.com.



Furbearer Planning

In 2019, the Department started a Furbearer Planning initiative. One of the first steps is to survey the public on their knowledge, attitudes, and concerns regarding furbearers and management options. We are looking forward to getting input from the public and learning more about how people engage with furbearers in Maine. This information will factor in to new Management Plans for six species groups: Beaver/Otter, Mink/Muskrat, Canids, Bobcat, Marten/Fisher, and Other Furbearers.

A Steering Committee made up of diverse wildlife stakeholder groups will be responsible for guiding this plan, and working groups with technical expertise will develop management goals, objectives, and strategies. Given the wide scope and number of species, this will be a multi-year project.

HARVEST UPDATE

In fall of 2019, we launched an online registration system for furbearers. In the past, to collect furbearer harvest data, Department staff or local businesses filled out fur cards and sent them all in at the end of the season for data entry. The new online system is a much more efficient and accurate tool.

The pelts of all furbearers, except weasels, raccoon, red squirrel, muskrat, skunk, and opossum, are required to be registered and tagged. Furbearers are primarily trapped, but fox, coyote, bobcat, raccoon, opossum, and skunk can also be hunted during a limited time of the year. Small game that can be hunted include snowshoe hare, red and gray squirrel, woodchuck, and porcupine. Tagging pelts gives the Department information on who harvested the animal, harvest method, town where it was taken, and month and year of harvest.

During the 2019 season, harvests were comparable to the previous three-year average (2016-2018), but far below historic trends (2006-2015; **Table 1**). Compared to recent trends, we saw an increase in some species, including bobcat, coyote, beaver, and river otter.

The low harvest in recent years can be attributed to trapping regulations, low pelt prices, and low trapper effort. In 2015, statewide trapping regulations were implemented to protect Canada lynx, requiring lynx exclusion devices for body-gripping traps on dry land and chain-and-swivel configurations for foothold traps. The number of trappers that had a license last year was similar to recent years, but the number of trappers tagging fur declined by ~50% compared to five years ago.

Also in 2019, a new electronic survey was developed for trappers to complete their Fall and Spring Harvest Reports online. We had 1,550 fall and 500 winter/ spring trapper harvest reports returned for the 2019 season. Additional reports have been received but not entered at the time of reporting, so the final number of reports will not be available until late summer of 2020. 53% of the harvest reports indicated that a trapper did not trap for furbearers during the fall season. Lack of time was the top reason for not trapping (55%), followed by trapping regulations (18%) and health issues (15%), as reported on the online portion of the Fall Harvest Report. Natural foods, like beechnuts and acorns, were in high abundance during the fall of 2019, which made it more difficult to catch some species.

TABLE 1. FURBEARER HARVESTS FOR THE 2019-20 TRAPPING AND HUNTING SEASON, AS COMPARED TO PAST TRENDS IN MAINE¹.

SPECIES	2019	3 YR AVG 2016-2018 AVERAGE	10 YR AVG 2006-2015 AVERAGE
Beaver	6,209	4,338	8,687
Bobcat	352	236	291
Coyote	1,909	1,468	1,728
Fisher	365	451	1,067
Red Fox	458	581	850
Gray Fox	248	197	301
Marten	315	859	2,174
Mink	335	435	1,765
Otter	678	458	705

¹ 2019-20 harvest data was updated to animals registered by June 2, 2020. Imports and roadkills were excluded from this summary.

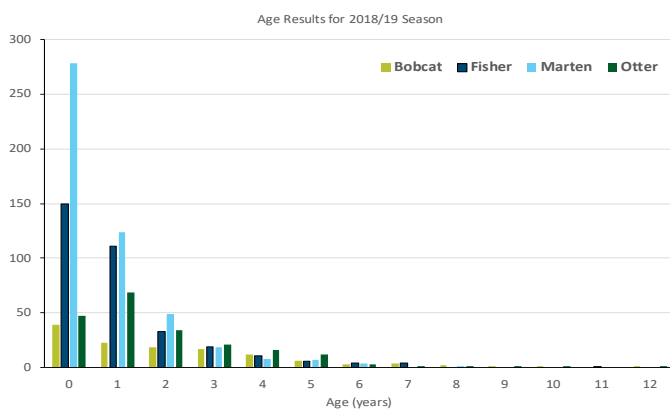
Tooth Submissions

In 2016, the Department began requiring trappers and hunters to submit tooth samples of all bobcat, fisher, marten, and otter harvested. The age and sex data collected from these samples provide insight into how intensively these species are being harvested. When multiple years of age and sex data are combined with overall harvest numbers and trapper effort, biologists will be able to use mathematical modeling to develop population trends for these species.

YEAR 1 (2016-2017)

For the 2016 season, 1,602 tooth samples were submitted, representing 42% of the bobcat, 83% of the fisher, 79% of the marten, and 97% of the otter harvest(s) with age information. The number of teeth submitted was exceptional for the first year of the program, especially considering the delay in publicizing information on the new rule. In general, most of the animals that were harvested tended to be younger, particularly for marten and fisher.

FIGURE 1. TOOTH RESULTS FOR BOBCAT, FISHER, MARTEN, AND OTTER HARVESTED DURING THE 2018 SEASON.



YEAR 2 (2017-2018)

For the 2017 season, the Department received 1,134 samples, representing at least 47% of the bobcat, 65% of the fisher, 63% of the marten, and 60% of the otter harvest. We saw similar age and sex trends for the 2016 and 2017 seasons. For bobcat, the percent kitten was 21% and 28%, percent adult (two years and older) was 50% and 41%, and male to female ratio (reported by hunters and trappers) was 0.9 and 0.86 for the 2016 and 2017 seasons. For fisher, the percent juvenile (<1 years old) was 48% and 57% and the male to female ratio was 0.48 and 0.6 for the 2016 and 2017 seasons. From discussions with trappers, we understand that the lynx exclusion devices are more conducive for catching female fisher because the larger males don't like to enter the cage with a baffle. Although the percent female is higher than males, the annual fisher harvest has declined by 50% since 2015, so the total number of female fisher taken is relatively low. For marten, 40% and 43% of the samples were juveniles (<1 years old), and the male to female ratio was 2.1 and 2.4 for the 2016 and 2017 seasons. For otter, 32% and 18% of the samples were juveniles (<1 years old), and the male to female ratio was 1.4 and 1.7 for the 2016 and 2017 seasons. During the 2017 season, a 14-year old male otter was taken, becoming the oldest otter recorded in Maine.

YEAR 3 (2018-2019)

For the 2018 season, the Department received 1,175 viable tooth samples (Figure 1). We determined that bobcat milk teeth (<1 years old) can be easily distinguished, so we cut costs by retaining these teeth. The age and sex results for the 2018 season were similar to the previous two years. The oldest age since the study began was 12 years old for bobcat, 11 years old for fisher, nine years old for marten, and 14 years old for otter.

The 2019 samples are being cleaned and prepped to send to the lab later this fall, with age results anticipated late winter/spring of 2021. The age and sex data collected from these samples continues to provide insight into how intensively these species are being harvested and improves the management of these species.

Rabies Update

Wildlife are tested for rabies when there has been potential exposure (typically a bite or direct contact) with humans or pets. Maine Department of Human Services reported 89 animals tested positive for rabies in 2019, which was higher than the previous five-year average (average = 55, range = 28-76 animals from 2014-2018). Every year, raccoon and skunk consistently represent the vast majority of cases.

Some areas of midcoast Maine have been hit particularly hard by rabies in recent years. In 2019, the City of Bath, with a population of over 8,000 people, received 72 suspicious animal calls. 26 sick animals were dispatched by officers or citizens and 16 animals tested positive for rabies. Of the 18 fox attacks on people or pets, 11 resulted in a person being bitten or scratched. The unusual number of aggressive grey fox attacks on people and pets over a 14-month timespan raised human health and safety concerns and prompted a focused trapping effort to remove rabies vector species to reduce human-wildlife interactions.

Meanwhile, USDA Wildlife Services continues its Oral Rabies Vaccine (ORV) Program in Maine, primarily focused on the Maine/New Brunswick border. The goal of the program is to prevent the further spread of wildlife rabies and eventually eliminate terrestrial rabies in the United States. In August 2019, the program distributed approximately 351,000 rabies vaccine baits around the town of Houlton by airplane and vehicle.

Learn more about annual rabies trends at maine.gov/dhhs/mecdc/public-health-systems/health-and-environmental-testing/rabies/rabies.htm.

GAME BIRD CONSERVATION & MANAGEMENT

MEET THE GAME BIRD GROUP



Brad Allen, Wildlife Biologist and Bird Group Leader

Brad oversees bird group activities and budgets and continues to investigate the lives and times of the common eider, focusing currently on a collaborative duckling survival study. Brad also coordinates Department interests in seabird research and management activities.



Kelsey Sullivan Wildlife Biologist

Kelsey coordinates MDIFW's waterfowl banding programs, surveys, and research to assess the status of game bird populations in Maine. Game bird species that Kelsey is responsible for include ruffed grouse, American woodcock, wild turkeys, waterfowl, and Canada geese. He is Maine's representative on the Atlantic Flyway Council Technical Section.



RESIDENT GAME BIRDS

Kelsey Sullivan

Wild Turkey Fall 2019 Harvest Summary

The fall wild turkey season opened two weeks earlier in 2019 to expand hunting opportunity and encourage more harvest in Wildlife Management Districts (WMDs) with high wild turkey densities. For the same reason, the bag limits in WMDs 15, 16, 17 and 20-25 were increased from two to five birds. Despite these liberalizations, the total harvest was 1,980 turkeys — on par with the seven-year trend as seen below in **Table 1** and **Figure 1**.

Fall turkey harvests can be influenced by the abundance of natural foods, such as acorns. In years when acorns are abundant and widely distributed (a high mast crop year), turkeys are widely distributed across the landscape. This makes encountering turkeys in the fall less frequent and the total season harvest tends to be lower. Fall 2019 was a high acorn mast crop year, decreasing the likelihood of turkey encounters; and as a result, very few wild turkey hunters took a full season bag limit of five birds last fall. 29 hunters tagged five wild turkeys, 42 took four, and 94 took three.

In low mast years when turkeys are concentrated and more likely to be encountered, we predict the fall harvest will be higher than it was this year and closer to what we saw during the previous fall (2018), when low mast crops and very successful summer wild turkey reproduction led to high harvest numbers.

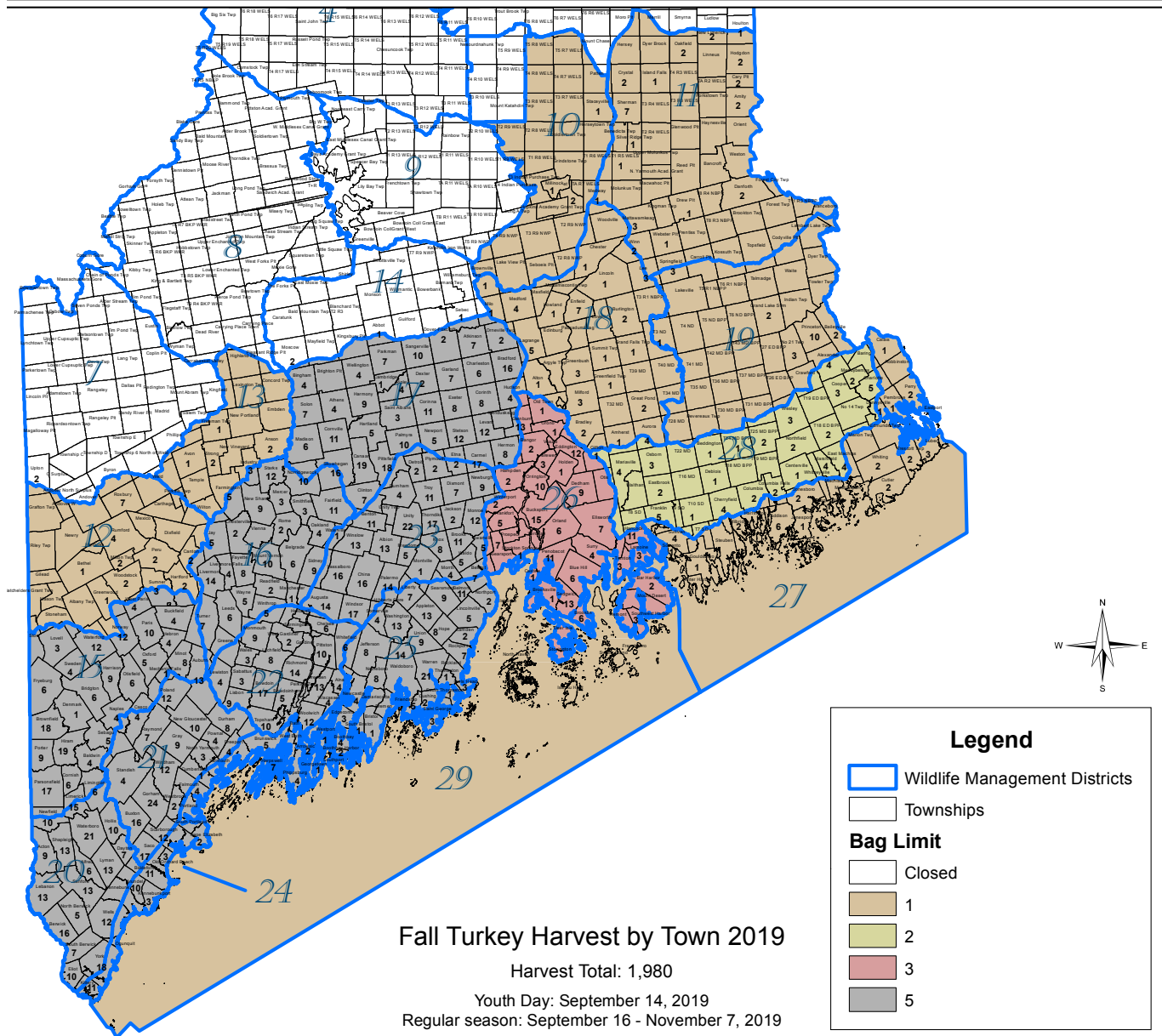


TABLE 1. WILD TURKEY SPRING AND FALL SEASON HARVEST TOTALS

SEASON	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SPRING	6,078	5,448	6,084	6,704	5,779	5,272	5,852	5,597	6,236	6,612
FALL	-	-	-	2,183	1,802	2,718	2,627	1,532	3,507	1,982



FIGURE 1. FALL 2019 HARVEST MAP DEPICTING BAG LIMITS AND HARVESTS. (NOTE: TOTAL HARVEST ON THIS MAP WAS PRELIMINARY TO FINAL COUNT OF 1,982)



Wild Turkey Research Project: Population Assessment and Harvest Management

The Maine Department of Inland Fisheries and Wildlife and the University of Maine at Orono's Department of Wildlife, Fisheries and Conservation Biology have completed the 3rd winter field season capturing, banding and marking wild turkeys with radio telemetry units. This effort is part of a research project designed to evaluate various aspects of the State's wild turkey population. A total of 373 wild turkeys were captured this winter. All received leg bands and 81 received radio telemetry units. In total, over the three winter field seasons, 894 wild turkeys were captured across several Wildlife Management Districts, all receiving leg bands and 270 receiving a radio telemetry unit. The telemetry units allow us to keep track of where turkeys are throughout the year. Wild turkeys with bands that are harvested should be reported and allow us to understand both harvest rate and dispersal from wintering areas where they were captured.

The need for research was identified in the Department's recent Big Game Management Plan, which incorporated public input into wild turkey management moving forward. The plan identified the need to scientifically evaluate various aspects of wild turkey ecology specific to Maine and incorporate this information into our wild turkey management system. These aspects include nesting behavior and timing, nesting success, seasonal and annual survival of turkeys, habitat use and movement across the landscape as well as the role disease has in wild turkey ecology.

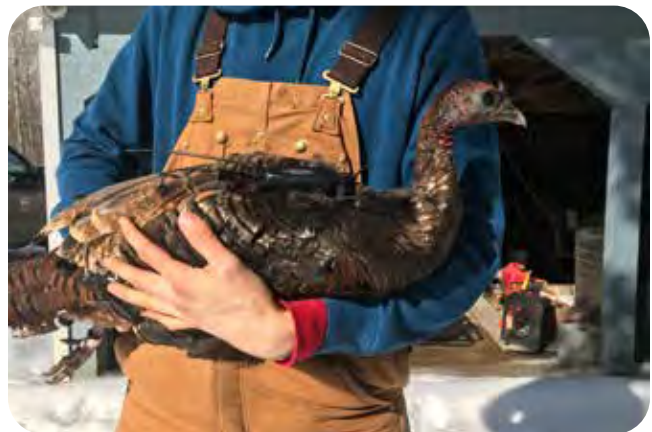
For more information on the project you can visit our project website at wildturkeyme.org.



Banded Tom Turkey in Albion (2019). Photo by Kelsey Sullivan.



Netting three Tom turkeys in Hampden (2020). Photo by Robert Michelson www.pbmphoto.com



Hen wild turkey with GPS/radio transmitter (Hampden 2020). Photo by Kelsey Sullivan

Wild Turkey Spring Harvest

Maine continues to have a quality wild turkey spring hunting season in recent years. As with many ground-nesting upland game bird populations, the wild turkey population fluctuates annually based on factors such as weather conditions, predator numbers, and reproductive success. The number of wild turkeys harvested in the spring is related to these annual fluctuations, which can naturally limit the number of turkeys available to hunt.

The table below shows the spring wild turkey harvest from 2015 to 2019 by Wildlife Management District (WMD). The Spring 2015 season followed one of Maine’s coldest, snowiest winters in recent memory. Winter conditions affect wild turkey survival, a relationship reflected in the lower 2015 spring harvest.

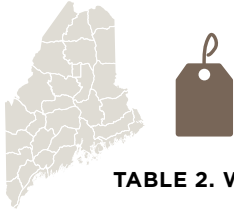


TABLE 2. WILD TURKEY SPRING SEASON HARVEST TOTALS BY WILDLIFE MANAGEMENT DISTRICT.

WMD	2015 HARVEST	2016 HARVEST	2017 HARVEST	2018 HARVEST	2019 HARVEST	5 YEAR AVERAGE
1	1	-	5	3		3
2	7	8	6	4	5	6
3	8	21	12	3	6	10
4	2	1		1	1	1
5	4	4	7	2	6	5
6	49	36	25	48	49	41
7	56	70	53	29	52	52
8	3	21	3	7	14	10
9	3	9	8	6	4	6
10	6	8	7	9	4	7
11	49	60	48	71	75	61
12	210	185	214	91	176	175
13	139	118	78	117	122	115
14	55	54	52	43	55	52
15	538	636	537	643	592	589
16	371	388	440	455	523	435
17	536	642	555	675	603	602
18	86	93	64	118	104	93
19	24	14	24	28	20	22
20	460	473	781	604	705	605
21	484	547	485	608	666	558
22	371	528	551	571	607	526
23	478	518	478	754	765	599
24	463	431	195	174	172	287
25	443	454	496	586	687	533
26	286	378	354	450	456	385
27	70	73	43	70	68	65
28	35	53	47	40	67	48
29	15	16	28	20	8	17
TOTAL	5,265	5,848	5,596	6,147	6,612	5,894

Grouse

MDIFW surveys and compiles data by geographic region and calculates the number of grouse seen per 100 hours of moose hunting effort (**Table 3**). Survey results show that the Northwest section (much of the North Maine Woods) observed had many grouse in the fall of 2018, with

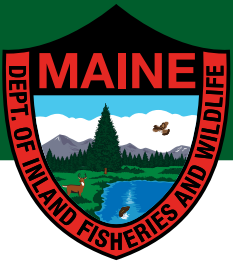
117 seen per 100 hours of moose hunting. This was the second-highest count since the survey began (the highest was in 1995, with 125 grouse/100 hours). Other sections of the state, such as the Northeast, also showed high counts. Overall, 2018 was a good year for grouse.



TABLE 3. STATEWIDE GROUSE SURVEY OF MOOSE HUNTERS AND OTHERS IN THEIR HUNTING PARTY DURING THE MOOSE HUNTING SEASONS (2008-2018).

METRIC	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
COMPLETE SURVEYS	-	1,875	1,332	1,343	1,374	1,220	513	961	229	345	893
TOTAL GROUSE SEEN	-	22,225	15,967	17,072	18,946	14,992	8,664	4,722	2,405	3,761	5,808
GROUSE /100 HOURS	30	50	49	43	47	35	52	43	25	41	70

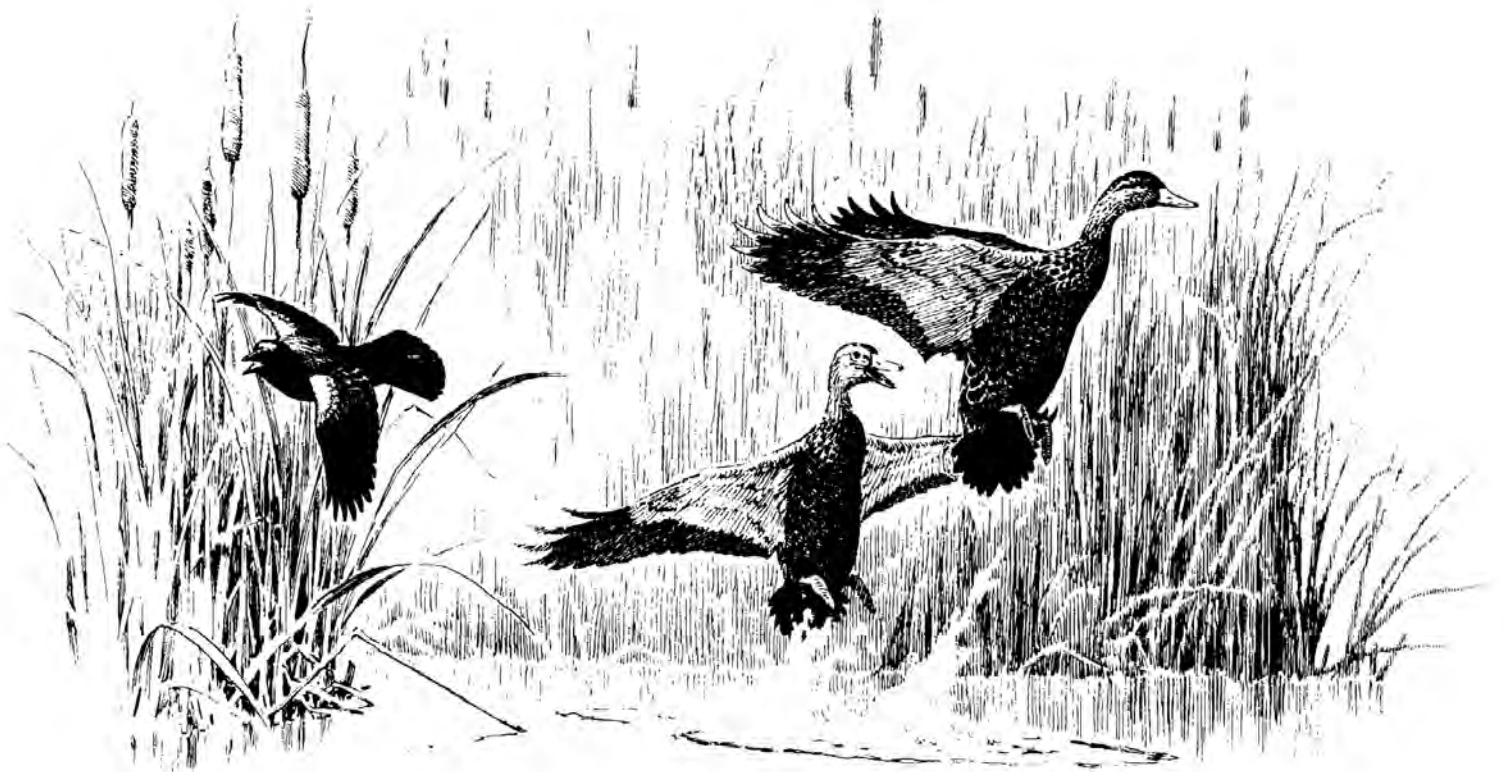




MIGRATORY GAME BIRDS

Kelsey Sullivan

MDIFW collaborates with the USFWS to monitor migratory game bird populations and assess their harvest. To monitor populations, we conduct several surveys throughout the year specific to migratory bird species groups, such as sea ducks and dabbling ducks, Canada geese, and American woodcock.



WATERFOWL HARVEST

The 2018-19 Maine regular waterfowl season selection continued with three zones: North, South, and Coastal. The federal framework offered states in the Atlantic Flyway a 60-day duck season with a six-bird daily bag limit and a 60-day Canada goose season with a two-bird daily bag limit. The season also allowed for additional hunting days to compensate for state-imposed Sunday hunting prohibitions.

The special sea duck season in the Atlantic Flyway and Maine was again limited to 60 days with a daily limit of five sea ducks per day with no more than four scoters, four eiders, or four long-tailed ducks per day.

In addition to the regular Canada goose season, a special early Canada goose season was open from September 1 to September 25. The early season daily bag limit was 10 in the South and Coastal zones and six in the North zone. Harvest rates for resident Canada geese over the last five years have been between 14 and 17 percent based on banding of resident Canada geese in Maine in July.

Table 4 below presents the results of the Harvest Information Program (HIP) waterfowl harvest surveys for the 2015-16, 2016-17, 2017-18 and 2018-19 hunting seasons.



TABLE 4. MAINE DUCK AND GOOSE HARVEST ESTIMATES BASED ON HARVEST INFORMATION PROGRAM, 2015/16-2018/19.

	2015-16	2016-17	2017-18	2018-19
Black Duck	807	2,700	2,900	5,600
Mallard	4,159	8,000	9,700	11,800
Mallard X Black Duck Hybrid	31	100	200	100
Green-Winged Teal	1,242	1,900	1,600	1,100
Blue-Winged Teal	62	200	0	0
Northern Shoveler	0	0	100	0
Northern Pintail	93	100	200	400
Wigeon	62	100	0	200
Wood Duck	3,166	5,500	6,500	3,700
Greater Scaup	31	0	0	100
Lesser Scaup	93	100	0	0
Ring-Necked Duck	217	800	200	800
Bufflehead	1,024	2,500	1,500	2,700
Common Goldeneye	497	600	600	700
Hooded Merganser	279	600	600	600
Other Mergansers	372	700	500	700
Total Dabbling/Diving Duck Harvest	12,119	27,000	32,200	39,400
Seasonal Duck Harvest Per Hunter	3.7	5.9	5.3	5.7
Canada Goose	7,196	11,400	15,200	11,400
Seasonal Goose Harvest Per Hunter	3.8	4	4.4	4.5
Common Eider	917	1,800	5,700	7,300
Long-Tailed Duck	423	800	1,700	2,600
Scoter Species	141	1,100	1,300	800
TOTAL SEA DUCK HARVEST	1,481	3,700	8,700	10,700



American Woodcock

Department biologists contribute data annually to the USFWS American Woodcock Singing-ground Survey (SGS). In the spring of 2019, MDIFW staff, USFWS staff, and several volunteers completed 50 SGS routes in Maine, during which the average number of males heard was 3.42 – slightly higher than the 2018 average of 3.01 and slightly higher than the 10-year average of 3.72. When all state's data are summarized, woodcock populations in the eastern region show a significant negative trend over the most recent 10 years (2009-2019).

Woodcock hunting season

As with waterfowl, the Harvest Information Program (HIP) provides statistically valid estimates of woodcock hunter numbers and harvest. Based on HIP data, approximately 3,800 woodcock hunters harvested an estimated 9,700 woodcock in Maine in 2018. Maine is one of the most important woodcock hunting states in the eastern region based on total harvests. The recruitment index of 1.8 immature (young of the year) to one adult female in the 2018 harvest was slightly above the long-term average of 1.7 young/adult female (1963–2017). The recruitment index is a measure of the ratio of immature woodcock per adult female derived from a wing-collection survey. Maine hunters provided 739 woodcock wings from their 2018 hunting season efforts.



2019-20
RESEARCH &
MANAGEMENT
REPORT

**Non-Game Mammals
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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.

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Conservation & Management

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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

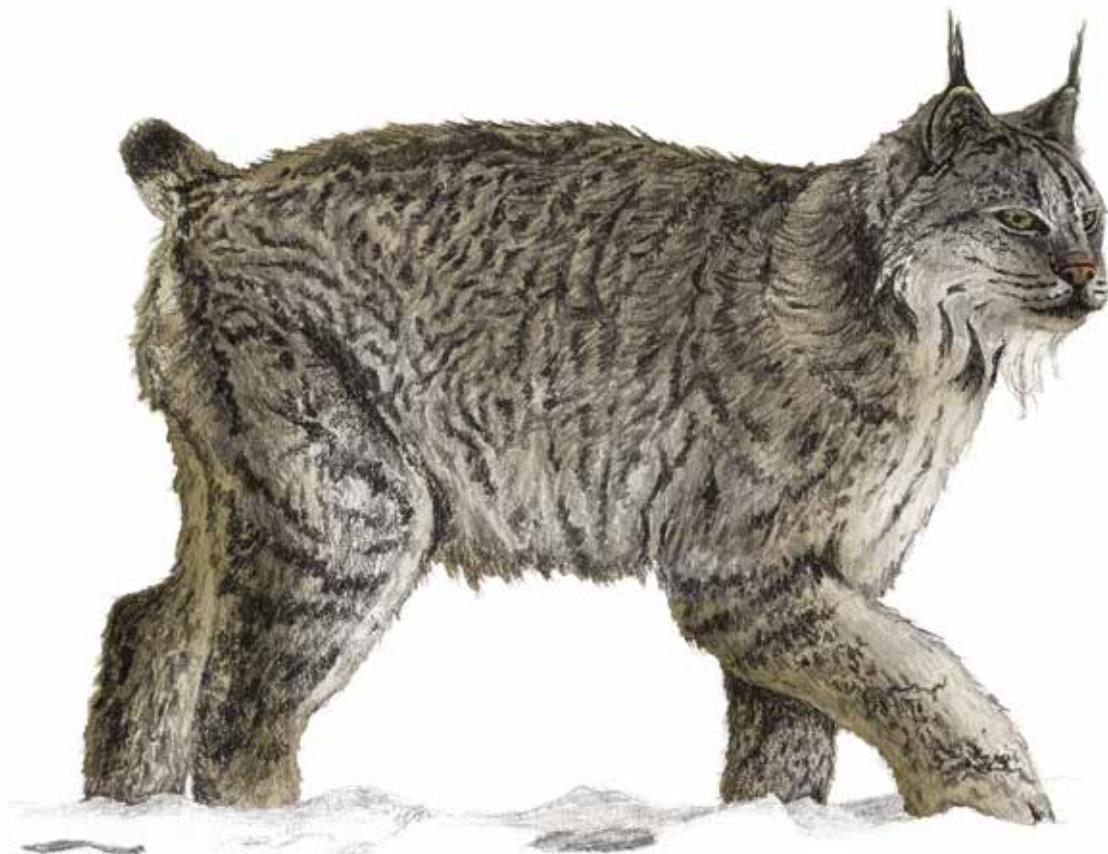
A Northern Species

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



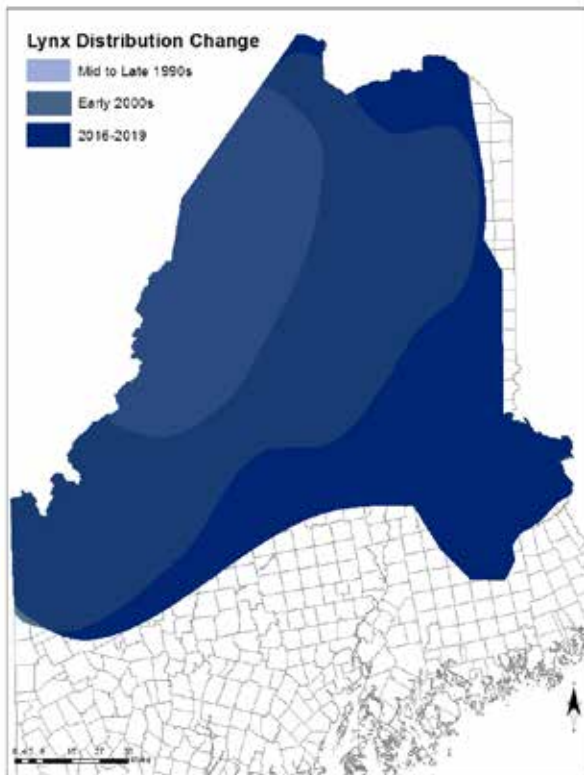
Range map by IUCN Red List



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.

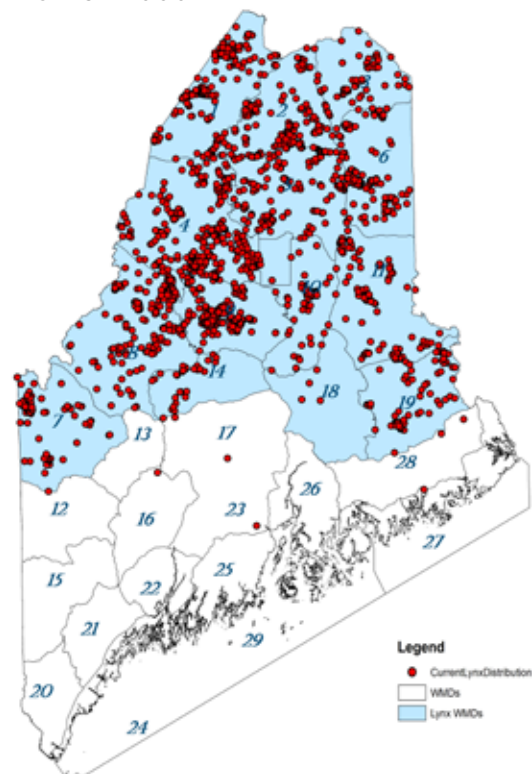
Snowshoe hare numbers also influence lynx reproduction rates, with female lynx producing more kittens when prey is abundant. In Canada, although litters as large as eight kittens have been observed, a normal litter is one to five kittens. In Maine, when snowshoe hares are abundant, litters of four to 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"	EAR TUFTS	Generally less than 1"
FACIAL RUFFS	Larger facial ruffs with black banding at outer edges	FACIAL RUFFS	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.	PELT COLOR	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	TAIL COLOR	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	FEET	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	TRACK SIZE	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



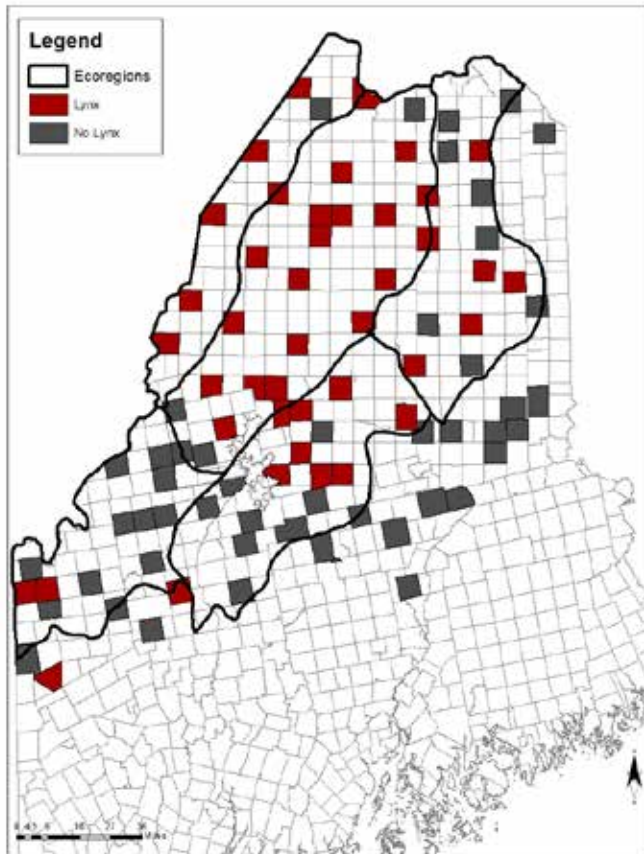
Set of bobcat tracks in crusty snow. Photo by MDIFW

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.

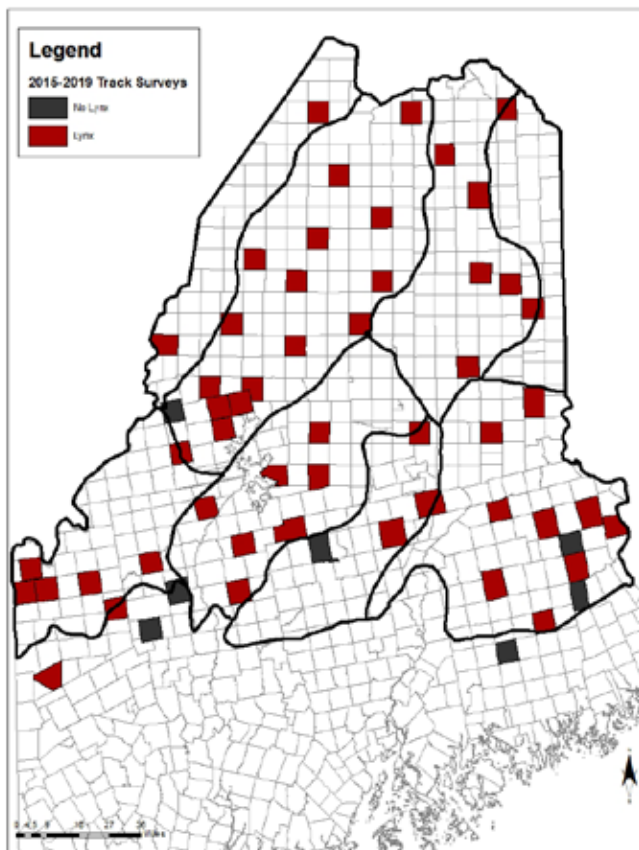
In 2012, the Department combined this data with the lynx densities and proportion of occupied areas (as determined by snow-track surveys) to develop a [*species assessment and the first data-driven statewide lynx population estimate.*](#)

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.

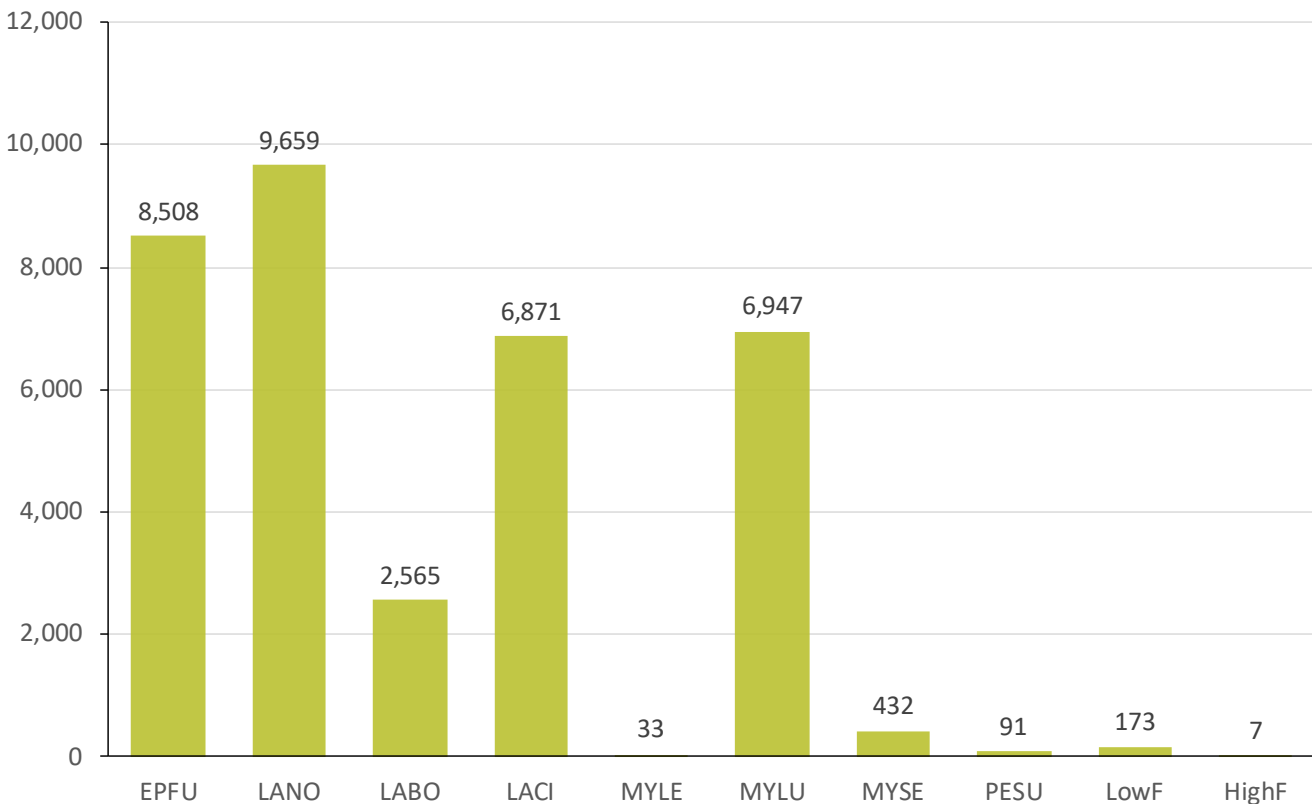
During the summer of 2019, we conducted our first comprehensive stationary acoustic survey to gather bat species occupancy data across a broad area of Maine. We surveyed 57 sites in 13 counties, and recorded over 100,000 call files during 741 detector nights. The survey results confirmed widespread statewide 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

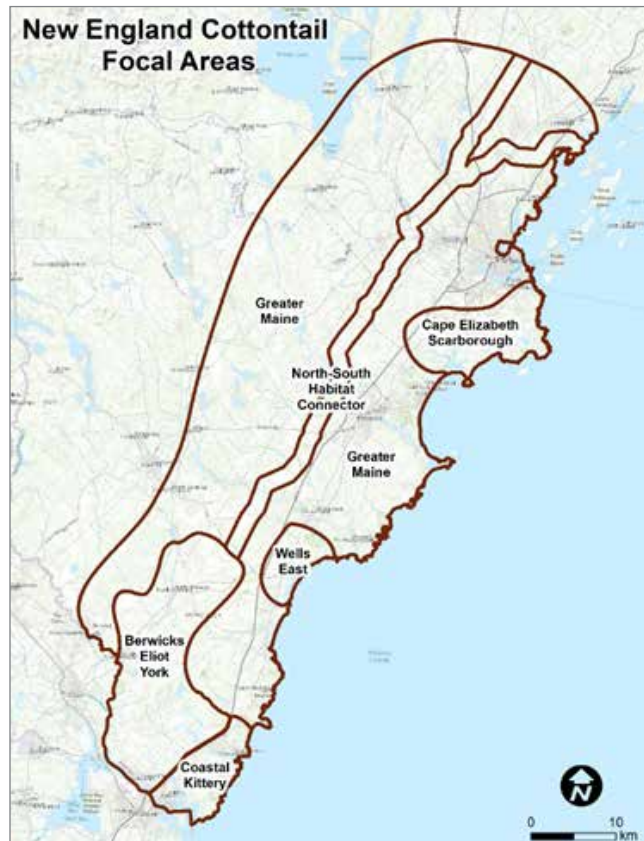
About the Rabbit

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.



2019-20
RESEARCH &
MANAGEMENT
REPORT

**Reptile, Amphibian, and Invertebrate
Conservation & Management**

Download additional sections 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.

Reptile, Amphibian, and Invertebrate Conservation & Management

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- » Beginning with Habitat Updates
- » Bird Conservation & Management

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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.



REPTILE, AMPHIBIAN, AND INVERTEBRATE CONSERVATION AND MANAGEMENT

Program Overview

Maine is home to 18 species of frogs and salamanders (amphibians), 18 species of turtles and snakes (reptiles), and over 15,000 species of terrestrial and freshwater invertebrates, from beetles and butterflies to mayflies and mussels. The Reptile, Amphibian and Invertebrate (RAI) Group is challenged with coordinating research and conservation priorities for this diverse suite of organisms, more than 100 of which are currently state listed as Endangered, Threatened, or Special Concern.

Some rare invertebrates, such as the Katahdin arctic butterfly and Roaring Brook mayfly, are state or regional endemics – found nowhere else in the world but in Maine or a small area of the Northeast. Other species, including the cobblestone tiger beetle and the short-tailed swallowtail butterfly, have only recently been discovered in Maine by our biologists. The RAI Group works to ensure that these and many other lesser known, but ecologically important, species remain a part of Maine’s rich ecosystem.

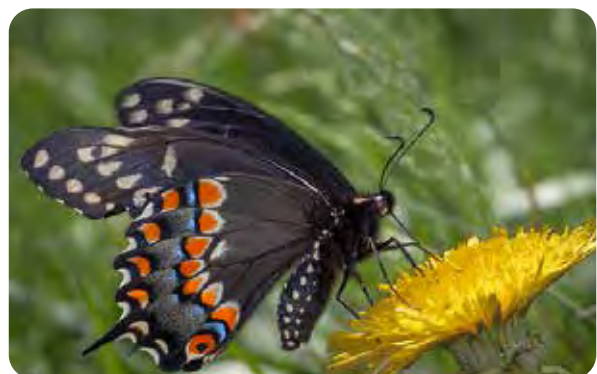
The RAI Group is one of the Department’s few units devoted entirely to nongame and endangered species work, and is therefore dependent on dedicated, non-General Fund sources of revenue, such as the Loon License Plate and Chickadee Check-off. Thank you for your support of both these critical funding sources, thus helping our Department meet its legislative mandate “to conserve, by according such protection as is necessary..., all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend” (107th Maine Legislature, 1975).



Black Racer photo by Derek Yorks



Wood Turtle photo by Derek Yorks



Black Swallowtail photo by Kent McFarland



MEET THE REPTILE, AMPHIBIAN, AND INVERTEBRATE GROUP



Phillip deMaynadier, Ph.D., Wildlife Biologist and Group Leader

Phillip supervises RAI Group activities and serves as one of the Department’s lead biologists on issues related to reptile, amphibian, and invertebrate conservation and endangered and nongame policy. Some of his recent projects include: participation on the lead team for Maine’s 2015 State Wildlife Action Plan; coordination of MDIFW’s program for protecting high-value vernal pools; co-coordination of state butterfly, dragonfly, amphibian, and reptile atlas efforts; and advising landowners and land trusts on rare and endangered species management practices. Phillip is also a Graduate Faculty member at the University of Maine’s Department of Wildlife, Fisheries, and Conservation Biology.



Beth Swartz, Wildlife Biologist

Beth is the Department’s lead biologist on a wide range of invertebrate taxa. Her recent efforts have been devoted to assessment and conservation of Clayton’s copper butterfly, brook floater and other freshwater mussels, rare mayflies, and bumble bees. Beth is currently coordinating a statewide atlas effort for bumble bees and targeted surveys for the rusty patched bumble bee, which was federally listed as an Endangered species in 2017. Beth also helps coordinate the Department’s vernal pool conservation efforts and plays a lead role in environmental review of large energy project proposals statewide.



Derek Yorks, Wildlife Biologist

Derek is the Department’s lead biologist on reptile and amphibian issues, coordinating research and conservation efforts on several priority rare species. Derek is currently assessing the distribution, status, and management needs of Maine’s black racers as well as Blanding’s, spotted, and wood turtles, and is coordinating Maine’s efforts with those of several working groups on these species across the Northeast. Derek is also studying and helping to develop recommendations for how to mitigate the impacts of roadways on Maine’s reptiles and amphibians.

SEASONAL STAFF AND PROFESSIONAL COOPERATORS

The RAI Group could not address such a diverse suite of taxa without the expert assistance of the following professionals in 2019-2020:

Dr. Samantha Alger
Dr. Catherine Bevier
Kalyn Bickerman-Martens
Paul M. Brunelle
Dr. Steve Burian
Dr. Ron Butler
John Calhoun
Dr. Matthew Chatfield
Charlene Donahue

Dr. Frank Drummond
Sarah Haggerty
Dr. Michael Kinnison
John Klymko
Megan Leach
Gregory LeClair
Dr. Cynthia Loftin
Derek Moore
Ethan Nedeau

Trevor Persons
Paul Powers
Bryan Pfeiffer
Dr. Leif Richardson
Marcia Siebenmann
Lisa St. Hilaire
Dr. Herb Wilson
Mark Ward

AMPHIBIANS AND REPTILES

By eastern U.S. standards, Maine is a large and climatically diverse state. Thus, while North American reptiles and amphibians (herpetofauna) are richest and most diverse at southern latitudes, Maine's relatively moderate southern and coastal climate permits many species to reach their northeastern range limit here. Only one species, the mink frog, reaches the southern edge of its range in Maine (and northern New Hampshire and Vermont).

Maine provides some of the most extensive and intact remaining habitat for the 36 known herpetofauna species it hosts. Of our 18 amphibians and 18 reptiles, one is extirpated (timber rattlesnake) and two introduced (mudpuppy salamander and red-eared slider turtle). Several are of regional and national conservation concern, and ~33% are listed as Species of Greatest Conservation Need (SGCN) in Maine's 2015 State Wildlife Action Plan. Some of MDIFW's recent survey, research, and conservation projects directed at these and other priority herpetofauna are highlighted below.



Partners in Amphibian and Reptile Conservation (PARC)

Derek Yorks and Phillip deMaynadier

MDIFW continues to cooperate with Partners in Amphibian and Reptile Conservation (PARC). Modeled partly after the successful Partners in Flight (PIF) bird conservation program, PARC forges partnerships between diverse public and private organizations to stem worldwide amphibian and reptile population declines.

MDIFW regularly attends PARC's northeastern chapter meetings, including the most recent 2019 annual meeting in Galloway, NJ (the 2020 meeting was cancelled due to Covid-19). Some of Northeast PARC's projects to date include: drafting model state herpetofauna regulations; compiling a list of regional species of conservation concern;

publishing management recommendations for important habitats; developing fact sheets on emerging amphibian and reptile diseases; designing guidelines for identifying Priority Amphibian and Reptile Conservation Areas (PARCAs); developing best management practices for turtle road crossing structures; and coordinating northeastern working groups for priority species such as the wood turtle, Blanding's turtle, and spotted turtle, and for priority habitats like vernal pools.

For more information on this or other national PARC conservation efforts, visit the PARC website at parcplace.org

This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

Maine Amphibian and Reptile Atlas Project (MARAP)

Derek Yorks and Phillip deMaynadier

From 1984-1988, MDIFW, in cooperation with Maine Audubon and the University of Maine, conducted the Maine Amphibian and Reptile Atlas Project (MARAP). Over a four-year period, 250+ volunteers across the state recorded roughly 1,200 amphibian and reptile observations. This initiative culminated in the 1992 publication of the book, *The Amphibians and Reptiles of Maine*, the first edition of which sold out within two years.

2ND EDITION (1999)

By 1998, considerable new data on the state's amphibians and reptiles had been compiled, and there was increasing demand for updated information. Editors Malcolm Hunter, Jr., Aram Calhoun, and Mark McCollough revised a second edition, incorporating information from 1,300 new records into updated range maps and species narratives, and added color photographs and a CD of the calls of Maine's frogs and toads. You can order the updated 1999 edition of *The Amphibians and Reptiles of Maine* for \$19.95 from MDIFW's Information Center (207-287-8000) or from our online store at mefishwildlife.com.

CONTINUING DATA COLLECTION

Since the publication of the most recent atlas, MDIFW has continued to collect data and maintain a comprehensive database on the distribution of Maine's 35 extant amphibian and reptile species (33 native and two exotic). As of spring 2020, our 1,700+ volunteers had logged nearly 14,000 records, nearly all having been carefully vetted and digitally curated by Trevor Persons, a consulting herpetologist.

INSIGHTS

The MARAP project has continuously improved our understanding of Maine's reptile and amphibian biogeography. For example, we now know that reptile species richness sharply decreases northward, while amphibian richness is fairly even across the state. MARAP findings have also helped to inform specific species' conservation

status assessments (e.g., Endangered, Threatened, Special Concern, SGCN), survey and research priorities, and on the ground conservation efforts.

There is still much to learn about the distribution and ecology of Maine's herpetofauna, and you can help! Members of the public can share photo observations in two ways:

1. Submit a MARAP reporting form, available on MDIFW's website in the Species Information section, or
2. Use the popular iNaturalist app. Within the platform, just look for the project entitled Maine Amphibian and Reptile Atlas Project. All amphibian and reptile observations added to iNaturalist within Maine are automatically added to this project.

This work is supported by the federal State Wildlife Grants program, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance.

How can you help?

Please submit observations of any of the four state-listed reptiles below as soon as possible to: derek.yorks@maine.gov or (207) 941-4475



Eastern box turtle (Endangered) photo by Derek Yorks



Blanding's Turtle (Endangered) photo by Derek Yorks



Black Racer (Threatened) photo by Derek Yorks



Spotted Turtle (Threatened) photo by Derek Yorks

Blanding's and Spotted Turtles

Derek Yorks

For over 25 years, MDIFW has researched the distribution and status of Blanding's (Endangered) and spotted (Threatened) turtles in Maine.

Blanding's turtles are seven to 10 inches long with a yellow throat and light-colored flecking on a helmet-shaped shell. They are found primarily in York county and areas south and southwest of Portland.

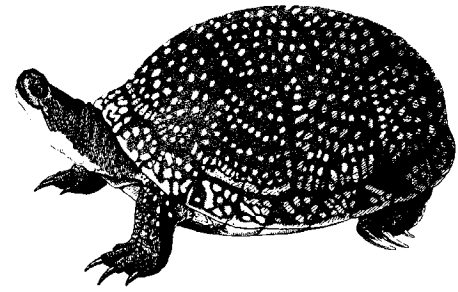
Spotted turtles are five to six inches long with yellow spots on the head, tail, and legs and a slightly domed, yellow-spotted black shell. They are found in southern Maine and the mid-coast area east to Penobscot Bay.

Both species are semi-aquatic, preferring small, shallow wetlands including swamps, marshes, and vernal pools. Undeveloped upland forests, fields, and other habitats surrounding these wetlands provide habitat for nesting, aestivating (a period of summer inactivity), and migration movements between seasonally occupied wetlands.

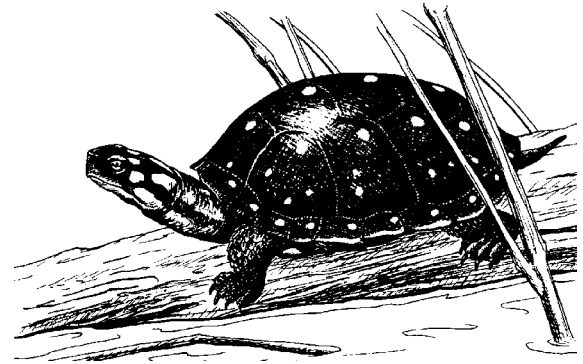
SURVIVAL CHALLENGES

Despite the attention these turtle species have received, habitat loss and fragmentation continue to threaten them in Maine. And as human population and development expands in southern and coastal areas, road mortality becomes an ever-increasing threat. The turtle's shell has provided sufficient protection from predators for millions of years but, unfortunately, is no match for a car tire.

Both Blanding's and spotted turtles are long-lived animals that take a minimum of seven (Spotted) to 14 (Blanding's) years to reach reproductive age. This delayed maturity, coupled with low hatching success, places increased importance on adult survivorship. Like most turtle species, Blanding's and spotted turtles have evolved a life history strategy dependent upon on a slow but steady reproductive output paired with long adult lifespans. Recent population analyses of Blanding's turtles indicate that as little as 2 to 3% additive annual mortality of adults is unsustainable, leading ultimately to local population extinction. In other words, losing just a few breeding adult turtles in a population each year to roadkill or other causes such as illegal collection may be these species' greatest threat.



Blanding's Turtle drawing by Abigail Rorer



Spotted Turtle drawing by Mark McCollough

CONSERVATION EFFORTS

MDIFW is currently involved in five conservation projects benefiting Blanding's and spotted turtles in Maine:

1. Conservation of Blanding's Turtle in the Northeast:

MDIFW and partner agencies in four other northeastern states were awarded a U.S. Fish and Wildlife Service Competitive State Wildlife Grant to implement collaborative conservation measures for Blanding's turtles.

This is the second such award these states have been jointly given for Blanding's turtle conservation, and our renewed effort focuses on implementing on-the-ground conservation actions and standardized population assessments that we identified in the 2014 Conservation Plan for Blanding's turtles in the northeastern United States.

These next steps toward maintaining and enhancing functional Blanding's turtle populations include improving and monitoring the use of nesting habitat, working to reduce road mortality, studying the population and demographics at priority sites, and reaching out to landowners and land trusts hosting high-value populations.

In 2019, Maine biologists concluded field work under this grant with intensive trapping studies at two Blanding's turtle sites, adding to the three sampled in 2017/2018, and we continued to analyze data and plan conservation actions with our project partners throughout 2020.



Blanding's Turtle photo by Derek Yorks

2. Cautionary Road Signage Project (Turtle Xing):

A cooperative study by the University of Maine and MDIFW identified high-density, rare turtle areas with road-crossing hotspots. With the assistance of the Maine Department of Transportation (MDOT), The Nature Conservancy, and local towns, we installed signs in strategic locations warning motorists to watch for rare turtles on the roadway. The signs are permanent, but they fold closed so that they may be deployed seasonally, coinciding with the spring and summer period when overland turtle movements are greatest. This reduces sign fatigue by local commuters, increasing the signs' impact. This project was one of the first of its kind among northeastern states and is now in its 15th year.

3. Maine Turtle Roadkill Survey:

In 2010, we partnered with Maine Audubon and MDOT to launch Wildlife Road Watch, a volunteer initiative to report wildlife-road interactions (both alive and dead). In 2014, we began monitoring for road mortality at previously documented Blanding's and spotted turtle crossing and roadkill sites and potentially important road-crossing sites identified in a predictive GIS model.

We expanded this effort in 2018 as the *Maine Turtle Roadkill Survey* – a partnership between MDIFW and Maine Audubon to refine the predictive model, improve survey methods, and enlist citizen scientist volunteers to collect data at roadways where turtles are at risk.

Data generated from these efforts will help us plan future wildlife roadkill mitigation efforts such as additional signage areas, critter crossings, exclusionary fencing, and public outreach.

For more information on the program, visit inaturalist.org/projects/maine-turtle-roadkill-survey or maineaudubon.org/projects/road-watch/maine-turtle-roadkill-survey.

4. Improving Nesting Habitat at Priority Blanding's Turtle Sites:

MDIFW, in partnership with local land

trusts, private landowners, and the U.S. Forest Service, is working to monitor, manage, and in some cases create or enhance nesting habitat at several of Maine's most promising Blanding's turtle sites.

Biologists are using time-lapse cameras at nesting areas to document nesting females and gather data that will help them effectively manage this critical resource. Most nesting sites were created by human disturbance and, without ongoing periodic managed disturbance, these bare gravel, sand, or soil areas are eventually overcome with vegetation.

This habitat-focused effort will improve long-term viability of regionally important Blanding's turtle populations in Maine. In addition to reducing the need for nesting females to travel outside core or interior areas of sites, management of nesting areas may serve to enhance nest success and hatchling survival by directing females away from marginal nesting habitats like backyards, active gravel pits, roadsides, and agricultural lands, where eggs and hatchlings are more susceptible to human-caused disturbance and human-subsidized predators, such as raccoons and skunks.

5. Conservation and management of the Spotted Turtle in the Eastern U.S:

In 2017, MDIFW, and eight other eastern states, was awarded a U.S. Fish and Wildlife Service Competitive State Wildlife Grant to assess spotted turtle populations and develop an adaptive conservation plan. The State-Threatened spotted turtle reaches the northeastern terminus of its range in the Atlantic Coastal Plain of Maine and is identified as a Species of Greatest Conservation Need (SGCN) in all 21 states in which it occurs. While at the outset of this grant the spotted turtle's distribution in York County was well understood, seemingly isolated populations had also been recently confirmed in another four counties as far as central and mid-coast Maine.

Under this grant, MDIFW broadened its spotted turtle population assessments in 2020, making a special effort to gather baseline data at sites supporting this species throughout its statewide range. We also focused considerable sampling effort on poorly understood areas outside of York county, which helped us to identify new spotted turtle populations ranging from seemingly small to rather substantial and of statewide importance.

This work is supported by the federal State Wildlife Grants program, the Maine Department of Transportation, The Nature Conservancy, the Maine Outdoor Heritage Fund, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance.

Mapping Maine’s Wood Turtles

The wood turtle, listed as Special Concern, is one of Maine’s rarest turtles. Medium sized (five-eight inches) with a distinct sculpted shell and orange coloration on its neck and legs, this long-lived species can survive for 58 years or more.

For much of the year, wood turtles are found in slow to moderate moving clear-water streams with a predominantly sand or gravel substrate. During late spring and summer, they use the surrounding uplands including forests, floodplains, meadows, and hayfields. From late fall to early spring, they hibernate underwater in sheltered areas of rivers, including deeper pool bottoms, under riverbanks, or under woody debris. No other Maine turtle species makes such extensive use of both aquatic and terrestrial habitats.

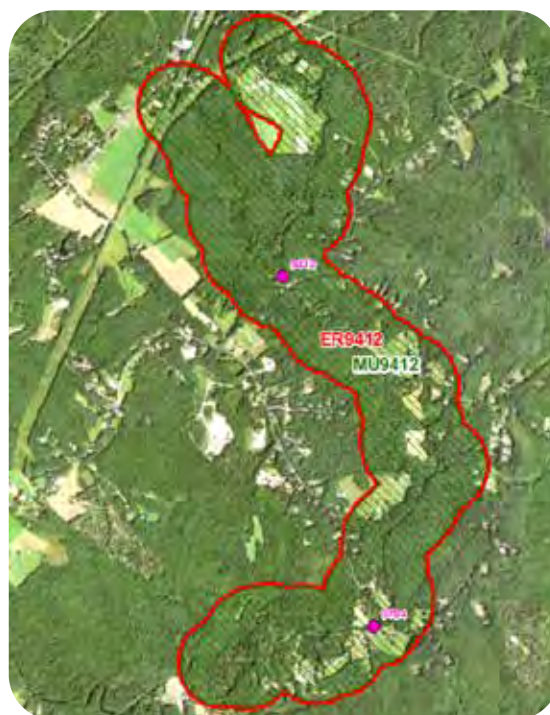
MDIFW verifies and tracks occurrences of this rare species and maps them for purposes of conservation planning, environmental reviews and inclusion in outreach efforts such as the Beginning with Habitat program. Wood turtles and many other species that the Department maps have long been represented by a simple buffer in the form of

a circle (often a ¼ mile in radius) around an occurrence point. We are increasingly engaging in a process to re-map species occurrences as “smart polygons” that are based upon detailed knowledge of the species’ habitat use and typical home range extents (**Figure 1**).

We began this process for wood turtles in 2019, remapping their stream habitat using a protocol developed with MDIFW Habitat Group biologists. The new mapping protocol results in polygons which follow the linear stream feature up and downstream from stream-associated occurrences, buffered to include upland habitats out to 300 meters. We have excluded nonhabitat incursions, such as intensive development and aquatic features not typically used by wood turtles (e.g. impounded streams) from the maps. Smart polygons such as these, informed by species natural history, do a better job of directing Department and partner resources toward those areas of the landscape that are most meaningful for conservation.

This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

FIGURE 1. TRANSLATING RARE ANIMAL OBSERVATIONS INTO MEANINGFUL HABITAT POLYGONS USING SPECIES NATURAL HISTORY INFORMATION.



Maps by Becca Settele and Derek Yorks.

Northern Black Racers

Derek Yorks



Northern Black Racer photo by Derek Yorks

Black Racer Habitats in Maine

In northern New England, black racers are habitat specialists and are most commonly found in shrublands and sunny open woodlands with predominantly sandy soils. They are diet generalists that prey upon rodents, frogs, birds, and even other snakes. The northern black racer is found from southern Maine to northern Alabama, Georgia, and South Carolina. In many areas of its range, it is abundant and is one of the most commonly encountered snake species. Despite its prevalence elsewhere, Northern black racer is listed as a Species of Greatest Conservation Need (SGCN) in all six New England states. The black racer reaches its northern range limit in Maine where it is at risk of extirpation due to rarity, habitat loss, and habitat fragmentation. Currently, Maine racer populations appear to be restricted to interior York County and southern Oxford County, where there are only about 12 modern, documented sites.

Monitoring Black Racer Populations

In the spring of 2016, MDIFW biologists initiated a multi-year project seeking to confirm and document new or poorly known occurrences and to establish a monitoring program at sites where black racer populations occur. The project has since evolved to include a study examining the impacts of grid-scale solar development on one of Maine's largest racer populations. In the first three years of this effort (2016-2018), we tracked 25 individual racers using VHF radio transmitters. In 2017, we added a monitoring program that assesses populations with repeated transect surveys, and we continued these surveys in 2018. An analysis of the data we collected during this period estimated that populations at three of Maine's best-known Racer sites range from 29.1 (95% CI =17.4-70.5) to 182.1 (95% CI =124.3-297.9). This tells us that even Maine's very best sites support relatively small populations.

This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.



Mudpuppy drawing by Abigail Rorer

The Introduced Mudpuppy

Phillip deMaynadier

The mudpuppy is Maine's largest and only non-native amphibian species. Entirely aquatic in all life stages, this giant salamander is found in lakes and streams throughout eastern North America, ranging from the Great Lakes region, south to the Gulf States, and approaching its native northeastern range in New York and Vermont.

Throughout much of its range, the mudpuppy is considered a species of conservation concern, but it is an introduced species in several New England states, including Rhode Island, Massachusetts, New Hampshire, and Maine. Accidentally introduced into the Belgrade Lakes, Kennebec County, in 1939, current documentation suggests the mudpuppy may have spread to 16 waterbodies (11 confirmed) across three major central Maine watersheds. This exotic salamander represents a potential management risk, where it could have negative interactions with economically important fisheries and several aquatic Species of Greatest Conservation Need (SGCN) identified in Maine's 2015 Wildlife Action Plan.

There is no clear evidence that the mudpuppy's introduction has negatively affected Maine's aquatic communities, but its ecological interactions as both predator and prey are also largely unstudied. Anecdotally, fishermen have expressed concerns that the mudpuppy interferes with fishing gear, is a possible fish larvae predator, and could be competing with game fish for food resources. Indeed, mudpuppies do have a broad diet that can include fish eggs, small fish, aquatic insects, mollusks, crayfish, and other amphibians. All of these taxa include constituent SGCN

species in Maine, some of which overlap the mudpuppy's potential range. More study is needed to assess the current range and ecological effects of mudpuppies in Maine's local aquatic communities.

MUDPUPPY STUDY

In the winter of 2017-2018, MDIFW and cooperators initiated a new study on the mudpuppy with the following objectives:

1. Document distribution and relative abundance using standardized field trapping techniques.
2. Conduct a diet analysis to understand potential impacts on lacustrine SGCN and aquatic ecosystems.
3. Update Mudpuppy records in the Maine Amphibian and Reptile Atlas Project database and prepare a distribution map for professional publication and public outreach.

eDNA SAMPLING

In addition to these direct objectives, this project will also inform novel mudpuppy environmental DNA (eDNA) detection protocols in development at the University of Maine (Dr. Michael Kinnison and Vaughn Holmes) by providing a confirmed baseline of occupied mudpuppy waterbodies and their relative abundance. eDNA consists of cellular DNA products shed from organisms into their environment, and has recently emerged as a sensitive and potentially cost-effective alternative to traditional survey methods for amphibians, fish, and other taxa. The challenge of mudpuppy detection and management presents an exciting opportunity to develop new techniques that combine eDNA sampling with traditional direct observation and trapping methods to determine and validate occupancy estimates for Maine's only exotic amphibian.

IMPROVED TRAPPING TECHNIQUE

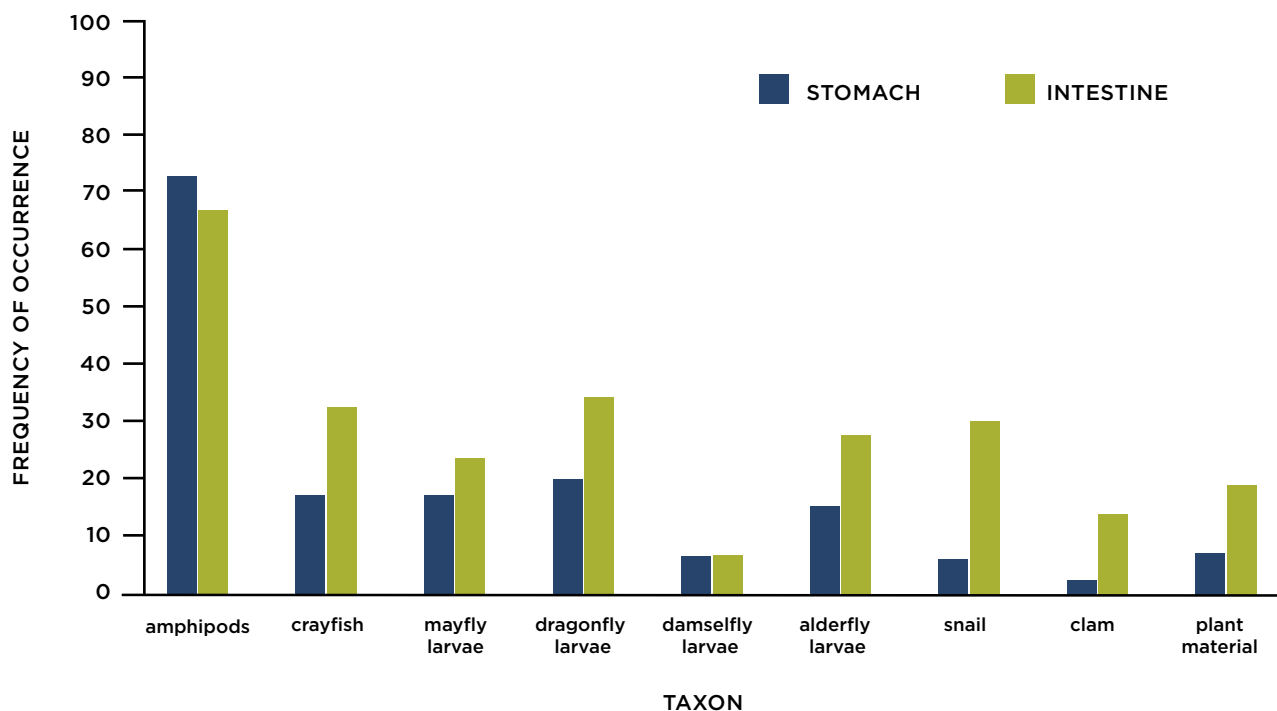
Following a review of mudpuppy biology and capture techniques, we developed a methodology to trap salamanders through the ice using modified, baited minnow traps. Our trapping method has been successful with a total of 356 mudpuppies captured during the winters of 2017, 2018, and 2019. Using this technique, we have confirmed mudpuppy presence in seven waterbodies including Salmon Lake (Belgrade/Oakland), North Pond (Smithfield/Rome), Long Pond (Livermore), Messalonskee Lake (Belgrade/Oakland), Togus Pond (Augusta), Long Pond (Belgrade/Mount Vernon), and Great Pond (Belgrade/Rome). Our capture rate of 0.488 animals per trap night compares favorably to those of other mudpuppy studies using similar methodology from within the species' native range, where capture rates range from 0.028 (Vermont) to 0.69 (Ontario). Notably, our capture rates on Long Pond (Belgrade/Mount Vernon) equaled 1.45 animals per trap night, a rate exceeding that of any reports from elsewhere in the species range.

GUT CONTENT EXAMINATIONS

A Colby College laboratory (Dr. Cathy Bevier) has dissected a total of 300 mudpuppies to examine digestive tract contents from both stomachs and intestines. This work is ongoing, but preliminary gut content identifications include remains from nine major taxa: crayfish (Decapoda), mayflies (Ephemeroptera), amphipods (Amphipoda), damselflies and dragonflies (Odonata), alderflies (Megaloptera), snails (Gastropoda), clams (Bivalvia), and plant matter (Figure 2). By far the most frequent food items were amphipods (scuds), occurring in 73% of mudpuppy stomachs and 67% of intestines. Incidental items included remains of a rubber fish lure, pebbles, fish lenses, two worms, two crane fly larvae, and an unidentified beetle. The presence of fishhooks in the stomachs of three mudpuppies suggests interference with fishing gear.

This work is supported by the federal State Wildlife Grants program, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, Colby College, and the University of Maine Orono.

FIGURE 2. MUDPUPPIES DIGESTIVE TRACT CONTENTS





INVERTEBRATES

As they do globally, invertebrates dominate Maine’s biota, both in richness and biomass. In fact, Maine’s non-marine invertebrates are conservatively estimated to exceed 15,000 species, or nearly 98% of the state’s animal species diversity. Like many other states, Maine’s legal definition of “wildlife” (any species of the animal kingdom) includes vertebrates and invertebrates, thus challenging MDIFW and conservation partners with a tremendous breadth and volume of species to protect and manage. One of the ways MDIFW triages its limited staff and program resources toward invertebrate conservation and management is to focus on better-studied species and groups with well-documented patterns of decline or imperilment. Maine lists 132 non-marine invertebrates as Species of Greatest Conservation Need (SGCN) in the 2015 State Wildlife Action Plan, and some examples of recent survey, research, and conservation projects for these and other priority invertebrates are highlighted below.

Bumble Bees

Beth Swartz

Bumble bees are one of our most valuable pollinators of flowering plants. Many spring wildflowers, as well as important Maine crops like apples, blueberries, cranberries, and tomatoes, thrive on bumble bees’ early spring emergence and “buzz pollination” method. Unfortunately, over the past 25 years, several species of North American bumble bees have all but disappeared, and others have drastically declined throughout their ranges. On a global scale, habitat loss, pesticides, diseases and parasites introduced with commercially raised bumble bees, and intensive agricultural practices likely all play a role in bumble bee declines.

scientists from all over Maine to collect data on what species are present, where they occur, what habitats they use, and how abundant they are.

Over the course of the project’s six seasons, more than 300 volunteers were trained in a standardized survey protocol and provided field equipment. This enthusiastic and productive group of citizen scientists then went to work and, by the end of the final field season in 2020, conducted surveys at more than 2,500 sites statewide and contributed more than 27,000 new bumble bee records for Maine! Their data showed that 14 of the 17 species historically known to occur in Maine (Table 1) were still present, and that some species had decreased in relative abundance while others had increased.

The three previously documented species not found by MBBA volunteers are the rusty patched bumble bee, American bumble bee, and indiscriminate cuckoo bumble bee. All are known to have declined in other parts of their range and it is possible they are now extirpated from Maine. The rusty patched bumble bee has experienced a 90% decline in both numbers and distribution throughout its entire North American range, and in March of 2017 it became the first ever bumble bee to be protected by the U.S. Endangered Species Act. While the species has not been documented in Maine for more than a decade, we are still hopeful that a remnant population is out there somewhere.

TABLE 1. BUMBLE BEES OF MAINE.

COMMON NAME	SCIENTIFIC NAME
Rusty Patched Bumble Bee	<i>Bombus affinis</i>
Yellowbanded Bumble Bee	<i>Bombus terricola</i>
Brown-belted Bumble Bee	<i>Bombus griseocollis</i>
Red-belted Bumble Bee	<i>Bombus rufocinctus</i>
Ashton’s Cuckoo Bumble Bee	<i>Bombus ashtoni</i>
Lemon Cuckoo Bumble Bee	<i>Bombus citrinus</i>
Fernald’s Cuckoo Bumble Bee	<i>Bombus fernaldae</i>
Indiscriminate Cuckoo Bumble Bee	<i>Bombus insularis</i>
Two-spotted Bumble Bee	<i>Bombus bimaculatus</i>
Common Eastern Bumble Bee	<i>Bombus impatiens</i>
Confusing Bumble Bee	<i>Bombus perplexus</i>
Sanderson’s Bumble Bee	<i>Bombus sandersoni</i>
Tri-colored Bumble Bee	<i>Bombus ternarius</i>
Half-black Bumble Bee	<i>Bombus vagans</i>
Northern Amber Bumble Bee	<i>Bombus borealis</i>
Yellow Bumble Bee	<i>Bombus fervidus</i>
American Bumble Bee	<i>Bombus pensylvanicus</i>



The Maine Bumble Bee Atlas: Keeping Track of Native Pollinators

In 2015, MDIFW and the University of Maine initiated the Maine Bumble Bee Atlas (MBBA), a project to improve our understanding of the diversity, distribution, and conservation status of Maine’s bumble bee fauna. This multi-year statewide survey enlisted the help of volunteer citizen

An encouraging outcome of MBBA has been documentation of the apparent recovery of the yellowbanded bumble bee – a species that has experienced rangewide declines, including in Maine, but appears to be rebounding in northern New England. MBBA volunteers found this species every year of the project, in more than 170 townships across all corners of the state and in a wide diversity of habitats.

But perhaps the project's most exciting highlight came in 2017, when one of our volunteers discovered a population of Ashton's cuckoo bumble bee in northern Aroostook County. This species is one of the rarest bumble bees in North America and had not been documented in Maine since 1996. An obligate nest parasite of both the rusty patched bumble bee and the yellowbanded bumble bee, its decline likely followed the crash of these two species. The now rising numbers of yellowbanded bumble bees in Maine give hope that a few more occurrences of this rare species may be found.

For more information about the Maine Bumble Bee Atlas, visit the project website at mainebumblebeeatlas.umf.maine.edu. You can also follow the project on Facebook at facebook.com/MaineBumblebeeAtlas.

This work is supported by the federal State Wildlife Grants program, in-kind contributions from the University of Maine at Orono and Farmington, the Maine Outdoor Heritage Fund, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance from citizen scientists.

Rusty Patched Bumble Bee Surveys

The rusty patched bumble bee was once widely distributed across much of the eastern and upper mid-western U.S., but since the 1990s it has declined by nearly 90% range wide. Consequently, in 2017, it was afforded protection under the U.S. Endangered Species Act.

The rusty patched bumble bee historically occurred across most of the state, with records regularly reported from the late 1800s to the mid-1990s. But since then, only two observations have been documented, both in the mid-coast region: one individual photographed in a Rockport (Knox Co.) flower garden around 2005, and another collected from a commercial blueberry field in Stockton Springs (Waldo Co.) in 2009. In the multi-year (2015-2020) state-wide volunteer survey effort to document Maine's bumble bee diversity that generated over 27,000 new records, no rusty patched bumble bees were found.



Rusty Patched Bumble Bee photo by Johanna James-Heinz

In 2019 and 2020, with funding from the U.S. Fish & Wildlife Service (USFWS), MDIFW conducted targeted surveys in the vicinity of the most recent Knox and Waldo County occurrences, as well as in adjacent Lincoln and Sagadahoc Counties and in areas of southwest Maine with hillier terrain. Using a combination of Maine Bumble Bee Atlas and USFWS survey methodologies for finding new populations of rusty patched bumble bee, biologists visited as many high-quality habitats as possible during the species' flight season. Across all study areas and through both field seasons, they conducted a total of 150 surveys at 119 sites. While 10 species of bumble bees were documented, unfortunately the rusty patched bumble bee was not observed.

MDIFW will continue looking for this extremely rare species in 2021. You can help by carefully observing the bumble bees you see and documenting any credible sightings with close-up, in focus photographs. You can submit your photos to iNaturalist (inaturalist.org), which MDIFW will monitor for confirmed reports. For more information on how to distinguish the rusty patched bumble bee from similar-looking, more common Maine bumble bees, please visit the Maine Bumble Bee Atlas website (mainebumblebeeatlas.umf.maine.edu) and read *Tips For Identifying the Rusty Patched Bumble Bee*.

This work is supported by the federal Endangered Species Section 6 grants program, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance from citizen scientists.

Dragonflies and Damselflies

Phillip deMaynadier

Insects in the Order Odonata, damselflies and dragonflies are conspicuous components of Maine’s wildlife diversity and valuable biological indicators of freshwater ecosystem integrity. Over 1/3 of the total North American Odonate fauna — 160 species — have been documented in Maine to date. In fact, northeastern North America is considered a regional hotspot for damselfly and dragonfly diversity, and several species of national and global conservation concern are found in Maine.

TAKING STOCK OF MAINE’S RARE BLUETS

From 2017 to 2019, a working group of experts from eight states (ME, NH, MA, CT, RI, NY, NJ, PA) was organized to better coordinate, on a regional level, the study and conservation of bluets (*Enallagma ssp*), which are some of the Northeast’s rarest endemic damselfies. As part of this project, MDIFW cooperated with Dr. Ron Butler from the University of Maine at Farmington to conduct standardized surveys of historical pond locations for the pine barrens bluet, scarlet bluet, and New England bluet, two of which are Species of Greatest Conservation Need (SGCN) in Maine’s Wildlife Action Plan.



New England Bluet photo by Bryan Pfeiffer

From 2018 to 2019, Dr. Butler’s team conducted 245 site visits to 116 ponds and lakes to document the status and habitat use of rare damselfly species. A final report was completed in 2020, and highlights from it include:

1. Scarlet and New England bluets are broadly distributed in Maine’s southern and central lakes from the New Hampshire to New Brunswick borders
2. Many historical New England Bluet populations cannot be reconfirmed, and the species is therefore recommended for Special Concern status.



Breeding Ringer Boghaunters photo by Terry Chick

3. There has been no confirmation of pine barrens bluet populations since 1995, suggesting potential species extirpation.

TRACKING THE ELUSIVE RINGED BOGHAUNTER DRAGONFLY

Listed as a state Threatened species and a Species of Greatest Conservation Need in Maine’s Wildlife Action Plan, the Ringed Boghaunter is globally rare and regionally restricted to the northeastern and upper midwestern U.S., where fewer than 60 populations have been documented. This species was a former candidate for federal listing and is considered “vulnerable” by the International Union for the Conservation of Nature.

The ringed boghaunter was first discovered in Maine in 1995 by MDIFW biologists, and extensive subsequent fieldwork (>715 field surveys of >315 wetlands) over nearly 25 years has only yielded nine confirmed breeding populations, all restricted to York and Oxford Counties. In some cases, boghaunter dragonflies share their habitat with Blanding’s turtles (State Endangered), spotted turtles (State Threatened), and ribbon snakes (State Special Concern). Significant in its own right, the ringed boghaunter is also an indicator of healthy pocket swamp and vernal pool ecosystems – habitats threatened by development in southern Maine. As with many other vulnerable elements of Maine’s biological diversity, identifying, characterizing, and mapping populations of the ringed boghaunter is an important first step toward forging proactive species conservation partnerships with landowners, land trusts, towns, and others.

This work is supported by the federal State Wildlife Grants program, a Northeastern Regional Conservation Needs grant, and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

Butterflies

Phillip deMaynadier

With over 120 species and subspecies, butterflies are a colorful and conspicuous component of Maine's biological diversity. They also play important ecological roles, both as wildflower pollinators and as prey to larger species, from dragonflies to birds. Despite growing concern for butterflies and other pollinating insects generally, Maine has, until recently, only had a rudimentary knowledge of the group.

MAINE BUTTERFLY SURVEY

Launched in 2007, the Maine Butterfly Survey (MBS) is a statewide atlas effort designed to fill information gaps on distribution, flight seasons, and habitat relationships for one of the state's most popular insects. Following in the tradition of previously state-sponsored wildlife surveys, such as the Maine Amphibian and Reptile Atlas Project, data generated from the MBS is generated by both professional biologists and citizen scientists.

There is increasing public demand for information on the status of butterflies and other nongame wildlife in Maine. Of special note is the high proportion of state butterflies considered Extirpated, Endangered, Threatened, or Special Concern. Additionally, about 20% of the state's butterflies are currently recognized as Species of Greatest Conservation Need (SGCN) in Maine's 2015 Wildlife Action Plan because of perceived rarity and habitat specialization. Statewide survey effort could demonstrate that some of

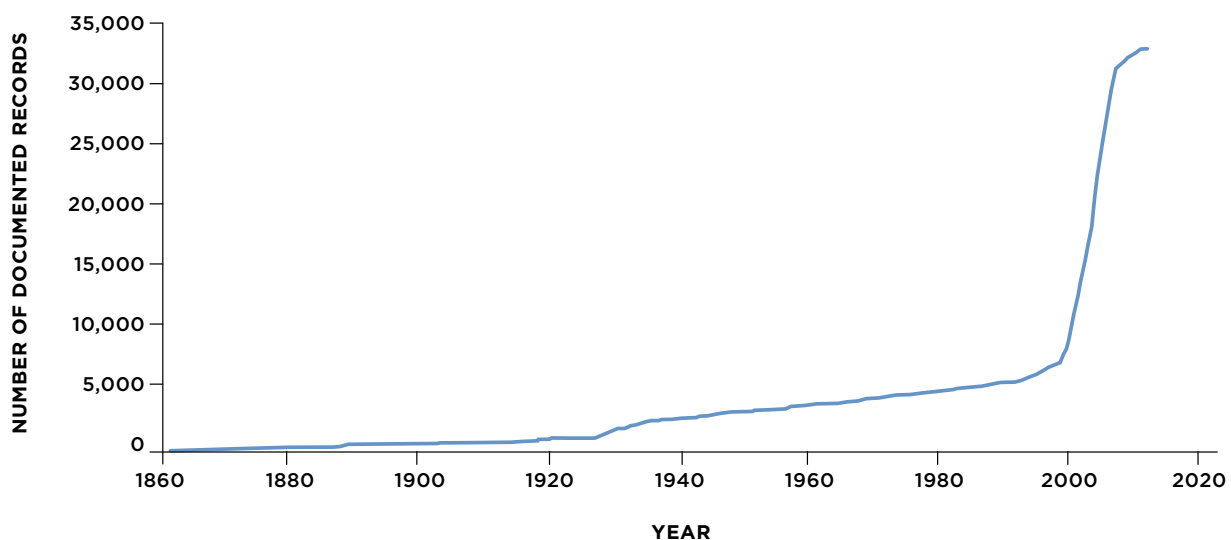


these species are more abundant than formerly believed, while others may merit increased conservation attention. By marshalling the efforts of volunteers and professionals, this multi-year butterfly atlas is designed to provide MDIFW and its conservation partners with a significant increase in knowledge on the status and trends of the state's butterfly fauna.

The volunteer atlas component of the MBS project was launched in 2007 and completed its 10th field season in 2016. From 2007 to 2014, more than 25,000 new records were contributed, representing a >270% increase in records over project baseline. Since then, we have limited new data submissions to unusual species and new county records.

Placed in the context of Maine's historical butterfly study over the past century (**Figure 3**), the MBS contributions are striking. Many of these records provide novel information to our understanding of butterfly distribution and abundance, including >240 new county records, 12 new state records, one new U.S. national record (Short-tailed Swallowtail), and dozens of newly recorded SGCN butterflies.

FIGURE 3. CUMULATIVE MAINE BUTTERFLY RECORDS





Common Buckeye photo by Roger Rittmaster

Public outreach goals for the project met expectations, with more than 300 volunteers attending MBS training workshops at Colby College, over half of whom contributed photo and/or specimen voucher records. More than 10 media articles were published on the project and the website (mbs.umf.maine.edu) has attracted more than 30,000 hits.

In 2016, we began working with the Atlantic Canada Conservation Data Centre (ACCDC; John Klymko) to combine data from their recently completed Maritime Butterfly Atlas with that of the MBS project. Our ultimate goal is to produce a regionally integrated assessment and publication entitled *An Atlas of the Butterflies of Maine and the Maritime Provinces of Canada*.

Progress on this regional atlas is underway with collaboration from five institutions: MDIFW, ACCDC (J. Klymko), Colby College (H. Wilson), UMaine Farmington (R. Butler),



Canadian Tiger Swallowtail photo by Bryan Pfeiffer

and University of Florida (J. Calhoun). Slated for completion in the spring of 2021, the atlas is under contract for publication with Cornell University Press. We hope that this contribution will not only summarize the state of knowledge of butterflies in the Acadian region for scientists, but also introduce new members of the public to the fascinating world of butterflies, and other invertebrates.

In addition to the publication, other MBS project deliverables planned for completion in 2021 include: a finalized electronic database of over 38K records, an updated MBS website, revised state butterfly rarity ranks (NatureServe S-ranks and state ETSC status), and a curated reference collection at the Maine State Museum.

The work is supported by the federal State Wildlife Grants program, The Nature Conservancy, the Maine Outdoor Heritage Fund, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance.

Mayflies

Beth Swartz

Mayflies, or “shadflies” as they are often called, are a diverse group of insects with over 160 species found in Maine. Some species inhabit lakes and ponds, but most live in the flowing waters of streams and rivers. Belonging to the Order Ephemeroptera – named for the short lifespan of the winged adults – mayflies spend nearly their entire lives underwater, where they play a significant role in the food webs of aquatic ecosystems. The often-abundant nymphs are major algae consumers and plant material decomposers, and they provide a high-quality

food source for many stream predators. Anglers know that a good mayfly stream is likely a good trout and salmon stream, too – and the most popular flies tied by fly-fishers are modeled after the different life stages of the mayfly.



Roaring Brook mayfly photo by Don Chandler

MAYFLY CONSERVATION

Most, but not all, of Maine’s mayfly species are common and widespread. Of the rarer mayfly species, Maine lists two as Threatened, and both are identified as Priority 1 Species of Greatest Conservation Need (SGCN) in Maine’s 2015 Wildlife Action Plan.

The Roaring Brook mayfly is among the rarest insects in the world. For many years, it was only known from a single adult specimen collected on Mt. Katahdin in 1939, until MDIFW confirmed in 2003 that the species was still present there. Since then, MDIFW has surveyed more than 160 streams and documented a total of 15 where the mayfly occurs, all in the mountains of north central and western Maine (**Figure 4**).

Researchers outside of Maine have also collected specimens in recent years: one in the Green Mountains of Vermont and several in the White Mountains of New Hampshire. While we now know the Roaring Brook mayfly is not confined just to Mt. Katahdin, it does appear to be New England’s only endemic mayfly, restricted to cold, undisturbed, high-elevation streams of the northern Appalachian Mountain Range.

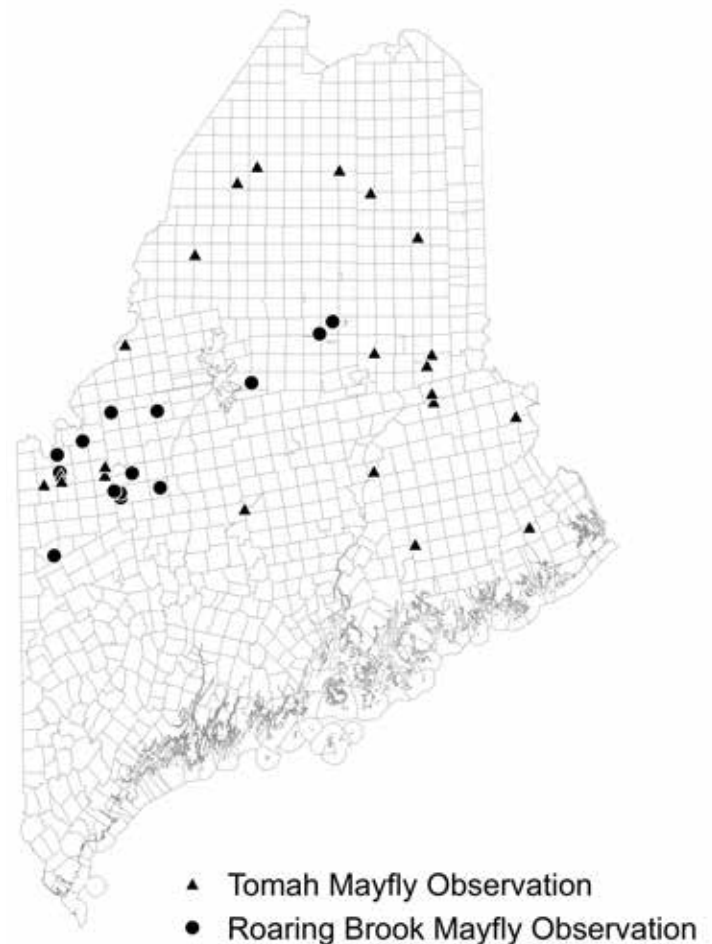
The Tomah mayfly, once thought to be extinct, was rediscovered in Tomah Stream (Washington County) in 1978 and has since been documented at 21 sites across northern, eastern, and central Maine (**Figure 4**) and at least one site in New York. Unlike other mayfly species, the Tomah mayfly is carnivorous as a nymph, preying largely upon other mayfly larvae. To complete its life cycle, this species depends on highly productive seasonally flooded sedge meadows along large streams or rivers. Although sedge meadows are not uncommon in Maine, the Tomah mayfly is only known to inhabit a limited number of sites.

In addition to the Roaring Brook and Tomah mayfly, 13 other Maine mayflies are considered Special Concern and SGCN. Many of them are only known from one or two sites, but comprehensive surveys have never been done. To help us plan such work for the future, the Department contracted mayfly expert Marcia Siebenmann to document

40 years of rare mayfly survey efforts and enter the data into a database. This database will help us track known occurrences and plan our search efforts for new populations of these uncommon insects.

This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

FIGURE 4. DISTRIBUTION OF ROARING BROOK MAYFLY AND TOMAH MAYFLY IN MAINE.



Map by Jason Czapiga and Beth Swartz

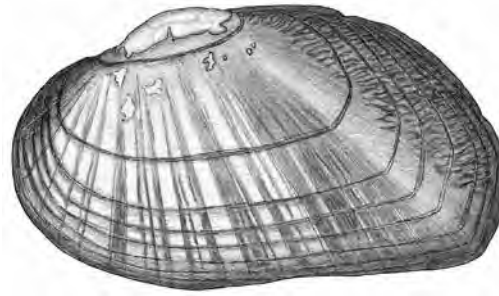
Brook Floater Surveys and Conservation

Beth Swartz

Maine is home to 10 species of freshwater mussels, three of which are listed as Threatened under the Maine Endangered Species Act (Table 2). One of those three, the brook floater, has been the focus of intensive survey efforts by MDIFW over the past decade. This species has declined throughout its Atlantic Coast range and is listed as Endangered or Threatened in nearly every state where it still occurs.

BROOK FLOATER HABITAT

One reason for the brook floater’s decline is its need for clean, relatively undeveloped, undammed riverine habitat with intact forested riparian buffers. While some of the state’s brook floater habitats have been degraded by human impacts, Maine’s many unspoiled rivers and streams still host the best remaining populations of this rare species throughout its entire range. Its stronghold lies in streams and rivers of the Penobscot River watershed, but it also occurs in the Pleasant River (Cumberland County), Sheepscot River, St. George River, lower Kennebec River watershed, and several Downeast rivers. Because Maine is so important to the conservation of this species, maintaining and protecting the quality of our stream and riverine habitats are essential to ensuring the brook floater remains a part of our natural heritage.



Brook Floater drawing by Ethan Nedeau

TABLE 2. FRESHWATER MUSSELS OF MAINE.

COMMON NAME	SCIENTIFIC NAME	STATE LISTING
Eastern Pearlshell	<i>Margaritifera margaritifera</i>	
Eastern Elliptio	<i>Elliptio complanata</i>	
Triangle Floater	<i>Alasmidonta undulata</i>	
Brook Floater	<i>Alasmidonta varicosa</i>	THREATENED
Eastern Floater	<i>Pyganodon cataracta</i>	
Alewife Floater	<i>Anodonta implicata</i>	
Creepers	<i>Strophitus undulatus</i>	
Yellow Lampmussel	<i>Lampsilis cariosa</i>	THREATENED
Eastern Lampmussel	<i>Lampsilis radiata radiata</i>	
Tidewater Mucket	<i>Leptodea ochracea</i>	THREATENED



Brook Floater Habitat photo by Ethan Nedeau

BROOK FLOATER SURVEYS

Over the past decade, the Department has intensively surveyed all of the 34 streams and rivers where the brook floater has ever been documented in Maine. Many of these sites had not been visited for over 20 years, and little was known about the brook floater's status at each. To conduct the surveys, MDIFW contracted Ethan Nedeau (Biodrawiversity, LLC), a mussel biologist with extensive experience studying brook floaters in the Northeast, and his work has yielded some interesting results. At Maine's only southern brook floater occurrence, the Pleasant River in Cumberland County, erosion and sedimentation likely caused by adjacent land use and severe flooding have nearly extirpated the species. Where 125 individuals were found at one location in 2001, only three were found in the entire river in 2020.

At the other end of the state, far Downeast in the remote Dennys River, Ethan spent three days looking and only found one live animal. In the St. George River, where we've always presumed the population was healthy, Ethan found relatively good numbers, but they were all old animals with little evidence of reproduction.

Conversely, some sites like Kenduskeag Stream, West Branch Union River, and the Passadumkeag River were confirmed to host relatively large, healthy populations – with the East Branch Pleasant River (Piscataquis County) boasting what might be the best population in the brook floater's entire North American range, with perhaps thousands of animals present.

At each site he surveys, Ethan documents the numbers and density of brook floaters, as well as habitat use and potential threats. This information will help MDIFW plan



Brook Floater Long-term Monitoring by MDIFW

and prioritize conservation efforts and will contribute valuable data to a regional brook floater conservation status assessment that we are working on with 12 other northeastern states.

BROOK FLOATER RANGEWIDE CONSERVATION AND RESTORATION

In 2016, the U.S. Fish and Wildlife Service awarded MDIFW and several partnering states a Competitive State Wildlife Grant for a range-wide brook floater conservation and restoration effort. In 2017, the Brook Floater Working Group was formed and went to work developing rapid assessment and long-term monitoring protocols for states to use throughout the species' range. Surveys conducted using these protocols will provide comparable and comprehensive data about occupancy and the status of each population and will give us a standardized way to monitor trends over time.

In 2018, MDIFW implemented the long-term monitoring protocol at two sites: one in Wesserunsett Stream in Kennebec County and one in the East Branch Pleasant River in Piscataquis County. We marked individual brook floaters at each site with uniquely numbered tags, then measured them and put them back where we found them. We surveyed each site twice in 2018, 2019, and 2020, relocating and remeasuring marked animals and tagging any unmarked animals we found. The data collected during these and future visits will give us information about population size and trends, age structure, survival, and growth.

The Brook Floater Working Group is also coordinating an investigation of effective captive rearing techniques so that brook floaters can be re-introduced to former habitats. Because Maine has some large, healthy populations and we know where to find them, MDIFW has been able to provide gravid females to the propagation study. These animals will help researchers determine how best to care for and successfully raise brook floaters in captivity. We also will share data about Maine's brook floater habitats with other states, in hopes of supporting their conservation efforts. Because we host some of the best remaining populations and habitats throughout the species' range, Maine will play a key role in the brook floater's future conservation.

This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

Tiger Beetles

Tiger beetles are a large group of predatory beetles belonging to the subfamily Cicindelinae within the family Carabidae (ground beetles). They are known for their incredible running speed (relative to their size) and their aggressive predatory behaviors. They have large eyes, long legs, and prominent mandibles. Maine's 14 known tiger beetle species live in a variety of habitats, but most are associated with bare or sparsely vegetated ground that may be composed of sand, gravel, cobble, or mud depending upon the species. The larvae of Tiger Beetles are fierce predators in their own right, living in burrows where they lie in wait to ambush invertebrate prey that pass over them.

CONSERVING RARE TIGERS

Most of Maine's tiger beetle species are widespread and common in their respective habitats. However, Maine lists one as Endangered and two as Special Concern. The State Endangered cobblestone tiger beetle is identified as a Priority 1 Species of Greatest Conservation Need (SGCN) in Maine's 2015 Wildlife Action Plan and the Special Concern salt marsh tiger beetle and White Mountain tiger beetle are identified as Priority 2 SGCN.



Cobblestone Tiger Beetle photo by Jonathan Mays

The cobblestone tiger beetle is considered a 'Globally Imperiled' (G2) species by NatureServe and is deemed 'Critically Imperiled' (S1) in most jurisdictions throughout its range including New Brunswick, Maine, New Hampshire, Vermont, New York, Pennsylvania, New Jersey, West Virginia, Indiana, Kentucky, and Alabama. It is 'Presumed Extirpated' in Mississippi. The cobblestone tiger beetle (CTB) was first discovered in Maine in 2009.

This unique insect is rare primarily because it is a habitat specialist confined to sparsely vegetated cobble bars (usually associated with islands) in free-flowing rivers of a very specific hydrology. This distinct habitat is maintained by high flows in the early spring that produce the preferred cobble substrate and limit the build-up of organic sediments. Statewide surveys to document potential additional populations of the cobblestone tiger beetle were conducted in 2010 and more recently in 2020, but failed to locate the species anywhere other than its original site of discovery in Somerset County. MDIFW will continue to search for this endangered beetle, but it is quite possible that the future of the cobblestone tiger beetle in Maine depends on our efforts to conserve the habitat integrity of a single small watershed in Maine's western foothills.

This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

SPECIAL HABITATS FOR REPTILES, AMPHIBIANS, AND INVERTEBRATES

Per the Maine Legislature, it is the state's policy (and MDIFW's responsibility) to conserve and manage all species of inland fish and wildlife. We take this mandate seriously, but we're also aware of the challenge it presents, considering wildlife is further defined by the state to include thousands of species of native birds, mammals, fish, reptiles, amphibians, and invertebrates.

The Department uses a fine-scale, hands-on approach to the conservation and management of a relatively small number of these species, mainly those managed as harvestable fish and game and those endangered or threatened by extinction. However, the state does not have the capacity to manage all fish and wildlife resources on an individual species-by-species basis. Biologists recognize that a more efficient and lasting approach for sustaining the majority of wildlife requires working at coarser scales, by identifying and conserving diverse high-value habitats and natural communities. Doing so not only provides a safety net for our most vulnerable habitat-specialized species, but also helps maintain healthy populations of all Maine wildlife. Below, we highlight some especially valuable habitats for reptiles, amphibians, and nonmarine invertebrates.

Pollinator Habitat

Beth Swartz

Maine is home to a wide diversity of native insect pollinators, including many species of butterflies and moths (Lepidoptera), bees (Hymenoptera), beetles (Coleoptera), and flies (Diptera). The ecosystem service that these wild pollinators provide to natural communities and human societies is immeasurable. Without them, many wildflowers, shrubs, and trees, as well as fruits, vegetables, and other food crops, would not get fertilized, including important Maine crops like apples, blueberries, squash, and tomatoes.

POLLINATORS IN PERIL

Over the past few decades, several native Maine pollinators, including the monarch butterfly and rusty patched bumble bee, have experienced significant declines throughout their ranges. Factors including habitat loss, disease, pesticides, and competition from introduced species have put these and other insect pollinators in danger of extirpation.





Monarch butterfly photo by Bryan Pfeiffer

HOW YOU CAN HELP

We can all help reverse the decline by establishing and protecting pollinator habitats. Here are a few ways to do so:

Invite Summer Monarchs – Providing summer habitat for monarchs is as simple as allowing common milkweed, the sole host plant for their caterpillars and a valuable nectar source, to grow and flourish.

Create a Bumble Bee Haven – Bumble bees are habitat generalists, but they require an abundance of diverse flowering plants that bloom continuously from spring to fall.

Embrace Your Wild Side – Some of the best habitats for pollinators are “weedy” un-mowed fields and roadsides, which generally benefit from full sun and are rich in pollinator favorites like clovers, milkweeds, goldenrods, vetches, dogbanes, asters, thistles, fireweed, lupines, and raspberries. You can replicate this at home by allowing a portion of your lawn to grow tall until late fall, or by creating an unmowed border around the edge of your property. In the early spring, waiting two to three weeks between cuttings can allow clovers, violets, creeping ground-covers, and dandelions to bloom, providing pollinators with some of their first available nectar and pollen sources of the season.

Plant a Pollinator Garden – Many common garden plants are especially attractive to butterflies, bumble bees, and other insect pollinators. Examples of favorites that are easily grown in Maine include bee balm, butterflyweed, sunflower, coneflower, thyme, mint, rhododendron, blueberry, and rose, but there are many more from which to choose. Use native plant species as often as possible.

Avoid Chemical Herbicides and Pesticides – Herbicides kill many of the flowering plants that pollinators feed on, and insecticides can kill bees and other insect pollinators – either directly or by affecting their abilities to forage, reproduce, or care for their colonies. There are safer alternatives that can still help you manage plant diseases and insect pests around your home and garden. Use native plant species as often as possible and be sure to select nursery plants and seeds that have not been treated with pesticides.

For more information, visit the Xerces Society at [xerces.org/pollinator-conservation](https://www.xerces.org/pollinator-conservation).

Vernal Pools

Phillip deMaynadier

Vernal pools are small, forested wetlands that come in many shapes, sizes, and settings. In the spring, their depressions fill with water from snowmelt and rain, and by late summer, they become partly or completely dry.

Isolated from streams, these habitats provide wildlife with a rich, highly valuable fish-free food base fed by surrounding organic forest matter. They also provide a nearly predator-free haven for a diversity of specialized amphibians (salamanders, frogs, and toads) and aquatic invertebrates (over 500 species in New England) that lack the physical and chemical defenses to reproduce in more fishy environs. Some of Maine's better-known vernal pool indicator species, including spotted salamanders, blue-spotted salamanders, wood frogs, and fairy shrimp, breed almost exclusively in vernal pools.

Still, just as deer wintering areas and waterfowl and wading bird wetlands host more than just deer and ducks, vernal pools provide habitat for more than a few specialized frogs and salamanders. Over half of Maine's amphibian and reptile species frequent vernal pool habitats during their life cycles, as do more familiar species like black ducks, great blue herons, flycatchers, hawks, deer, moose, fox, mink, bats, and other small mammals. Some forest herbivores are drawn to vernal pools because they serve as spring oases, offering up the season's first herbaceous forage. And forest predators are attracted to vernal pools because of the abundance of amphibian prey on the surrounding forest floor. In some forests, the collective weight (or "biomass") of these unseen spring amphibian sentinels has been estimated to exceed that of all birds and mammals combined! Indeed, their sheer abundance and palatability has many biologists and sportsmen convinced that the terrestrial wanderings of pool-breeding frogs and salamanders play a powerful role in the local ecology of Maine's woodlands.

Additionally, among Maine's dozens of wetland community types, few host as many rare and endangered species as do vernal pools, which provide sustenance and shelter to the Blanding's turtle (Endangered), spotted turtle (Threatened), ribbon snake (Special Concern), ringed boghaunter dragonfly (Threatened), as well as rare plants including the featherfoil (Threatened) and sweet pepperbush (Special Concern). Some of these species could face extinction in Maine without the distribution of high-value vernal pools throughout their range.



Vernal Pool photo by Phillip deMaynadier

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DEFINING AND PROTECTING SIGNIFICANT VERNAL POOLS

In 2006, MDIFW and the Maine Department of Environmental Protection (MDEP) developed a definition of Significant Vernal Pools — the most recent Significant Wildlife Habitat under the state's Natural Resource Protection Act (NRPA) — which was approved by the 120th Maine Legislature.

By definition, a vernal pool is considered significant if a State Endangered or Threatened species is present or there is evidence of exceptional breeding abundance by specialized amphibian indicator species.

In collaboration with MDEP, MDIFW has reviewed over 3,800 vernal pools to date, and approximately 25% of them have met standards for potential regulatory significance under NRPA. This use of science-based and legislatively approved criteria for defining a high value (significant) subset of Maine's vernal pools helps MDIFW biologists prioritize those with the greatest wildlife habitat values.

ONGOING EFFORTS AND HOW TO HELP

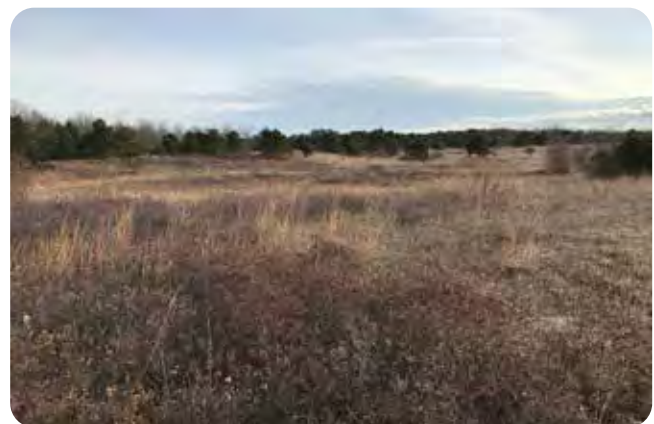
MDIFW and MDEP cooperate with the Maine Department of Conservation (DOC), municipalities, and landowners to conserve vernal pools. Workshops on vernal pool biology and conservation have been held throughout the state for landowners, land trusts, and land managers, and several publications are available offering voluntary techniques for protecting vernal pools and their wildlife. One such publication, *The Maine Citizen's Guide to Locating and Documenting Vernal Pools*, provides a comprehensive introduction to recognizing and monitoring vernal pools, including color photographs of the indicator species. Also available are two complementary guidebooks for protecting vernal pool habitat during timber management (*Forestry Habitat Management Guidelines for Vernal Pool Wildlife*) and development (*Conserving Pool-breeding Amphibians in Residential and Commercial Developments in the North-eastern United States*). All of the guides can be obtained by contacting the Maine Audubon Society at 207-781-2330.

Pitch Pine Woodlands and Barrens

Phillip deMaynadier

Pitch pine woodlands and barrens are lightly forested upland areas with dry, acidic, and often sandy soils. Pitch pine, red pine, scrub oak, blueberry, huckleberry, and/or bluestem grasses are commonly among the sparse vegetation of this unique natural community.

Once viewed as unproductive wastelands, Maine's few remaining pine woodlands and barrens are now recognized as areas of exceptional wildlife value, providing habitat for a variety of highly specialized plants and animals that feed on the specialized barrens vegetation. These unique habitats are especially rich in rare butterflies and moths, such as Edwards' hairstreak (Endangered), sleepy dusky-wing (Threatened), cobweb skipper (Special Concern), and barrens buck moth (Special Concern). Other rare species associated with Maine's barrens include black racers (Endangered), grasshopper sparrows (Endangered), upland sandpipers (Threatened), northern blazing star (Threatened), and many rare plants.



Pine Pitch Woodlands and Barrens photos by Derek Yorks

Dry woodlands and barrens often require periodic fire to prevent succession to a more common, closed-canopy white pine-oak ecosystem; however, fire is a natural disturbance that is now short-circuited by habitat fragmentation and active fire suppression. Both MDIFW and The Nature Conservancy make an effort to manage barren habitats that are in conservation ownership by implementing prescribed burns and mechanical harvesting as tools for conserving the ecosystem's unique vegetation structure and composition. It is estimated that over half of the state's original pine barren acreage has been lost to residential development, agriculture, and gravel mining, and what remains intact (mainly in the towns of Kennebunk, Wells, Waterboro, Sanford, Shapleigh, Hollis, and Fryeburg) is now tracked as a rare natural community by the Maine Natural Areas Program (MNAP, maine.gov/dacf/mnap).

Freshwater Marshes and Shrub Swamps

Derek Yorks

Freshwater marshes and shrub swamps are open, vegetated, shallow wetlands that contain water most of the time. They vary in size and appearance, but are all characterized as sun-soaked places with standing water, abundant vegetation, and high biological production. Many of Maine's amphibians, reptiles, and invertebrates depend on these wetlands for some or all of their life cycle.

WILDLIFE HUBS FOR MAYFLIES, MINK FROGS, AND EVEN MOOSE

Across Maine's forest-dominated landscape, marshes and shrub swamps serve as focal points for wide-ranging wildlife.

The mixture of lush herbaceous vegetation found above and below the water surface provides amphibians with shelter from predators, plus food in the form of invertebrate prey or the vegetation itself. Frogs, including leopard frogs (Special Concern), pickerel frogs, green frogs, bull frogs, mink frogs, gray tree frogs, and spring peepers breed and often live here year-round. Many reptile species, including spotted turtles (Threatened), Blanding's turtles (Endangered), painted turtles, ribbon snakes (Special Concern), garter snakes, and northern water snakes, thrive here too. And these habitats are also hugely important to several invertebrates, perhaps most conspicuously dragonflies and damselflies, as well as waterfowl, beaver, muskrat, and moose.



Shrub Swamp photo by Derek Yorks



Blanding's Turtle photo by Derek Yorks

CRITICAL HABITAT FOR BLANDING'S TURTLE

Thanks to a Competitive State Wildlife Grant (U.S. Fish and Wildlife Service), MDIFW has recently been able to conduct assessment and planning efforts focused on Blanding's turtles in Maine.

While Blanding's turtles are known to use a number and variety of wetlands, even in a single season, they are not found in just any wetland type. High-value marshes and shrub swamps are often at the core of their home ranges, generally serving as overwintering and late summer feeding areas.

As Maine biologists continue to collect and analyze data from this project, we expect to learn more about what specific characteristics of marshes and shrub swamps are critical for the survival of this species.



2019-20 RESEARCH & MANAGEMENT REPORT

Regional Wildlife Management

Download additional reports at
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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.

Regional Wildlife Management

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- » Non-Game Mammals Conservation & Management
- » Beginning with Habitat Updates
- » Bird Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management

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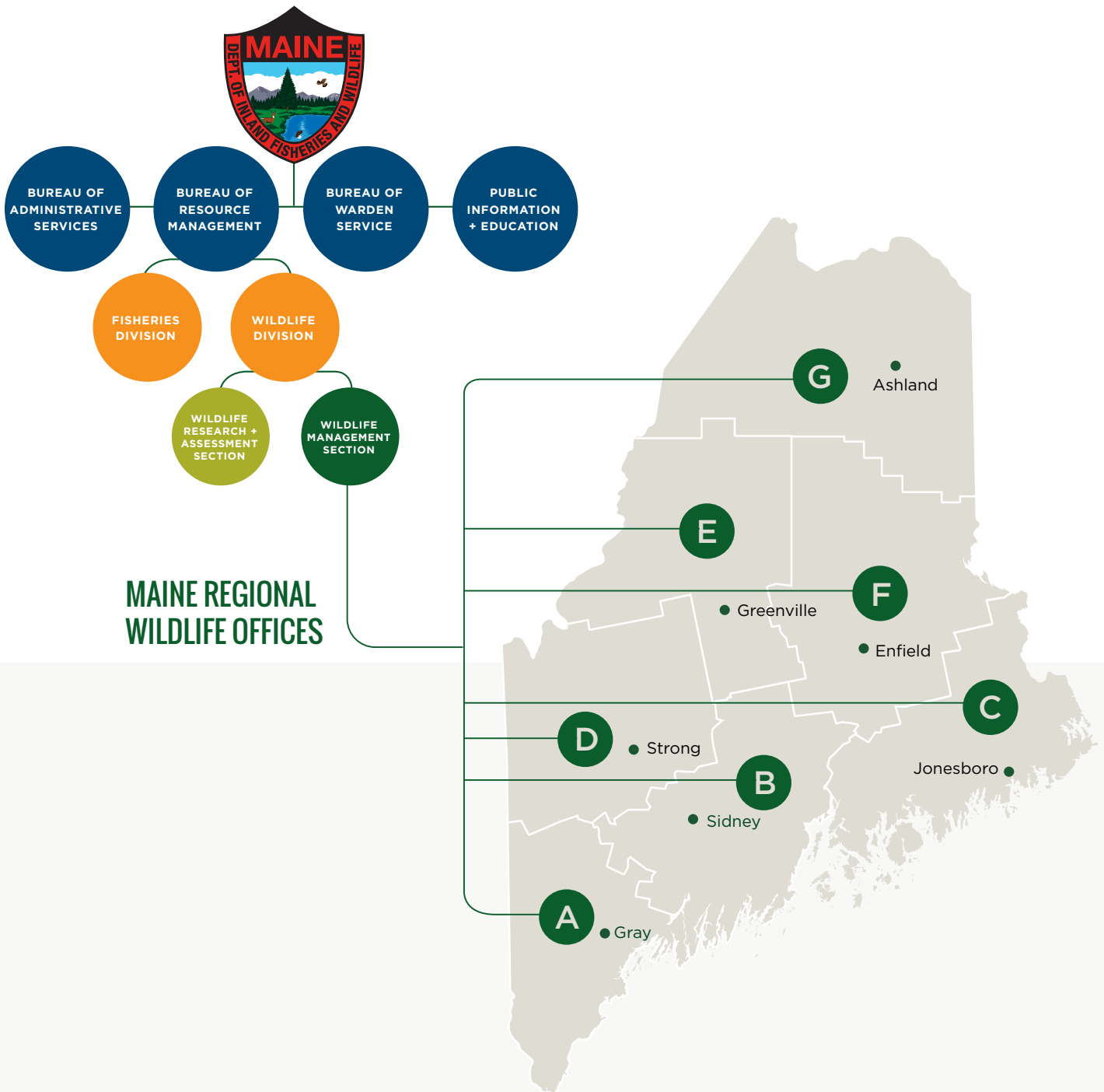
Accordingly, all Department programs and activities must be operated free from discrimination in regard to race, color, national origin, age or handicap. Any person who believes that he or she has been discriminated against should write to The Office of Equal Opportunity, U.S.



WILDLIFE MANAGEMENT

Ryan Robicheau

The Wildlife Management Section is MDIFW’s on-the-ground wildlife management work program. It is organized into seven regional geographic districts throughout the state, with regional offices in Gray, Sidney, Jonesboro, Strong, Greenville, Enfield and Ashland. Each office is set up to allow for interactions with the public and to facilitate administrative oversight within the respective region.





In addition to Regional Wildlife Biologists, the Wildlife Management Section also contains the Lands Management Program, which is focused on habitat management throughout the state, primarily on Wildlife Management Areas (WMAs), and we also employ a wildlife biologist assigned to the Maine Department of Agriculture, Conservation and Forestry.

The work program encompasses biological data collection for species management purposes, planning and implementation of wildlife habitat management on state and private lands, environmental review of development projects, development of statewide regulatory recommendations, administration of the Animal Damage Control Program, working with wildlife rehabilitators, and providing technical assistance and public outreach.

Truly comprehensive in its scope, the Wildlife Management Section touches on all aspects of the Department's approach to wildlife management. For the public, regional wildlife biologists are the main points of contact for wildlife issues in the state, and they serve as important conduits for information coming in and out of the Department.

This report includes articles written by Wildlife Management Section staff, focused on work developed and implemented under one of the Wildlife and Sportfish Restoration (WSFR) grants received by the Department from the United States Fish and Wildlife Service. This funding is administered by the Department under the Federal Aid in Wildlife Restoration act of 1937 (commonly referred to as the Pittman-Robertson Act). The Act created a federal tax on firearms, ammunition, and other sporting goods to be used for the conservation and

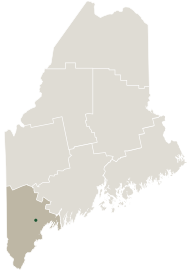
management of bird and mammal species in the United States. Funding from this legislation has proven essential for state fish and wildlife agencies to research, develop, and manage scientifically based programs that conserve birds, mammals, and their habitats.

The articles that follow highlight some of the work we have done, often with the help of our conservation partners, both on state-owned WMAs and on private land. We greatly appreciate the landowners who partner with us to manage their land for healthy fish and wildlife, and who give the people of Maine incredible opportunities to hunt, fish, trap, and more.

MDIFW currently owns and manages just over 108,800 acres of State WMAs and utilizes a WSFR grant to fund wildlife habitat management and public access improvements on those properties. Work activities covered under the grant include:

- Construction, improvement, and maintenance of roads, bridges, and parking areas
- Vegetation control (i.e., mowing of field and shrub habitats)
- Timber management
- Prescribed fire
- Waterfowl and other nest structures and platforms
- Wetland enhancement/water level control
- Plantings
- Herbaceous seedings

Developed and implemented by highly dedicated staff, and guided by management plans, these activities help the Department meet its objectives of maintaining high-quality wildlife habitat and recreational opportunities in Maine. I encourage the reader to explore these Wildlife Management Areas, or to contact us to learn more about them.



REGION A GRAY

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Kennebunk Plains Wildlife Management Area: Maintaining Rare Habitats Through Active Management

Scott Lindsay

Region A spans nearly 30,000 acres from the foothills of the White Mountains to the coastal plain, and features the state's widest range of habitat types and highest levels of plant and wildlife biodiversity.

The nine Wildlife Management Areas (WMAs) in Region A all offer recreational opportunities and large blocks of valuable wildlife habitat. But some — such as Kennebunk Plains WMA in Kennebunk — were acquired specifically to conserve a rare habitat type and the species that depend on it.

Kennebunk Plains is home to perhaps the largest stand of the showy Northern Blazing Star (*Liatris scariosa*) in the world — a rare plant that puts on a show in late summer when it flowers throughout the plains. The site also hosts populations of the state-endangered Grasshopper Sparrow (*Ammodramus savaanarrum*), the state-endangered Northern Black Racer Snake (*Coluber constrictor*) and the state-threatened Upland Sandpiper (*Bartramia longicauda*).

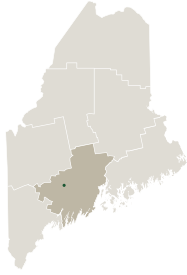
The 1,800-acre WMA contains 600 acres of sandplain grassland, initially a gift from the glaciers as they receded from Maine about 12,000 years ago. The sandplain persisted due to natural (and later man-made) fire, some lumbering, and development as a commercial blueberry farm. The sandplain is the best of its type in Maine, and is surrounded by two rare forest communities: pitch pine — heath barrens and pitch pine — scrub oak barrens. These three habitat types are exceedingly well-drained, and the plants found within them are adapted to dry, nutrient-poor conditions.

If left alone, the sandplain would mature into forest, which is happening to a certain extent today; and the surrounding rare forests would mature into a common pine-oak forest. If this were to happen, the species specially adapted to these habitats would decline and eventually lose viability at this site, becoming another casualty of habitat loss on a developing landscape.

Since acquiring this fire-dependent sandplain grassland habitat, MDIFW biologists from Bangor and Gray, along with our partners at The Nature Conservancy, have managed the habitat through prescribed fires in the spring and fall.

We managed the surrounding forest communities to a much lesser extent until 2016 and 2017 when, with biologists' input and under the supervision of MDIFW Lands Program foresters, we harvested three sites totaling about 140 acres. Our goals were to thin out the stands, open the canopy, and promote more regeneration of the critical shrub layer, all while maintaining the habitat connectivity needed to manage viable wildlife populations.

This work will return the stand to a more open pitch pine — oak woodland and favor regeneration of desired pitch pine instead of more shade-tolerant hardwoods. This will benefit wildlife species that use this habitat, most notably the Black Racer snake — a subject of many years of research and monitoring by MDIFW's Herptile and Invertebrate Group biologists. With these forested blocks now managed through timber harvest, they will soon be ready for management with prescribed burning — a worthy effort by MDIFW and TNC staff to preserve the gem of ecological diversity that is the Kennebunk Plains WMA.



REGION B SIDNEY

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Merrymeeting Bay Wildlife Management Area: Green Point Unit

G. Keel Kemper

The Wildlife Management Areas (WMAs) owned and managed by MDIFW throughout the state contain the full suite of wildlife habitats from prime uplands to rare wetlands. Some are remote, obscure areas that the public rarely visits; but occasionally we acquire a property so unique that, once the word gets out, it becomes a public favorite and gets considerable use almost every day. The Green Point unit of the Merrymeeting Bay Wildlife Management Area, located in Dresden, is just such a property... and you should check it out!

The Green Point unit is part of the Eastern River compartment of the much larger Merrymeeting Bay Wildlife Management Area. Located at the confluence of the Eastern and Kennebec Rivers and accessed via Rte. 128, the property consists of 483 acres, 81 of which are considered prime agricultural lands, plus over 12,000 feet of shoreline along both rivers and Merrymeeting Bay.



This area, formerly known as the Green Point Farm, was actively farmed by Steve Powell and his nephew Robert Gleason for many years. The property contains superior agricultural soils, is surrounded by several multi-generational family farms, and has long been a part of Dresden's rich agricultural history. Since acquiring the property in 2000, MDIFW has leased Green Point's farmlands annually to neighboring farm families, enabling them to more effectively manage their own lands and rotate the use of their fields for peak productivity. The income from these agricultural leases is covered under a grant agreement with the U.S. Fish and Wildlife Service, wherein all monies received are placed in a dedicated account and must be used within a specified focus area. Examples of approved expenditures include legal fees for land acquisition, wildlife management activities, and maintenance of facilities on MDIFW properties.





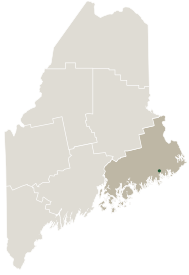
The Green Point unit has two unique habitat components: a very large apple orchard and several very large maintained fields.

Following acquisition, several efforts were made to prune, release, and improve the existing apple orchard. The upper orchard is well-maintained, bees are kept there to increase soft mast production, and annual mowing allows for easy public access. The lower orchard has been left unmanaged to provide dense cover for wildlife and exceptional hunting opportunity. A seasonal gate limits vehicular access, but pedestrian access is encouraged. A half-mile walk from the gate along the improved road leads to the “Green Point” and its expansive views of Merrymeeting Bay.

The northern end of the Green Point unit contains two very large open fields, which are mowed at least once a year to maintain early successional habitat. These fields are ideal for “field trials” and as such are utilized by several of the local dog clubs. Volunteers from the North American Versatile Hunting Dog Association have given back to the property through a variety of projects and also volunteer their time to mow the fields, saving the Department a considerable expense.

MDIFW provides a different experience on lands we manage, rooted in our commitment to open access and our encouragement of hunting, trapping, fishing, and other types of natural resource appreciation. Not all conserved lands within the Merrymeeting Bay area have the same management philosophy. This provides a strong argument for MDIFW to continue to acquire and manage its own lands for the benefit of Maine’s wildlife and its people.

Green Point is a very special place. Put it on your bucket list of properties to visit, as it will not disappoint.



REGION C JONESBORO

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Cobscook Bay Wildlife Management Area: the Crown Jewel of the Downeast Coastline

Steve Dunham

Considered by many to be the crown jewel of the Downeast coastline, Cobscook Bay's iconic shores, powerful tides, and expansive mudflats are big attractions for people and wildlife alike.

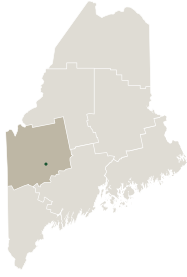
Cobscook, the Maliseet-Passamaquoddy tribal word for "boiling tides," appropriately describes the area's unusually large tides, which rise and fall 24 feet. The Cobscook Bay area encompasses the tidal waters of Denny's Bay, Whiting Bay, Straight Bay, Pennamaquan River, and East Bay, as well as the adjacent shoreline.

Cobscook Bay is a hydrologically and geologically complex estuary, with nutrient-rich Gulf of Maine waters and relatively low levels of human disturbance or development enabling high levels of biodiversity and productivity. Thousands of shorebirds forage and roost here on their annual migrations, attracted by the abundant seaweeds and phytoplankton in waters and the diverse intertidal invertebrates in the mudflats.

During the winter, the bay provides wintering habitat for waterfowl and, during certain periods, may contain up to 25% of Maine's black duck population. Cobscook Bay also played a key role in the restoration of bald eagles to the northeast and still contains the highest density of nesting bald eagles in the region.

The Cobscook Bay Wildlife Management Area is a network of 10 units comprising over 2,000 acres of land in a mix of tidal shoreline, freshwater wetlands, and upland habitats with numerous apple trees dotting the landscape. The area was historically farmland, and MDIFW continues to mow a series of small fields each year to maintain "old field" habitat conditions. We also mow many of the old woods roads each year for recreational and management access. A network of trails, part of the larger Cobscook Trails complex, are maintained on several of the units for additional recreational opportunities.

Last year, MDIFW Region C staff cleared and maintained about five miles of trail, and a permit was issued to Cobscook Shores to clear and maintain a new trail on the Race Point unit. With all of this new access, birders looking to see a diverse suite of species or upland bird hunters looking for woodcock, ruffed grouse, or turkey should definitely plan a trip to Cobscook Bay WMA.



REGION D STRONG

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Strong Wildlife Management Area: Habitat for Wildlife and More

Chuck Hulsey

The highest priority for uplands and wetlands designated as Wildlife Management Areas (WMAs) is the management of wildlife and their habitats. In the 1950s and 1960s, MDIFW primarily acquired WMAs for waterfowl production, with the purchases often funded by the Pittman-Robertson Federal Aid to Wildlife Restoration Act. This landmark legislation, enacted in 1937, may be the most important piece of legislation ever passed to restore and actively manage for wildlife.

Today, WMAs serve many purposes beyond waterfowl production. With input from various stakeholders, regional wildlife biologists write and follow management plans that address the needs of many different species. If a species is rare, or protected as Threatened or Endangered, then biologists might use intensive habitat management measures for their benefit, such as the prescribed burning that maintains dense, shrubby New England cottontail habitat in some southern Maine WMAs. More broadly, WMAs give the public access to natural landscapes for wildlife viewing, photography, canoe/kayak, hunting, trapping, and more.

The origin of the Strong WMA is unique: MDIFW purchased the 93-acre property in 1969 to relocate five regional biologists from a rental in Farmington to a department-owned modular home on the property. The headquarters and land span both sides of U.S. Route 4, four miles east of the village of Strong. While the property technically does not have frontage on the Sandy River, it does have “river-bottom” land with older red oaks and maples growing on a significant backwater connected to the Sandy River — a favored habitat for deer, gray squirrels, and wood ducks.

Locally known as the Hunter Farm, all the forested upland on the property was harvested heavily prior to being sold, and the nine acres of field were mowed by a neighbor for hay until the late 1980s when the neighbors sold their livestock. The WMA’s first wildlife habitat management practice was allowing the neighbor to keep the cut hay. This prevented natural plant succession of the fields, which otherwise would revert to shrubs and then trees. When that opportunity was lost, Region D wildlife staff took over the mowing by borrowing a tractor and bush hog from another region. Since then, we have mowed the fields every other year to provide ground cover for small wildlife. This schedule extends the flowering period to benefit pollinators and maintains milkweed utilized by butterflies and moths. Being an old farm site, one field has a large patch of mature blackberries. In a mowing year, we mow paths within the patch to rejuvenate growth and create better access for berry picking — a popular activity among the locals.



One of the four fields at the Strong WMA with two seasons of growth to maintain ground cover but remain as a field. Plants with yellow leaves are milkweed. Photo by Chuck Hulsey



The flowers of milkweed are highly attractive to pollinators, as are the maturing pods.

In July 1981, biologists at the U.S. Fish and Wildlife Service Moosehorn National Wildlife Refuge in Calais published *A Landowner's Guide to Woodcock Management in the Northeast*, which describes their research results and gives landowners step-by-step instructions to improve their lands for woodcock. In 1985, Assistant Regional Wildlife Biologist Tom Schaeffer saw an opportunity to adopt these practices at the Strong WMA and hired a recent biology graduate from the University of Maine at Farmington to begin cutting small patches in the alder and young second-growth hardwood stands surrounding the fields.

Management Moving Forward

The greatest return from this WMA is the ability it gives us to demonstrate and promote management practices that other landowners can use to benefit wildlife species, especially those with greater conservation need. It also gives us a chance to manage habitats that are less common in the region.

The four components of habitat are food, water, cover, and space. When any of the four are absent or lacking (in quality or abundance), they are known as **Limiting Factors**. Wildlife habitat management is all about creating, sustaining, or increasing lacking habitat components. Simple, right? Not so fast. Here's why:

First, *no two species will occupy the exact same role (niche) in an ecosystem*. This affords greater species diversity because they are not competing for the same resources. In human terms, not everybody in your town can be a plumber and still have enough work. So, *all species have habitat needs that are specific to them*. Bluebirds utilize fields and chickadees the forest. Okay, that's easy, right? Not so fast, it is more interesting than that.



Within a species, *habitat needs often differ based on time of year, age, and sex*. At the Strong WMA, we prioritize management activities based on the species we can reasonably expect to be in the area and the ability of the land to provide at least one of its required habitat components. It is okay if the habitat can only meet one or two of those needs.

Four Areas of Focus at the Strong WMA

1. American woodcock

This small and popular upland game bird is highly dependent on fields and younger forests. The steady loss of fields to development and natural plant succession have led to critical woodcock habitat loss throughout its eastern North American range. At the Strong WMA, we are able to manage the land for woodcock roosting, courtship, nesting, foraging, and cover.

MANAGING FOR ROOSTING AND COURTSHIP

Woodcock use fields and open areas for roosting at night, and males use such areas for their springtime courtship display.

Maintaining roosting and courtship habitat is straightforward: we keep fields as fields through periodic mowing. Short grass like a lawn is not desirable, nor is a field overtaken by shrubs. Why are shrubs a negative? Because woodcock have large eyes positioned on the sides of their head. This is to see danger if it comes near. *Eyes in front, born to hunt, eyes on the side, better hide*. Shrubs impede their ability to watch for danger.

Mowing every other year (or every third year) allows grasses, but not trees or shrubs, to develop. You can also create similar habitat with small clearcuts distributed over space and time, or with log landings, especially if you seed the area with a mix of grasses and legumes once the log landing is no longer needed.

MANAGING FOR NESTING, FORAGING, AND COVER

For nesting, female woodcock prefer young, second-growth (not mature) stands of deciduous trees and alders, ideally near fields or large forest openings. Here, they build nests on the ground and the leaf litter helps them to blend with their surroundings.

This habitat also offers both sexes daytime shelter and the chance to use their long, pointed bills to probe for their favorite food: earthworms. Hardwoods, which demand better soil quality than conifers, and alders, which as legumes fix atmospheric nitrogen in the soil, create conditions where earthworms thrive.

The right habitat can also help the woodcock to escape predation. Woodcock are cryptically colored (hard to spot), so their first choice is to sit tight and blend in with the ground litter.

When hiding doesn't work, they can also explode off the ground into a weaving and dodging flight. Built somewhat like a fighter jet with a compact body and short, rounded wings, they are capable of a quick take-off, speed, and great maneuverability in tight places.

To take advantage of both options, they desire diurnal (daytime) cover with a high density of young, vigorously growing hardwood or alder stems, but not so much ground vegetation as to hinder an escape flight.

This is achieved and sustained with frequent patch clearcuts, distributed over space and time. Clearcutting stimulates sprout growth and produces multiple stems originating from a single tree stump. Stands created by clearcuts become good cover at 10 years and can last another 20-30 years. Around age 40, alders become over-mature and start to decline. When that happens, other vegetation takes over and the site becomes less attractive to woodcock.



High-density aspen stems from a clearcut like this provide ideal daytime cover.
Photo by Chuck Hulseley

At the Strong WMA, the 10 acres of alder stands as well as the low-lying hardwood stands are designated for frequent, small patch clearcuts. We conducted some cuttings in the 1980s and 1990s, and will be cutting more areas in the immediate future. The objective is to rotate the cuttings so there are always some tree/alder stands at the ideal age of 10-20 years old.

2. Passerines (Songbirds) and Pollinators (Insects)

The WMA has four fields totaling nine acres which we mow every other year. The habitat that this creates has been beneficial to many species.

Unfortunately, it is not very common in Maine for two reasons: First, Maine is 90% forested; and second, most fields are managed for agricultural crops, including hay. Hay is usually cut twice a season, which does not afford for the development of much cover for nesting birds or flowers beneficial to pollinators.

Looking ahead, we plan to further optimize the land for pollinators — a management action supported by several factors:

- **The ripple effect** - Managing for pollinators benefits many wildlife species, including passerine birds.
- **Promotional value** - Promoting this practice could draw interest from landowners new to wildlife habitat management.
- **Cost/benefit** - The cost is lower than managing for food plots because treatments to the soils and vegetation are good for several years and need not be done annually.
- **Safety** - U.S. Route 4 bisects the two largest fields. Planting to attract large-bodied wildlife could result in an increase in collisions with vehicles.

To promote more beneficial pollinator habitat on the WMA, we scheduled an assessment of the fields for this spring with a forestry/wildlife consultant who specializes in managing fields for pollinators, including soil testing, tilling, application of lime for proper pH, fertilizing, and seeding with a variety of plants attractive to these species.

He has done this work for other MDIFW regional wildlife biologists, and we were looking forward to working closely with him but unfortunately, due to Covid-19, he was unable to come to Maine and quarantine properly. This put our new management action for the fields temporarily on hold, although we will still mow them in fall 2020.

3. Forest Interior Wildlife

Many wildlife species benefit from what is termed the *edge effect* — the highly-desirable and diverse conditions that exist at the spot where two or more habitat types meet.

Some wildlife species, however, don't occupy the edges. In forested habitats, species that avoid them are called *forest interior species*. This relates back to the beginning of this piece and how no two species will compete for the same resource. For example, the fields provide foraging habitat for the kestrel (a small, colorful falcon). But another raptor, the goshawk, does not benefit. Instead, they nest and hunt within the interior of mid-age to mature forest stands.

Upland forests make up 65 acres of the Strong WMA. They are composed mostly of northern hardwood species such as red and sugar maple, yellow birch, white ash, red oak, and American beech. Because 50 years have passed since the last heavy harvest, the forests have reached a stage where a light commercial harvest can be done.

The forest on the WMA provides an opportunity to manage under an *uneven-age* silviculture system.

Most Maine forests are established and grow in *even-age* stands (see image below), which are stands with one age class (or two if there is a distinct overstory and under-story). Maine forests tend to naturally grow that way, and timber harvesting as practiced usually favors this system.

Forest stands with three or more age classes are termed *uneven-age*.



This is a classic two-age or even-age stand of white pine. At some point, the landowner will harvest all the overstory trees and it will go back to having a single age. Photo by Chuck Hulsey.

Tree species that are long-lived and windfirm, occur on deep soils, and have shade tolerance (ability to regenerate and grow in shade) can be managed within uneven-aged stands. Most northern hardwoods have all of these characteristics.

To develop and sustain the second and third age classes that define uneven-aged stands, we use timely, light cuts

and the **Selection Method**. Under this method, we mark trees to be harvested — either individually or in small, scattered groups. Criteria for removal include species priority, form, physical damage, insects, disease, or diameter. Within distinct stands of even age, smaller diameter trees are usually the same age as larger diameter trees, making them a priority for removal. A normal volume to remove on each stand entry is 20 to 30%, though in our case it is closer to 20%.

Under uneven-aged management, the time between harvests, also known as the **cutting interval** or **cutting cycle**, is usually 10 to 20 years. At the Strong WMA it will likely be 15 years. Because most of our hardwood trees have shade tolerance, harvests will stimulate regeneration. After two cutting intervals, there will be two new age classes added to the residual (original) stand, transforming it to an uneven-age forest. Barring major fire, insect, or disease, we will be able to continue this management method indefinitely.

This method of forest management benefits landowners and wildlife alike. For the landowner it provides a steady stream of product or income; and for wildlife it creates a habitat with *vertical diversity*. When most people think of habitat diversity, they envision varying vegetation types across the land; but vertical diversity provides structure from the ground all the way to the top of the forest canopy. Most wildlife occupies either the ground, mid-canopy, or upper canopy, but not all three, making uneven-age management a great way to meet the habitat needs of diverse species. The selection method also makes it easy to retain dead or dying trees, which some wildlife use for their habitat. This is not as easy with even-age regeneration methods such as clearcutting or shelterwood because there is no surrounding cover.



This uneven-age stand has three age classes and shows vertical habitat diversity. White pine in the foreground is the youngest. Second oldest are the sugar maples on the upper right and left. The large diameter trees in the center are the oldest. This provides a diverse habitat from the ground to the top of the oldest trees and is an example of the uneven-age management objective for the Strong WMA upland forest. Photo by Chuck Hulsey.

Foresters in the Department’s land program will mark and oversee the first harvest, prioritizing red oak and American beech for retention given how they meet the criteria for uneven-age management, plus they have high wildlife value. These species produce large hard mast (mast is the seed, nut, or berry of a tree or shrub) that benefit a large range of wildlife from gray squirrels to black bears. Sugar maple and yellow birch are next in the step-down priority for retention due to their high commercial value. However, form and vigor will sometimes drive the decision when two trees are too close and one should be cut.

4. Apple Trees and Cavities

Once a farm, this property has apple trees scattered among the alder runs between the fields. Many of these trees have been released during previous cutting of alder blocks, or opportunistically at the edges of fields or along access trails. In future clearcutting of alder blocks, all apple trees will be retained.

All trees with cavities will also be retained. We practice two methods at the WMA to provide habitat for cavity nesters:

placement and maintenance of bluebird nest boxes at the edges of all the fields and maintenance of dead trees.

We retain standing dead trees where they are not a hazard, and other times we will create them by girdling with three cuts completely around the trunk.

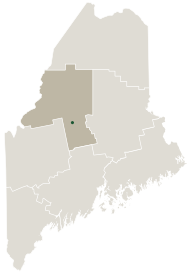
This will kill most trees while keeping them standing, as long as the cut goes through the inner bark and into the sapwood. Sapwood is made up of live wood cells that transport water, sugars, and minerals. Upon the tree’s death, woodpeckers will excavate for insects, often creating cavities that other wildlife will use. But if a cavity isn’t created, many species will still use the standing dead trunk to forage, hide, or perch.

For this, we try to select a tree of little or no commercial value, especially if it is competing for sunlight with a more desirable tree.

Three cavity trees per acre is adequate; but because dead trees are far less windfirm, some level of management is needed to maintain a presence of standing dead trees. Dead trees don’t have a long life.



Standing dead trees (left) and live trees (right) are valuable for both foraging and shelter. Large, rectangular holes are the signature of the pileated woodpecker. Photos by Chuck Hulsey.



REGION E GREENVILLE

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Deer Wintering Area Management

Doug Kane

In northern Maine, white-tailed deer are near the northern limit of their natural range. In the winter (December-April), severe weather conditions cause deer in the state's northernmost areas to migrate away from more open, deciduous forests to areas where they can access important conifer shelter and where snow depths are considerably lower.

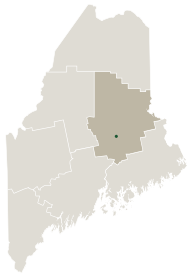
Without this adaptive behavior in this part of their range, the energetic demands on deer would be too great for them to survive. These special micro-habitats where deer congregate during winter are known as deer yards, or deer wintering areas (DWAs).

Our Department has long known the importance of DWAs to deer survival. In fact, we have records of DWA surveys conducted by Department staff in our northern regions dating back to the 1950s. We usually conduct these winter surveys from the air via fixed-wing aircraft and on the ground on snowshoes. Through the years, we've learned that deer fidelity to the DWAs is significant, with our records indicating that some of these areas have been used for multiple decades.

Most DWAs in the Moosehead Lake Region and in other areas of the state are located on private land. Therefore, for our Department to have input toward the management of these important habitats we must work cooperatively with the landowner or land manager.

In 1996, our Department signed landmark agreements with the largest landowner in the state for the management of three very large DWAs (11,000, 9,000, and 6,500 acres) just north of Moosehead Lake. Management plans for each of these areas included forest stand-specific maps and details of when and how each stand would be treated in terms of a possible timber harvest during the 15-year life of the plan.

These plans proved to be critical over time and were honored by the subsequent landowners after the land was sold. Today, two and a half decades later, these three areas still contain some of the largest blocks of quality winter deer shelter in the Moosehead Lake Region.



REGION F ENFIELD

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Habitat Management at Page Farm

Mark A. Caron

The Mattawamkeag River System WMA encompasses over 10,000 acres and is located in Webster Plt., Drew Plt., Kingman, and Prentiss Twp. (Delorme Atlas Map 44 C-5). The WMA is composed of three units including Page Farm which encompasses over 1,200 acres. As the name implies, much of this unit was once active farmland but has since largely reverted to early-successional and mature forest habitat.

The unit also includes 20 acres of field, much of which was slowly reverting to early-successional forest. Early-successional forest includes a richly diverse habitat with vigorously growing grasses, forbs, shrubs, and trees which provide food and cover for a wide variety of wildlife species. However, disturbance (management) is needed to perpetuate this habitat over time. If not managed, it will continue to grow into mature forest.

Beginning in 2009, we reclaimed two fields that were reverting to early-successional habitat and planted them with a conservation mix. In 2013, we reclaimed and planted a third field; and we've maintained all of the other fields with annual mowing. We accomplished much of this work in partnership with the Natural Resource Conservation Service (NRCS) and the National Wild Turkey Federation (NWTF), and it ultimately has benefited a wide variety of game and non-game species whose habitat needs include open fields.

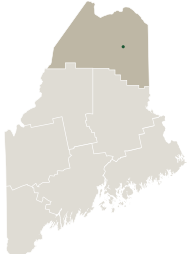


In 2010, Region F partnered with the Wildlife Management Institute (WMI) on early-successional forest management operations that focused on ruffed grouse and woodcock. The grouse habitat management centered on 70+ acres of intolerant hardwood and balsam fir. By managing it in five-acre clearcut blocks over a 40-year rotation, we have been able to provide all the life requisite habitat (breeding, nesting, brood rearing, winter roosting) for grouse.

Our woodcock management efforts consist of a network of 16 strips 100 feet wide (of varying lengths) managed in a 25-year rotation. These strips are adjacent to managed open field, and the combined habitats provide for all the life requisites for woodcock (nesting, brood rearing, feeding, courtship, and night roosting).

Additional Page Farm habitat work has included planting of soft and hard mast shrubs and trees and pruning/releasing several hundred apple trees. In two locations, we accomplished a 'feathering of edges,' which is a practice that creates structural diversity between field and forest, adding more nesting cover primarily for game and non-game birds.





REGION G ASHLAND

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Lt. Gordon Manuel Wildlife Management Area (LGMWMA)

Shawn Haskell

The LGMWMA is a bit over 6,500 acres in the southern Aroostook County towns of Hodgdon, Linneus, Cary Plantation, and the northeastern tip of TAR2 Wels. The area has been actively managed for wetland and upland fish and wildlife habitats and public recreation, although overnight camping is not allowed, and there are no bathroom facilities.

The primary flowage behind the Hodgdon dam winds south for about three miles before turning into a small stream and crossing under the Oliver Road to the west. It is a popular spot for waterfowling, and we maintain a couple dozen nest boxes for ducks on this stretch.

We occasionally stock the primary flowage with brown trout, but it is largely a warm water fishery. There is a small boat launch next to the dam and summer snack bar, a primitive boat launch around the bend off Horseback Road, and another small, well-maintained boat launch about 1.5 miles down the flowage off Horseback Road, just past the gravel pit. On a recent early-summer trip to this site, the abundance of dragonflies and damselflies (Odonates) was remarkable, and it seemed that the mosquitoes paid the price.

The gravel pit helps us to maintain roads for forest operations, and the roads can also be used by ATVs and snowmobiles when there is no trucking activity. We work with the local clubs to move recreational traffic around active forest operations. Our lands help connect the trail systems of Cary, Hodgdon, and Linneus, and some of our winter logging roads now double as walking trails, seeded into an herbaceous conservation mix for wildlife.

We release apple trees and conserve all oak trees that we find, and thick regeneration of aspens and maples provide food for deer, moose, and hare. There are also 122 acres

of field on LGMWMA, most of which are leased out for active agriculture with grassland buffers. We mechanically maintain a field off Townline Road, whereas on other WMAs in Region G we also use fire.

Some of our work includes surveying for breeding birds, waterfowl broods, and bats. Breeding birds range from hummingbirds inland to loons on Hunter Pond. Waterfowl broods include resident geese, black ducks, ring-necks, goldeneye, mergansers, and woodies. The only known location of the Federally-threatened and State-endangered Northern Long-eared Bat in the past few years in northern Maine is on LGMWMA, immediately adjacent to the Hodgdon flowage and a hardwood stand by the gravel pit that we have been working to thin and regenerate.

In recent years, the Department has conducted management activities to benefit the upland habitats found in LGMWMA, operating in several management compartments. We have continued a long-standing management approach focused on improving grouse and woodcock habitats by management of young forest conditions.

In the middle of LGMWMA is another flowage that is part of the south branch of the Meduxnekeag Stream, maintained by a smaller dam about six feet high. Beyond that, by our boundary off Townline Road, is a third wetland flowage, the level of which has been negotiated recently with the resident beavers. The beavers have blocked our culvert and flooded the flowage's value for nesting wetland birds, so we have installed a water passage device from under the water level, through the beaver blockage, and into the culvert. Nuisance beaver issues are common for landowners in Aroostook County, and there are options for resolving them. Your regional wildlife office can help, so don't hesitate to reach out.



BIOLOGIST ASSIGNED TO BUREAU OF PARKS & LANDS

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Sarah Spencer
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Wildlife Biologists and Foresters Working Together for Maine's Wildlife

Sarah Spencer

MDIFW has a long history of working with partners across the state, including other state agencies. Since 1983, a MDIFW wildlife biologist has worked within Maine's Department of Agriculture, Conservation & Forestry's Bureau of Parks and Lands (BPL) to maintain healthy fish and wildlife on the Bureau's 700,000 acres of land. BPL's ownership is managed for multiple resource values, including recreation, cultural and historic preservation, wildlife, and timber. The biologist serves as a wildlife specialist liaison to BPL, helping them achieve their mission.

One of the responsibilities of the wildlife specialist is to review BPL foresters' timber harvest plans to ensure they address wildlife considerations. At a minimum, these reviews ensure that appropriate riparian buffers, seasonality of harvest, and biodiversity components are all incorporated into the plan. Some more in-depth assessments require multiple site visits, review of historical records, communication with biologists and foresters, and review and development geospatial data.

In the winter of 2019/2020, a harvest in a deer wintering area on Public Lands marked the culmination of several years of work by foresters from BPL's Northern Region Public Reserve Lands, biologists from MDIFW Region F, and the wildlife specialist. This area has hosted approximately 75 deer, in what appear to be two distinct herds (though the number of deer using the area change over time), and this harvest followed several decades of BPL and MDIFW efforts to manage the forest to produce high quality winter shelter for deer.

A harvest prescription was developed several years prior, and the forester and wildlife specialist incorporated deer wintering area habitat guidelines into the prescription at that time. The three objectives of the harvest were to establish softwood regeneration, to release existing advanced regeneration, and to promote healthy and vigorous stands of softwood to shelter wintering deer. Additional considerations were given to aesthetics of the harvest adjacent to roads, campsites, a seasonal snowmobile trail used primarily for ice fishing access, and an active MDIFW project involving deer capture in the region.



After biologists and foresters approve a final draft of the agreement, BPL works closely with a timber harvesting contractor to implement it. It's not unusual for biologists and foresters to reconvene on-site at least once during the harvest, often more, to ensure the plan is being implemented as expected and to discuss any challenges or unexpected situations that may arise. In addition to making the harvest plan available to the contractor in a GPS-enabled tablet, biologists and foresters flagged all deer trails prior to the 2019/2020 harvest so that special treatment would be applied adjacent to these important corridors.

Field assessments indicated total shelter made up well over the 50% target of primary and secondary shelter combined; however, the majority fell in the category of secondary shelter, being under the target of 25% primary shelter. By harvesting in specific areas to promote vigorous growth and crown closure in winter 2019/20, this harvest should improve the primary shelter ratio over time.

Perhaps the best-kept secret of managing deer wintering areas for shelter is that we're managing them for much more than just the deer. While deer are the species we focus on, more than 70 other Maine species prefer at least one of the stand types in a managed deer wintering area at some point during their life cycle. From the familiar bobcat, snowshoe hare, and black bear, to the less-commonly noted black-backed woodpecker, merlin, and American marten, deer wintering areas provide habitat components for a wide range of species.

The process of actively managing deer wintering areas is never complete. It's a constant effort of assessment and treatment as the forest grows and changes over time. It requires communication, boots on the ground, data development, planning, implementation, and attention to detail by foresters, biologists, and logging contractors who all care about healthy fish and wildlife.

Because the harvest area overlapped with an area zoned by Maine's Land Use Planning Commission (LUPC) as a Deer Wintering Area, a plan agreement was required to be submitted prior to harvest. This agreement documents the planned activity for each stand or group of similar stands or treatments, the silvicultural prescription to be used, how the trees will be selected for harvest, where roads and landings will be located, and in what season(s) the harvest will occur. In developing an agreement, the wildlife specialist and regional wildlife biologist work with the forester(s) to understand how and if each stand will be treated. While the BPL forester has often spent many days afield examining the stands prior to developing the harvest plan, the plan agreement offers an opportunity for BPL and MDIFW to look at the stands together, verify shelter value, and discuss proposed treatment for the upcoming harvest and future entries.

We conducted these site visits in summer 2019, visiting representative stands of each type and silvicultural prescription combination in the harvest plan. We also visited stands that weren't going to be harvested, to assess their shelter value. A biologist rarely returns from the field with data on a single species, and site visits to deer wintering areas are no different. From singing birds during the summer months to mammal tracks in the snow, we gathered plenty of additional information as part of the assessment. Back in the office, we compiled the GPS data and notes and used them to develop summaries of existing shelter and our expectations for shelter over the next 15 to 30 years.



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Habitat Management at Frye Mountain Wildlife Management Area: Compartment J

The MDIFW Lands Program Team

Operating within MDIFW's Wildlife Management Section, the Lands Program supports the work of wildlife biologists by planning and implementing habitat enhancement and maintenance projects on State-owned Wildlife Management Areas (WMAs).

In the winter of 2020, we began conducting habitat work at the Frye Mountain WMA, Compartment J, clearing two of the three roads' rights-of-way with a whole tree operation. Compartment J, in the town of Knox, totals 643 acres on the southeastern side of the 5,238-acre WMA. Heading South on Frye Mountain Rd. from State Rte. 137, the entrance to Sunnyside Cemetery Road, which runs through the WMA, is approximately .25 miles on the left.

The new road construction for this project totals roughly 1.5 miles, and we also plan to improve 1.25 miles of the Sunnyside Cemetery Road. We expect to complete the harvest in roughly two years. This timeframe will allow us to treat certain areas in the summer and others in the winter, depending on ground conditions and habitat goals.

Road construction is slated to begin in mid to late summer and harvest operations will start this winter (2020-2021). Last winter (2019-2020), to prepare for the harvest, Lands Program staff began marking individual trees and designing a layout that would create, maintain, and enhance wildlife habitat on the site. This work continued throughout the spring and summer.

In 2018, MDIFW developed a Forest & Wildlife Management Operations Report, also known as a harvest prescription, for Compartment J. The Lands Program staff

have cruised and inventoried the entire compartment and have set wildlife habitat management goals and objectives based on current forest types, soils, and habitat features. These goals and objectives were developed in coordination with wildlife biologists from MDIFW and Maine Natural Areas Program (MNAP) during the planning process. The proposed operations in their report are subject to competitive bidding through the Division of Procurement Services to ensure equal work opportunities for qualified businesses.

Compartment J features a variety of forest types including oak-beech and oak-pine uplands, northern hardwoods, hemlock, and spruce-fir. It also has several maintained fields, as well as open water, scrub-shrub, and forested wetland habitats. This wide range of habitats presents numerous opportunities for enhancement through silvicultural harvest.

Much of the compartment's forested area was previously cleared for agriculture, and it offers little habitat diversity in terms of age class (all trees are about 80-100 years old) or vertical/horizontal structure. To remedy this, we plan to regenerate portions of the compartment to a younger age class through single tree selection, group selection, and patch cut treatments. In doing so, we will remove the short-lived, pioneer tree species such as paper birch, aspen, and balsam fir which are generally in overall decline. This will establish a new generation of trees, increase structural habitat diversity, and benefit numerous wildlife species.



The upland areas will be managed for hard mast (nut) production. Northern red oak will be prioritized for its acorns' value as a wildlife food source, but some portions will be specifically managed for American beech. This will benefit the early hairstreak butterfly, a rare, state special concern lepidoptera species that requires mature beech and beech nuts for its lifecycle, as well as numerous other wildlife species that will forage on the tree's hard mast during beech mast years. Still other upland areas will be managed for red oak and eastern white pine, which together provide a mix of acorns and pine softwood cover that eastern wild turkeys love.

The mid-slope areas, composed of northern hardwoods, will generally be managed with single-tree and small-group selection methods to promote long-lived, shade-tolerant northern hardwoods species like sugar maple, as well as intermediately-tolerant species like yellow birch, white ash, American basswood, and red oak. This will eventually create an uneven aged forest with a varied structure suited to a wide variety of wildlife. All at once, it will include newly regenerating areas with woody browse and herbaceous plants, mature trees for cover, trees with cavities, and trees bearing nuts, seeds, and catkins for food.

Other treatments include thinning, which will allow healthy trees to grow larger, and patch cuts, which will allow shade-intolerant species like aspen and paper birch to regenerate. We will also use treatments to link up existing habitats, creating additional wildlife value. For example, in one area we will place a two-acre patch cut in maturing aspen between two alder-dominated lowlands. This will create a dense, sapling-sized stand ideal for ruffed grouse, American woodcock, and snowshoe hare, while providing hardwood browse for deer and potential nesting/brood-rearing habitat for songbirds and other shrubland-dependent wildlife species.

In the lowlands, we will generally manage for mixed-wood and softwood stands. The plan is to remove dying balsam fir and intolerant hardwoods, release and retain eastern hemlock and red spruce, and regenerate softwoods. We are also targeting some red maple for removal to improve deer wintering areas, provide a source of winter browse

for deer, and create suitable habitat for ruffed grouse, snowshoe hare, and songbirds. Throughout the compartment, we also plan to promote soft mast by retaining and releasing the area's many vigorous apple and cherry trees.

There is one mapped Significant Vernal Pool in the compartment, as well as several other smaller, unmapped vernal pools that we identified during forest inventory. Vernal pools support several species of special concern in Maine, including wood frog, spotted salamander, blue-spotted salamander, four-toed salamander, ribbon snake, wood turtle, spotted turtle, and Blanding's turtle. We plan to protect and manage all vernal pools, mapped or unmapped, per recommendations in the publication *Forestry Habitat Management Guidelines for Vernal Pool Wildlife*, which was created in collaboration between the University of Maine, Maine Audubon, Wildlife Conservation Society, MDIFW, and Maine Department of Agriculture, Conservation and Forestry (formerly Maine Department of Conservation).

Management operations may also include the cutting, felling, and on-the-ground retention of three to six low-quality pulpwood trees per acre. This will add coarse and fine woody debris (CWD) to the forest floor, enhancing the habitat for invertebrates, amphibians, and reptiles. Additionally, when marking individual trees, we will retain standing cavity trees, current snag trees, and some snag tree candidates that we might use in the future for forest-floor CWD.

An invasive plant is defined as a plant that is not native to a particular ecosystem, whose introduction causes, or is likely to cause, harm to the economy, environment, or human health. A handful of invasive plant species, including Japanese shrubby honeysuckle, multiflora rose, Japanese barberry, and Asiatic bittersweet, have been found in abundance on the Frye Mountain WMA. As we plan and implement habitat management across the Compartment J, we will also need to manage invasive species so that desirable native species and herbaceous plant communities can establish themselves, develop, and regenerate. In collaboration with MNAP, we have implemented a multi-faceted plan to survey and treat these species on the compartment, both pre- and post-harvest.

