



2021-2022

RESEARCH + MANAGEMENT REPORT



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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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**Compiled and edited by  
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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.



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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.

This is a compilation of all Research & Management Reports for the Maine Department of Inland Fisheries & Wildlife for 2021-22. Each report can be downloaded individually at [mefishwildlife.com/wildlifereport](http://mefishwildlife.com/wildlifereport).

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# ALL IN FOR THE MAINE OUTDOORS

## Business as Usual

Throughout 2021 and 2022, while much of the world was readjusting to ‘normal’ work-days, MDIFW’s dedicated field biologists were busy with a full range of in-person habitat management, wildlife monitoring, research, and public involvement tasks. Approaching from land, air, and sometimes even sea, all forms of wildlife work continued, banding ducks on frigid winter days, evaluating black racer snakes in the summer heat, collecting moose check station data in the fall and much more. With an all-hands-on-deck attitude, and in all kinds of weather, they seized opportunities, overcame challenges, and logged major accomplishments – many of which are detailed in this report, and all of which serve to support and protect our state’s diverse wildlife species.

In other words, it was business as usual.



## SOME ESPECIALLY NOTABLE ACCOMPLISHMENTS INCLUDE:



The **Land Acquisition and Water Access program** completed 16 mission-critical projects covering 15,890 acres, including acquisition of undeveloped Pleasant River estuary frontage (flats) that provide food and rest for thousands of shorebirds during their long migrations.

We introduced the **Adaptive Moose Hunt** on the western side of Wildlife Management District 4 to help combat winter tick, following several years of comprehensive research showing the negative impacts of winter ticks on moose calf survival and cow productivity. We're collaborating with several northeastern states and Canadian provinces', including their wildlife biologists, game wardens, information & education staff, and the public, on this effort to decrease winter tick proliferation, though it may be years before we see the positive impact on moose populations.

Another great success was our initiation of a **long-term bat population monitoring program**, which will give us more statically robust methods of tracking bat population trends. We will survey some new sites each year, with most repeated on a two-year rotation.



A total of 1,749 winter birders contributed to 16,628 checklists to the **Maine Bird Atlas**, an incredibly popular community science project that is wrapping up this year. Enjoying time outdoors while also contributing to science was a bigger hit than ever before, and the effort that volunteers put forth was immensely appreciated!

The value that MDIFW staff and Mainers place on fish, wildlife, and their habitats is extraordinary. And it's a partnership: staff lead with innovative research, and volunteers and citizen scientists help move the needle. To all who help protect and enhance our fish and wildlife resources, thank you!



## Recent Retirements

On a bittersweet note, several MDIFW Wildlife Division staff members retired in 2021 and 2022. Most not only dedicated their careers but also their lifestyles to the protection and enhancement of wildlife and natural resources. Their passion and love for wildlife created a dynamic workplace and left lasting impressions, and we thank them for their commitment!



### Craig McLaughlin

**Craig McLaughlin** spent an impressive 38 years in public service, 20 of which were with MDIFW. A strong advocate for wildlife conservation and science-based wildlife management, he helped shape Maine's black bear management program as MDIFW's lead bear biologist from 1983 to 2002. He also pursued and completed his doctorate developing a population model from the Department's long-term black bear monitoring. Over the years, Craig's role grew to include agency lead on rare carnivores (lynx, wolves, and cougars). He was instrumental in initiating the Department's lynx monitoring program, establishing the first formal winter track survey effort in the 1990s and the first telemetry study in 1999. Although the first half of his career was dedicated to black bears and other carnivores, the latter half was dedicated to helping lead natural resource agencies. His positions included Mammals Program Coordinator, Big Game Program Coordinator, and Wildlife Chief (Utah Division of Wildlife), Terrestrial Section Manager (Colorado Division of Wildlife), Wildlife Division Director (Vermont Department of Fish and Wildlife), and most recently Wildlife Research and Assessment Section Supervisor (MDIFW). Craig has mentored many wildlife professionals, volunteered countless hours as an associate editor of the *Ursus Journal*, was a member of the governing council of the International Association of Bear Research and Management, and served on a variety of professional boards and committees including Pacific Flyway Council, WAFWA, AFWA, and Southern Rockies LCC. Craig's career and commitment to wildlife will be long-lasting and unforgettable.



### Brad Allen

**Brad Allen** worked for MDIFW in various capacities for 41 years, more than half of which were spent in Bangor as the Bird Group Leader. Brad has long been a stable leader within the agency, mentoring many staff, willingly sharing his expertise with the public and media, and writing many popular informational articles. His knowledge of waterfowl management is unsurpassed, and he has long led the agency's efforts to monitor and conserve seabirds, including work on dozens of seabird nesting islands. Brad is known internationally for his work on common eider survival and harvest rates in the Atlantic Flyway. He and a team of federal and state biologists initiated and successfully completed a large-scale banding study, banding over 11,000 common eiders in Maine. He has worked collaboratively with other state and federal agencies on American woodcock survival and harvest rate research, and has helped the Atlantic Flyway Council Technical Section with several other migratory bird conservation projects. His love and appreciation of history is invaluable, especially as it applies to the coastal islands, their natural resources, and their local communities.



### Al Starr

**Al Starr** had a diverse career with the Department, starting as a contract worker in 1984 for the bear study, where he had his initial field experience monitoring Maine's bears via den visits. Al gained diverse experience across the state in his early years, settling into Region B as a wildlife technician. He implemented habitat management practices on the unique Wildlife Management Area that is Swan Island, conducted waterfowl banding, handled duck boxes, and worked with Animal Damage Control agents and trappers to deal with wildlife conflict. Al had the uncommon experience of contributing significant time to both the Wildlife and the Fisheries Divisions during his tenure. His time spent with the Fisheries Division in Enfield often involved conducting creel surveys to observe fish harvest. Eventually, Al became the Assistant Regional Wildlife Biologist in Enfield, and has been instrumental to the region's various wildlife surveying and management efforts. Al made vital contributions to the biological sampling for Chronic Wasting Disease in deer, and was a statewide leader in this surveillance work. Al typically sampled 500+ deer each fall, and sometimes as many as 650 – an amazing achievement given the large geographical area you have to cover to find that many samples. Al's strong people skills and easygoing personality have allowed him to work effectively with members of the public, local businesses, stakeholders, and his peers. He took a tremendous amount of pride in this work and will be very missed!



### Brenda Lord

**Brenda Lord** was a Secretary Associate in the Wildlife Research and Assessment Section since 1998, dedicating 23 years of her profession to supporting wildlife biologists in a variety of capacities. Brenda was always a positive and composed peer, regardless of the consistent requests that added to her long list of to-dos. Working quietly behind the scenes, Brenda offered a wide diversity of administrative functions to the Wildlife Division, including staff support for contracts and grants, scientific collection permits, and program budget tracking. She also recorded and managed the volunteer match for citizen science participants and was a huge help when crunch time came for workshop preparation, helping to print out, collate, and organize materials for volunteers even though it wasn't her job! Brenda was always eager and willing to help whenever she could, contributing her vital prioritization and multitasking skills to every facet of the Wildlife Division. We wouldn't have functioned without her!



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Endangered Species Conservation Strategies



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### Endangered Species Conservation Strategies

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- » Land Acquisition & Water Access Programs
- » Habitat Conservation & Management
- » Bird Conservation & Management
- » Game Species Conservation & Management
- » Non-Game Species Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management
- » Regional Wildlife Management

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*Cover photo: Short-eared owl – This threatened species nests on the ground in large open grassy landscapes, but can often be seen roosting on fenceposts or lone trees between hunting flights.*



# ENDANGERED SPECIES CONSERVATION STRATEGIES

Alexander Fish

## A Mandate to Conserve Maine’s Wildlife Diversity

In 1975, the State Legislature enacted Maine’s Endangered Species Act (Maine ESA). 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

Maine’s state Endangered and Threatened (E/T) listing process is quite different from that of other states. Whereas other states typically do this by agency rulemaking alone, Maine follows a process wherein the legislature makes statutory changes in response to agency recommendations. This extra legislative oversight has perhaps averted legal petitions and court challenges that can confound endangered species conservation.

Authority to make those recommendations is split between three different agencies: The Maine Department of Inland Fisheries and Wildlife (MDIFW) holds that authority for all terrestrial animals, all birds (regardless of habitat), and all freshwater fauna. The Maine Department of Marine Resources has jurisdiction for animals (except birds) that occur in tidal waters. And Maine’s Natural Areas Program in the Department of Agriculture, Conservation, and Forestry maintains the list of E/T plants.

Within MDIFW, staff and administrators review potential changes to the E/T list internally, then open them up to further scrutiny from peer scientists. Then we present proposals: first to the MDIFW Advisory Council, then at legally mandated public hearings. A formal 30-day com-



*Edward’s hairstreak – This endangered butterfly only occurs at three known sites in Maine and is dependent on pitch pine-scrub oak barrens, a rare forest type in the state. ©T. Persons*

ment period follows, in compliance with Maine’s Administrative Procedures Act. Next, we present our final recommendations as a bill to the Maine Legislature’s Joint Standing Committee on Inland Fisheries and Wildlife, which considers such bills during the first year

(odd number) in biennial sessions. When the bill goes in front of the committee, the public has yet another opportunity to provide input.

The MDIFW thresholds for listing Maine species rely mostly on combinations of risks. These listing guidelines (see [www.maine.gov/ifw/docs/listingHandbook.pdf](http://www.maine.gov/ifw/docs/listingHandbook.pdf)) have successfully guided MDIFW and the Legislature’s state-listing decisions since 1996.

To designate fauna as E/T, MDIFW biologists review the best available science on populations’ and habitats’ conditions and use 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 (Northeast) conservation status. Threats are secondary considerations, and do not trigger listing unless they present additional hazards to already-vulnerable species.

The last time the state E/T list changed was 2015, and the next update is due by 2023. This scorecard (**Figure 1**) shows the status of 52 species listed by MDIFW since Maine ESA was enacted, 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 - 2022

**BIRDS (CLASS AVES)** 

▲ SIGNIFICANT IMPROVEMENTS  
 ■ NO SIGNIFICANT CHANGES  
 ▼ SETBACKS OR NEW LIMITATIONS

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 nycti-corax</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 savannar-um</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 stellaris</i> )	Endangered (since 1987)	■	▲	■
Short-eared Owl ( <i>Asio flameus</i> )	Threatened (since 2007)	■	■	■
Upland Sandpiper ( <i>Bartramia longicauda</i> )	Threatened (since 1997)	▼	▲	■



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

## FISH (CLASS ACTINOPTERYGII)

SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
Redfin Pickerel ( <i>Esox americanus americanus</i> )	Endangered (since 2007)	■	■	■
Swamp Darter ( <i>Etheostoma fusiforme</i> )	Threatened (since 1997)	■	■	■

## INSECTS (CLASS INSECTA)

Arctic Fritillary ( <i>Boloria chariclea grandis</i> )	Threatened (since 2007)	■	■	■
Boreal Snaketail ( <i>Ophiogomphus colubrinus</i> )	Threatened (since 2007)	■	■	■
Clayton's Copper ( <i>Tharsalea dorcas claytoni</i> )	Threatened (since 2015)	■	■	■
Cobblestone Tiger Beetle ( <i>Cicindela marginipennis</i> )	Endangered (since 2015)	■	▲	■
Edwards' Hairstreak ( <i>Satyrrium edwardsii</i> )	Endangered (since 1997)	▲	■	■
Frigga Fritillary ( <i>Boloria frigga saga</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)	■	■	■
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>Lycia rachelae</i> )	Threatened (since 1997)	■	■	▲
Twilight Moth ( <i>Erynnis brizo</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)	■	▲	▲

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

## 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>Atlanticoncha 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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## Wildlife Conservation Status Categories in Maine

Rare and declining species in Maine may receive different conservation status depending on their rate of population decline and their extinction risk. The various conservation statuses (shown below with examples of species) make specific funding opportunities available for monitoring and land conservation. Threatened or Endangered species and associated habitats are provided with additional legal protections.

	Species of Greatest Conservation Need	Species of Special Concern	Threatened Species	Endangered Species
JUSTIFICATION	Declining populations or limited distribution in Maine	Declining populations or limited distribution and potential to be listed as Threatened or Endangered in Maine	Moderate risk of extinction in Maine	High risk of extinction in Maine
CONSERVATION ACTION	Listed in Maine's Wildlife Action Plan which makes species eligible for certain federal grants and funds	Increased population monitoring and sharing of best management practices with landowners and land trusts	Protected under the Maine Endangered Species Act, thereby providing protections for both species and their habitat. Known populations are included in the Environmental Review process, and MDIFW makes expert recommendations to avoid or minimize impacts on Endangered and Threatened species.	
EXAMPLE SPECIES	Common Eider Lemon Cuckoo Bumble Bee Muskrat Northern Leopard Frog Bobolink	Evening Grosbeak Canada Lynx Northern Spring Salamander Monarch Lake Whitefish	Atlantic Puffin Spotted Turtle Brook Floater Upland Sandpiper Clayton's Copper	New England Cottontail Piping Plover Black Racer Northern Long-eared Bat Katahdin Arctic



# Meet the Biologists Working with Endangered & Threatened Species



**Alexander Fish, Ph.D.**

**Wildlife Biologist**

Alex is MDIFW’s Endangered & Threatened Species Coordinator. He spends most of his time working with both state and federally listed Endangered and Threatened species, as well as Maine species of Special Concern, and also coordinates the Maine Wildlife Action Plan, which identifies Species of Greatest Conservation Need. Much of Alex’s Endangered and Threatened species work relies on collaboration with biologists in MDIFW’s Bird, Habitat, Inland Fisheries, Mammals, and Reptile, Amphibian and Invertebrates Groups, all of whom contributed to information contained within this section.

## Wildlife Research Assessment Section Biologists

MDIFW staff in the Wildlife Research and Assessment Section (WRAS) are tasked with developing surveys, research, and conservation strategies. 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.

**Danielle D’Auria**

*Wildlife Biologist, Waterbird Specialist*

**Phillip deMaynadier, Ph.D.**

*Wildlife Biologist, Reptile, Amphibian, and Invertebrate Group Leader*

**Erynn Call, Ph.D.**

*Wildlife Biologist, Raptor Specialist*

**Adrienne Leppold, Ph.D.**

*Wildlife Biologist, Songbird Specialist*

**Cory Stearns**

*Wildlife Biologist, Small Mammals*

**Kelsey Sullivan**

*Wildlife Biologist, Game Bird Specialist*

**Beth Swartz**

*Wildlife Biologist, Invertebrate Specialist*

**Jennifer Vashon**

*Wildlife Biologist, Black Bear and Canada Lynx*

**Derek Yorks**

*Wildlife Biologist, Reptiles and Amphibians*

**Brad Zitske**

*Wildlife Biologist, Shorebird Specialist*

## 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 management, employing strategies that not only address the factor(s) that led to species rarity, but also new threats that arise once populations and/or habitats are compromised and vulnerable.

### The Bald Eagle: A Success Story

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. In 1962, MDIFW began monitoring bald eagle populations; and in 1967, we initiated four decades of contaminants research. In 1972, we started intense habitat protection efforts. 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. MDIFW did not delist bald eagles until 2009, when enough conservation lands and easements had been established to create a safety net protecting traditional nesting habitat from future threats.

### Maine's Cave Bats: A Work in Progress

In 2015, cave bats were newly listed as Endangered or Threatened in Maine. Over the span of just a few years, white-nose syndrome caused Maine's little brown bat and northern long-eared bat populations to decline by roughly 90%. First detected at a New York cave in 2006 and caused by a non-native fungus, white-nose syndrome has killed



*The little brown bat was once a common species in Maine, but has experienced population declines due to white-nose syndrome*

millions of bats across the U.S. For perspective, that level of decline would reverse all 40 years of bald eagle progress — at ten times the rate of change.

As we do with most newly listed species, Maine's biologists have started monitoring and researching bat populations to guide conservation strategies. While white-nose syndrome remains persistent, there is evidence that some bat populations are beginning to cope with it. Still, bats face a very slow population recovery dictated by their slow life history (raising only one pup each year). Ultimately, biologists will also need to address risks like recreational cave use, disruption of maternity colonies, and incidental mortality or injury from low-speed wind turbines operating at night.



## Habitat Maintenance/Enhancement Strategies

**Maintaining abundance** - Some listed species are highly specialized to rare habitats; 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 tiny land snail reliant on calcareous fens typically only found in areas of limestone bedrock, as opposed to the granite that 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 Maine’s biodiversity. With that in mind, while it is not always possible to fully recover listed species as self-sustaining populations or to delist species with naturally limited habitats, we do have the tools to minimize their extirpation risk.

**Enhancing quality** - For some species, habitat quality (rather than abundance) is the bottleneck. Take the brook floater: while Maine’s extensive waterways seem to offer ample riverine habitat for this threatened freshwater mussel, water quality and connectivity barriers render some streams and rivers unsuitable. Maine is the U.S. brook floater stronghold, so “as Maine goes, so goes the nation”: brook floaters were recently petitioned for range-wide listing under the federal ESA.

**Working regionally** - The brook floater 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 likely that unsuitable stream habitat can be remediated by restoring riparian buffers and paying careful attention to watershed land use practices.

**Staying youthful and connected** - 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. In such cases, thoughtful land management and incentives to create and enhance transient habitats are more beneficial than regulatory Maine ESA provisions.

**Giving the barrens a hand** - Another variation on this theme are habitats that once rejuvenated themselves naturally, but no longer do, such as the Northeast dry pine barrens. These habitats emerged in sandplains left by the retreat of glaciers, and persisted in part due to naturally occurring wildfires. A pattern of wildfires favors fire-resistant vegetation like the pitch pine and scrub oak, which also 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. To maintain pine barren habitat on conservation lands, we use prescribed fire and silviculture.



*Prescribed fire application (controlled burning) at Kennebunk Plains prevents trees encroachment and maintains early-successional habitat.*

## Cooperative Conservation

One of our most successful endangered species conservation efforts is an ongoing one. The piping plover is a resident shorebird that nests only on foredunes 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 (including record levels of beach use since the beginning of the pandemic). Cooperative conservation efforts by MDIFW, Maine Audubon, state parks, USFWS, USDA Wildlife Services, and municipalities have led to a rebound in plover abundance over the past few decades; 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.

## Keeping an Eye on Climate Change

Maine is a natural ecoregion transition zone, and as such hosts a blend of species that mostly reside further north or south. Species listed under Maine ESA 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, black-crowned night heron, and roseate tern.

**“Down-listing”:** Four species once designated as Endangered in Maine have been reclassified as Threatened, due to conservation success while listed: bald eagle, Clayton's copper, ringed boghaunter, and Roaring Brook mayfly.



*Black-crowned night heron – The black-crowned night heron primarily forage nocturnally or in the evening, making it difficult to locate and observe.*



*Roseate tern – The US endangered roseate tern nests in colonies on off-shore islands managed to protect nesting seabirds.*



### Protected Under the U.S. Endangered Species Act in Maine

Twelve Maine species are listed under the U.S. Endangered Species Act (US ESA; Table 1); however, six of them are either marine animals or plants and thus under the purview of Maine Department of Marine Resources or Maine Natural Areas Program. Although three federally listed species (Northern Long-eared Bat [since 2015], Piping Plover [since 1985], and Roseate Tern [since 1987]) are also listed under Maine ESA, three additional species are not state listed. This is either because the population in Maine is secure (Canada Lynx [since 2000]), only migrates through Maine but does not breed or overwinter in the state (Red Knot [since 2015]), or is likely extirpated following range-wide population declines (Rusty Patched Bumble Bee [since 2017]; Maine’s last observation was in 2009). All three of these federally listed species are species of Special Concern and therefore remain on the forefront of MDIFW’s monitoring and conservation efforts. Regardless of state listing status, MDIFW staff often work closely with biologists and administrators from the U.S. Fish and Wildlife Service on issues related to US ESA species management and protection in Maine.

**TABLE 1. SPECIES DIVERSITY IN MAINE BY TAXONOMIC GROUP AND THE NUMBER OF SPECIES IDENTIFIED AS SPECIES OF SPECIAL CONCERN, LISTED UNDER THE MAINE ENDANGERED SPECIES ACT (MAINE ESA), OR LISTED UNDER THE U.S. ENDANGERED SPECIES ACT (US ESA).**

	SPECIES IN MAINE	SPECIAL CONCERN	MAINE ESA	US ESA
AMPHIBIANS	18	2	0	0
BIRDS	292	48	21	3
FISH <sup>1</sup>	56	5	2	0
INVERTEBRATES	>16,000	48	20	1
MAMMALS	58	7	5	2
REPTILES	16	2	4	0
TOTAL	>16,440	112	52	6 <sup>2</sup>

<sup>1</sup>Not including marine fish

<sup>2</sup>Six additional marine or plant species are listed; however, MDIFW does not manage these species.

**BIRDS**

- The cooperative management approach for **piping plovers** has resulted in five consecutive record-setting years on Maine’s southern beaches. In 2022, 140 nesting pairs fledged 252 fledgling plovers. Three beaches each fledged over 30 plovers: Wells Beach (40), Ogunquit Beach (35), and Seawall Beach (34). We thank the towns of Ogunquit, Old Orchard Beach, Scarborough, and Wells, the city of Saco, the Maine State Parks, and the Prouts Neck Association for their plover stewardship through beach management agreements with MDIFW.
- **Atlantic puffin** and **razorbill** on the Gulf of Maine’s seabird nesting islands had higher fledgling success in 2022 compared to their almost complete reproductive failure in 2021. The Gulf of Maine is warming faster than 99% of the world’s oceans, increasing the likelihood of high chick starvation events due to low forage fish availability. Warming summer waters cause forage fish to move deeper or further offshore, making it hard for adult waterbirds to catch enough to feed their chicks. A special thanks to the Gulf of Maine Seabird Working Group for their annual efforts to monitor Seabird Nesting Islands in the Gulf of Maine.
- Two high-elevation songbird species, the **Bicknell’s thrush** and **Blackpoll warbler**, are being proposed as Threatened under the Maine Endangered Species Act. Both birds rely on dense stands of spruce-fir or fir-dominated forests. In Maine, these forest types are found in high elevations with stunted growth (>1,100 m; think trying to crawl through a balsam fir fortress) or at lower elevations in commercial stands where forest regeneration mimics high-elevation stunted forests. Both species have experienced recent population declines in Maine.
- Aerial insectivore populations have been declining across Maine. Landscape-level changes (conversion of grasslands or agricultural lands to development or reforestation) have reduced habitat statewide. Additionally, increased use of potent pesticides has reduced insect availability and essentially limited food in many high-quality foraging areas. Two aerial insectivores, the **bank swallow** and **cliff swallow**, are being proposed for Threatened status under the Maine Endangered Species Act due to significant population declines. Other aerial insectivores experiencing population declines include the **purple martin**, **tree swallow**, **whip-poor-will**, and **common nighthawk**.
- MDIFW biologists have been studying the return rates and movement patterns of **black terns** that breed in Maine by color-banding adults and attaching small tracking devices called geolocators to them. This data will allow MDIFW to better understand if Maine’s breeding terns return to the same nesting sites annually, where they spend the non-breeding season, and what migratory routes they take in the autumn and spring.
- After **peregrine falcons** completely disappeared from the Eastern U.S. in the 1960s, MDIFW worked closely with a broad array of partners (e.g., biologists, falconers, private landowners, nonprofits, and citizen scientists) to return breeding peregrines to Maine. Breeding pairs can now be

- found nesting on cliffs and on tall buildings in Maine’s urban cities; and in 2019, a three-year intensive effort to locate breeding pairs and estimate nesting success across Maine was initiated. Surveys in 2021 found 27 successful nesting pairs that raised a total of 50 fledglings!
- The Biodiversity Research Institute, in collaboration with MDIFW, has initiated a multi-year effort to monitor **upland sandpipers’** migratory movements and habitat use. Birds will be tracked in Maine during the summer to study local habitat use, and along their migratory routes to their South American overwintering regions. This project would not have been possible without financial support from The Nature Conservancy and the Maine Outdoor Heritage Fund.



*Peregrine falcon – The peregrine falcon population in Maine continues to recover and benefits from protection provided by the Maine Endangered Species Act.*



*Upland Sandpiper – The upland sandpiper breeds in large treeless grasslands and blueberry fields primarily in southern and eastern Maine.*



Tri-colored bat – The tri-colored bat is being proposed as threatened under the Maine ESA and endangered under the US ESA.

## MAMMALS

- Since 2015, MDIFW has conducted annual surveys of our eight bat species during the summer maternity season. These surveys use ultrasonic acoustic recorders that record the high-pitched calls (beyond the range of the human ear) bats make while in flight and then use computer software to match calls to species. In 2022, we initiated a long-term monitoring plan in which we will survey the same sites on a two-year rotation. These surveys will allow us to track changes in bat populations and distribution over time.
- MDIFW has partnered with researchers from the University of Maine to study non-traditional bat hibernacula in Maine, with an emphasis on the three cave bats (**little brown, eastern small-footed, and northern long-eared**) listed under the Maine Endangered Species Act. This research confirmed that bats are using talus slopes (boulders and rock slab piles) during the hibernation period.
- One additional species of cave roosting bat, the **tricolored bat**, is being proposed as Threatened in Maine and Endangered on the US ESA. Tricolored bats have only been recorded overwintering in one Maine hibernacula but have been detected across the state in summer.
- In January 2023, the **northern long-eared bat** was uplisted on the US ESA from Threatened to Endangered. Northern long-eared bat populations continue to decline range-wide due to white-nose syndrome, and uplisting gives their populations additional protections.
- The number of Maine sites known to have **New England cottontails (NEC)** grew to 41 in 2022, up from a low of 17 in 2017. Central to the expanding NEC population has been a translocation effort (releasing NEC from captive breeding colonies or moving NEC from larger populations) that started in 2017. Four NEC were translocated in 2021, and 15 in 2022. Translocations help to establish new NEC populations, but also increase genetic diversity in isolated populations to prevent inbreeding. Translocation along with habitat restoration on private lands in southern Maine is central to maintaining a sustainable NEC population.
- Maine and New Hampshire are the only northeast states with **northern bog lemming** populations. The species was listed as Threatened under the Maine ESA in 1987 and is currently being considered for listing under the US ESA. To better understand northern bog lemming distribution in Western Maine, the University of New England (in coordination with the United States Fish and Wildlife Service and MDIFW) collected rodent feces from potentially suitable habitat and extracted DNA from it. The extracted DNA identified northern bog lemmings at four additional sites in Maine. This advanced DNA extraction technique showcases the incredible tools available to survey for and study secretive wildlife populations.

REPTILES, AMPHIBIANS, AND INVERTEBRATES

- A new population of **northern black racers**, Maine’s largest and rarest snake species, was documented in Brownfield (Oxford County) in spring 2021. A report of a roadkill specimen from the public led to the discovery. This is the northernmost confirmed population of this state Endangered snake.
- Maine’s first road crossing structure specifically designed for freshwater turtles was completed in the spring of 2021. The large concrete box culvert was installed at Route 236 in Eliot primarily for the benefit of state Endangered **Blanding’s turtles** after surveys there documented the highest level of turtle road mortality statewide. Subsequent monitoring has shown a substantial decrease in overall turtle mortality at the site since construction of the passage and adjoining turtle fence.
- In 2022, MDIFW partners, with USFWS funding, conducted a radio telemetry/GPS tag study of eight state threatened **spotted turtles** at a mid-coast site. The data will help answer questions about the biology and behavior of this rare turtle species at the northeastern edge of its global range, and will inform habitat protection efforts including landowner and land trust technical assistance.
- The **eastern box turtle** was first state listed as Endangered in 1986 based on documented reports from areas of apparently suitable habitat in southern Maine. At the time, it was hoped that targeted surveys would validate the reports and confirm native populations in the state. However, extensive field work over the past three decades in areas most likely to support box turtles has failed to locate any populations. In addition, continued reports of individual turtles have come from widely scattered areas, with no concentration that might suggest the existence of natural populations. Instead, these reports likely pertain to released captive animals, as box turtles are popular, long-lived pets. For these reasons, MDIFW is proposing to remove the eastern box turtle from Maine’s list of Endangered and Threatened Species. However, it will remain a Species of Greatest Conservation Need in the state’s Wildlife Action Plan in order to facilitate surveys and research should a potentially native population be discovered in the future.



*Black racer – The black racer is a Maine endangered species found in southern portions of the state.*



*Boreal snaketail – This threatened species of clubtail dragonfly occurs further north than any other clubtail dragonfly, and is active from mid-June to the end of August. ©J. Abbott*



Rusty-patched bumble bee – The US endangered rusty patched bumble bee has not been observed in the state since 2009.

- **The rusty patched bumble bee**, listed as federally endangered in 2017, is one of about 21 bumble bee species in the eastern U.S. Once one of Maine’s most common bumble bees, the species may now be extirpated following a range-wide collapse in the 1990s, likely caused by disease and pesticide use. Since 2019, MDIFW has been conducting targeted surveys every summer to look for any remaining populations; but unfortunately, the species has not been observed in Maine since 2009.
- **Ashton’s cuckoo bumble bee** was historically found statewide, but was not seen at all from 1996 to 2017. Currently known to exist in just one northern Aroostook County location, it has been proposed for Endangered status under the Maine ESA. If listed, it will receive special attention from MDIFW and our partners by way of increased population monitoring, research on limiting factors, and population recovery efforts such as habitat protection and landowner technical assistance.

- Surveys contracted by MDIFW in 2021-2022 resulted in new findings for one of Maine’s rarest freshwater mussel species. After previous failed attempts to redocument the state-Threatened **tidewater mucket** in Cold Stream Pond (Penobscot Co.), where it was last observed in 1946, it was finally rediscovered this past summer – 76 years later! And in 2022, live tidewater muckets were documented in the lower Androscoggin river for the first time, following up on a nearly 30-year-old record of empty shells found at the mouth of the river in Merrymeeting Bay. Finding remnant populations of rare species can be a painstaking exercise, requiring detailed knowledge of the species’ natural history and years of persistent detective work by dedicated biologists.
- With over 120 species and subspecies, butterflies are diverse and colorful components of Maine’s insect fauna. They also play important ecological roles, both as pollinators and as prey to larger species, from dragonflies to birds. Despite growing general concern for butterflies and other pollinating insects, Maine has, until recently, only had a rudimentary knowledge of the group. From 2007 to 2016, MDIFW sponsored a statewide citizen science butterfly atlas effort, culminating in a rich database of over 25,000 new records and a detailed natural history compilation. *Butterflies of Maine and the Maritime Provinces* will be published by Cornell University Press in 2023. One result of special conservation interest is the high proportion (20%) of Maine butterfly species considered Endangered, Threatened, Special Concern, or Species of Greatest Conservation Need. These include many species that are colorful in both name and form: **Hessel’s hairstreak** (Endangered), **Frigga fritillary** (Endangered), **Clayton’s copper** (Threatened), **sleepy duskywing** (Threatened), and **Katahdin Arctic** (Endangered).
- The **rapids clubtail dragonfly** was first listed as state Endangered in 2007 based on data indicating that the species may be limited to just one population on the upper Saco River. However, field work over the past 25 years in areas of southern Maine most likely to support Rapids Clubtail has neither located another population, nor reconfirmed its presence in the Saco River location. In fact, MDIFW biologists now question the original identification due to the difficulty of distinguishing species in this genus from larval morphology alone (the original observation was based on the shed skin [exuvia] of a larvae), especially using the rudimentary larval keys that were available in the mid-1990s, now much improved. For these reasons, and in order to keep the state’s endangered species list as accurate and credible as possible, MDIFW is proposing to remove the rapids clubtail from Maine’s list of Endangered and Threatened Species.

## Program Funding Remains a Challenge

America's state wildlife agencies were initially established to manage game species and sport fisheries, and were supported as such by federal aid programs. In Maine, license fees generate matching state funds. The Pittman-Robertson Act (1937) and Dingell-Johnson Act (1950) each generate income for management of wildlife and fisheries, respectively.

Awareness of, and public interest in, endangered species conservation now requires traditional "fish and game" agencies to take on broader responsibilities for which there are no dedicated funding programs. And while Maine and other state wildlife agencies have developed Action Plans that identify all "Species of Greatest Conservation Need," program funds remain well below program needs.

In 2020, Recovering America's Wildlife Act (H.R. 3742) was passed in the House Committee on Natural Resources but failed to pass the Senate by the end of 2022 and is expected to be reintroduced to the House in 2023. If enacted, this legislation would stabilize and increase funding for at-risk species. 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 has exceeded \$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 has generated more than \$11,370,000 for the Fund, 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 to date has totaled more than \$561,000.

We are grateful for these contributions, which have enabled the startup of the Department's endangered species programs; but they have naturally declined over time as competing state interests have also begun to utilize checkoffs and license plates as funding strategies.

Until we have a stable funding source, staff must triage efforts for our most vulnerable species, even when we know it would be best to address at-risk species before they are highly jeopardized and in need of E/T listing.

Recent public surveys confirm that most members of the public strongly support MDIFW's E/T conservation efforts, but only a small subset of residents financially contribute to the Endangered and Nongame Wildlife Fund. Please consider joining this impactful group of citizens by donating through the chickadee checkoff, purchasing or renewing a loon plate, or making an independent donation.



2021-2022

RESEARCH + MANAGEMENT REPORT

Beginning with Habitat



Download additional sections at [mefishwildlife.com/wildlifereport](https://mefishwildlife.com/wildlifereport)



## 2021-22 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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- » Game Species Conservation & Management
- » Non-Game Species 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.



## Meet the Beginning with Habitat Group

### **Steve Walker**

#### **Beginning with Habitat Coordinator**

Steve supervises the Beginning with Habitat program, and facilitates the work of Beginning with Habitat's Steering Committee which is made up of more than a dozen sister agencies and natural resource organizations from across the state all with the shared goal of promoting local conservation action.



### **Amy Dowley**

#### **Resource Biologist**

Amy creates and maintains paper and digital map packages for towns, land trusts, and landowners. Harnessing the power of GIS tools and spatial data, Amy helps inform and enhance conservation communication and decision-making at the state and local level. Amy also maintains and provides current data to online mapping services and assists staff and the Department with GIS-related needs.



### **Corinne Michaud-LeBlanc, Climate Coordinator**

Corinne coordinates MDIFW's efforts to plan for and adapt to the impacts of climate change on Maine's fisheries, wildlife, and their habitats. She provides technical assistance to fellow state agencies, local governments, and conservation partners, with the goal of integrating climate resiliency and species vulnerabilities into strategic conservation plans for fisheries and wildlife habitat. Corinne also represents the agency on technical, scientific, and stakeholder groups to support the goal of incorporating fisheries and wildlife considerations into policy-level discussions regarding renewable energy siting, carbon sequestration, habitat restoration, land use policy, and acquisition of conservation lands.



### **Joseph Roy**

#### **Private Lands Wildlife Biologist**

Joe assists private landowners across the state with their wildlife habitat management goals. Additionally, he works with local, state, and federal partners to increase the funding opportunities and technical assistance available for private landowners working on wildlife habitat management.

# BEGINNING WITH HABITAT



## Program Overview

If you are taking the time to read an MDIFW Research & Management Report, chances are you're an avid angler and/or hunter, an outdoor enthusiast, or in some other way awakened to the preciousness of Maine's unique natural heritage, which is our real "quality of place." You may have also heard that scientists have declared a global biodiversity crisis which, coupled with and inextricably linked to a global climate crisis, is extraordinarily troubling. So, what is your fish and wildlife agency doing, and how can you help?

It helps to start with a historical perspective. Going back forty years to the mid-1980s, then-Governor Brennan recognized the cumulative effects of a recent increase in land conversion to development as "the most pressing

resource issue in Maine." This initiated the former State Planning Office's Cumulative Impact Project in 1985, which identified a growing concern among Mainers that "rapid and unmanaged growth are permanently and adversely changing Maine's special character and quality of life" (Arbuckle, J., and M. Lee. 1987. *The cumulative impacts of development in Maine: A study of habitat changes in five coastal towns*. Augusta: Maine State Planning Office). Up until that time, state officials had paid little attention to the cumulative effects of development. As stated in the initial report, "these effects on our landscape and resources take place individually and incrementally over time as an area develops; their sum produces impacts which far surpass the direct effects of any single project."





As an example, the report described how an individual house built on one piece of land may directly take space, possibly contribute to the tax base (assuming low costs to provide town services and few children that require public education) and increase the local permitting load; this single house might destroy a small amount of wildlife habitat or add an “insignificant” amount to septic pollution or runoff in the area. However, the report further describes how “fifteen similar houses built in the same area over a period of years, may permanently remove precious prime topsoil or destroy a large deer wintering area, cut off recharge to groundwater, contaminate local water supplies, or overload traffic routes and water supplies.” This cause-and-effect dynamic was common knowledge 40 years ago.

Around this same time, in the early to mid-1980s, MDIFW began collaborating with other state resource agencies on a “baseline” of important resources — region by region, bay by bay — focused initially on Maine’s rapidly developing coastal communities. One of the first of these efforts was the 1981 Casco Bay Coastal Resources Inventory, which at the time made Casco Bay the only substantial section of the entire Atlantic Coast to have a complete, seasonal inventory cataloging its wildlife populations and habitats. Similar efforts were subsequently completed for Sheepscot and Muscongus Bays, followed by Penobscot Bay and the entire

southwestern coastline. Although the inventories were initially undertaken to prepare for the unthinkable — a significant coastal oil spill — they soon became valuable resources for land trusts planning strategic conservation and marked the beginnings of centralized data to inform municipal natural resource planning. 1988’s Identification and Management of Significant Fish and Wildlife Resources in Southern Coastal Maine laid out a simple four-step process that local planners could use to prioritize and protect open space. Accessible tools were now available to better equip local decisionmakers to make informed growth decisions.

The rapid increase in data resulting from resource inventories, and new legislative mandates that required municipal action, prompted The Nature Conservancy in collaboration with the then Natural Heritage Program (now Maine natural Areas Program), State Planning Office, DECD, MDIFW, and DEP to launch the Maine Natural Heritage Data System in 1989. Its stated goal was to enable all these agencies, as well as the Conservancy, to cooperate more effectively in their efforts to protect significant wildlife habitats in Maine while also establishing a data clearinghouse accessible to local entities. The stage had now been set to provide comprehensive natural resource data information in an accessible format to municipalities and land trusts to best inform local land use decisions.

Concurrently, in 1988, the Maine Legislature passed three foundational laws which continue to this day to influence local protections for Maine’s plant and animal habitats: the addition of an Essential Habitat designation under the Maine Endangered Species Act; the Natural Resources Protection Act; and the Comprehensive Planning and Land Use Regulation Act. Each of these laws helps to address cumulative loss of habitats and their functions, and each one to some extent was crafted to inform municipal planning. Under the Natural Resources Protection Act and Maine Endangered Species Act, direct state-level wildlife habitat protection is focused on specific sites: isolated patches of habitat considered of statewide significance and legally defined as significant wildlife habitat and essential wildlife habitat. Under the Comprehensive Planning and Land Use Regulation Act, municipalities are encouraged, but not required, to implement a more general approach to habitat conservation that gets at landscape functions, habitat connectivity, and development performance standards that would keep common species locally common as the town grows.



By the early 1990s, MDIFW began mapping important habitats town by town. The Department considered these efforts critical because “most local governments do not have the information necessary to delineate areas important for fish and wildlife populations in their towns” (MDIFW 1989) and the recently adopted comprehensive planning rules required towns to address natural resource issues in future growth plans. By 1997, MDIFW had initiated a strategic planning effort to modernize Department operations, functions, and communications. Within that plan, a key vision for the Wildlife Division was to “develop a strong approach to address long-term wildlife habitat management with landowners and towns” (Strategic Plan 1997).

Enter Beginning with Habitat — a program based on a simple model developed through the University of Maine’s Cooperative Fish and Wildlife Research Unit in 2000. This model, still utilized 20+ years later, depends on strong riparian (upland areas along streams, wetlands, etc.) protections at the local level coupled with local protection of Significant Habitats and known rare, threatened, and endangered plant and animal habitats embedded within and linked to a network of spacious, unfragmented natural lands. Beginning with Habitat translated this model into a series of maps scaled to the town level highlighting each of the model’s resource categories and accompanied the maps with guidance for typical municipal permitting and planning decision points where protection of key resources could be addressed through zoning, incentives, and other approaches. None of it is mandatory, but rather is intended to take the guesswork out of habitat protection initiatives that a town wants to voluntarily take on.

## So, after actively promoting this program to towns and land trusts for 20+ years, how are we doing?

Beginning with Habitat has become a core resource for most, if not all, Maine land trusts, helping staff and board members decide which properties to pursue for acquisition and how best to steward them. We send maps and data to every organized town undertaking comprehensive planning, together with model ordinance language, planning suggestions, and examples of successes from other communities. Beginning with Habitat staff is available to meet with local boards and committees to help them with their local resource planning efforts. Outreach efforts include meeting with landowners to discuss specific land management options and sending staff to conduct presentations and deliver data packages to town offices. The information is out there, and it is as accessible as we can make it.

Still, many challenges remain. Our State Wildlife Action Plan's designated Species of Greatest Conservation Need increased from 213 in 2005 to 378 in 2015, and the candidate list for Maine Endangered Species Act review (forthcoming in 2023) includes 8 additional species. Access for hunting, angling, shellfish harvesting, and other outdoor pursuits continues to disappear, and forest blocks have been getting incrementally smaller and more disconnected from other habitats with each new road and subdivision.



Brook trout have become harder and harder to find as local watersheds have become increasingly paved and less forested. MDIFW can certainly weigh in and help to guide development in ways that avoid and minimize wildlife impacts, but only if our input is triggered through the MDEP permit review process, or if we are made aware of a potential Maine Endangered Species Act nexus. The vast

majority of development projects fall to local review and jurisdiction, leaving the frontline defense of Maine's fish and wildlife heritage to local Code Enforcement Officers and Planning Boards. The need to balance growth and permanent protection for a sustainable landscape grows with every change in land use, but also grows more difficult.

It can be a real conundrum for an agency charged with preserving, protecting, and enhancing the inland fisheries and wildlife resources of the state to effectively influence local growth and development decisions when municipal home rule authority does not guarantee us a seat at the table. Fortunately, local champions, citizens who have an understanding and appreciation for Maine's fish and wildlife heritage, have stepped up over the years and have been able to make a lasting difference for traditional outdoor recreation and biodiversity protection in their communities.

Perhaps the 1997 Response to Sprawl document by the Maine Environmental Priorities Project puts it best: "The biggest challenge to planning is to find the public support and political will to actually implement the plans. Land trust members, hunters, foresters and others can find common cause in protecting areas that provide multiple benefits. These same individuals can provide volunteer assistance in the planning process and beyond. This is particularly important because planning by itself does not save wildlife habitat: following through with planning recommendations does."

The urgency of today's dual challenges of climate change and biodiversity loss demands that each of us get involved at the local level to address global issues. The impacts of development sprawl on plant and animal habitats stem from decisions people make; but they're not intentionally setting out to alter Maine as we know it. The real problem lies in unconsidered consequences, questions rarely asked, incrementally rising costs for taxpayers, and costs untabulated to wildlife. Sprawl is about a Maine we value even as the growing love for Maine challenges the very qualities that draw people here to begin with.

"The most effective way to protect wildlife habitat in your town is to get involved in the local planning process" (Integrating Wildlife Habitat into Local Planning: A Handbook for Maine Communities, May 1991). This has never been more true or more urgent. What is the best way to help address seemingly insurmountable global environmental issues? Be a champion in your town. We are here to support you and help you get started. Your grandchildren will thank you.

# Private Lands Wildlife Biologist

Joseph Roy, AWB\*

A key tenet of the Maine Department of Inland Fisheries and Wildlife’s mission is to “protect and manage Maine’s fish and wildlife and their habitats.” Since Maine is over 94% privately owned, it’s essential that we partner with private landowners statewide to manage our wildlife species. The job of the Private Lands Wildlife Biologist is to assist private landowners as they work to achieve their stewardship goals.

The Private Lands Wildlife Biologist creates and strengthens partnerships with Maine landowners and land-owning organizations, serving as their point of contact and providing them with technical assistance on their lands. This may be in the form of guidance documents that help landowners achieve their goals, site visits to answer questions and provide advice, or workshops on specific management topics. An example might be providing landowners with materials on managing for biodiversity on their property.

Additionally, the Private Lands Wildlife Biologist maintains partnerships with other conservation organizations that provide Maine landowners with technical and financial assistance. Examples of this include connecting landowners with staff at the Maine Forest Service who can provide financial assistance for forest management plans, or helping landowners get funding for habitat improvements through the Natural Resource Conservation Service.

In 2021, the Private Lands Wildlife Biologist directly assisted 63 landowners representing over 35,000 acres statewide, participated in 14 workshops/events, and collaborated with over 100 staff from federal, state, and local agencies as well as private organizations.

If you are interested in learning more about how to manage for your wildlife goals and objectives, please reach out to Joseph Roy, AWB\*, Private Lands Wildlife Biologist, at 207-592-3344 or joseph.roy@maine.gov.

## 2021 PRIVATE LANDS BIOLOGIST PROGRAM HIGHLIGHTS



Directly engaged with 63 landowners representing over 35,500 acres. Landowners varied in size from 5 to 16,000 acres. 81% owned 500 acres or less, 55% owned 100 acres or less.



Expanded the website to collate 50+ resources and guidance documents.



Participated in 14 events.



Worked statewide with over 100 staff from federal, state, and local agencies to advocate for increased funding and technical assistance opportunities for private landowners and managers.



Engaged with 500+ private landowners.



# 2021-2022

## RESEARCH + MANAGEMENT REPORT

### Land Acquisition & Water Access Programs



This Facility is for the Launching and Retrieving of Boats and Recreational Fishing Access

STATE OF MAINE LAWS

PUBLIC ACCESS SITE

This Property Protected with Ambulance from the

Conservation Land Act



# 2021-22 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.

## Land Acquisition & Water Access Programs

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## Meet the Land Acquisition & Water Access Group



**Bethany Atkins**

**Land Acquisition and Habitat Grants Biologist**

Bethany manages the Department’s land acquisition program and purchase of Wildlife Management Area lands. Bethany also manages the Department’s responsibilities to several state and federal grant programs focused on land protection, public access, and habitat restoration including the Land for Maine’s Future Program, Maine Natural Resource Conservation Program, Maine Outdoor Heritage Fund, and National Coastal Wetlands Conservation Program. She works closely with agency, land trust and municipal partners to facilitate conservation work across the state.



**Alison Truesdale**

**Land Acquisition Assistant**

Alison works on all aspects of site assessment, due diligence, and grant applications for the acquisition of land for habitat conservation and public access to state waters. Alison is responsible for keeping the GIS conservation and water access data up to date; she also coordinates with state grant applicants to guide them through the processes of obtaining grants from the Land for Maine’s Future Program and Maine Outdoor Heritage Fund.



**Diano Circo**

**Chief Planner & Federal Aid Coordinator**

Diano directs the Water Access Program and manages acquisition, design, construction, maintenance, and recreational use of the Department’s 168 water access facilities. Diano represents the Department on a number of issues related to public access. He also coordinates with the U.S. Fish and Wildlife Service in policy development and oversight of the Department’s federal grants.

# LAND ACQUISITION & WATER ACCESS PROGRAMS

Acquiring and managing land is the most permanent activity MDIFW undertakes to implement its mission of protecting and managing Maine's fish and wildlife and their habitats, promoting Maine's outdoor heritage, and safely connecting people with nature through responsible recreation, sport, and science.

In 2021-2022, the Land Acquisition and Water Access programs completed 16 projects covering 15,890 acres. 2,057 acres became state-owned, MDIFW-managed lands. The remaining 13,833 acres were acquired by other conservation organizations with grants secured by MDIFW. We also secured one easement, providing public access to Salt Pond in Blue Hill.

## Land Acquisition Program

The goal of MDIFW's Land Acquisition Program is to provide a statewide, ecologically based system of land holdings for the protection and enhancement of important fish and wildlife habitats, while also providing opportunities for public access and recreation. When MDIFW acquires land, we work to restore or improve its habitat and public access, then manage it and make it available for public use in perpetuity by incorporating it into MDIFW's Wildlife Management Area (WMA) system. We carefully evaluate each parcel we purchase to make sure it meets Department goals, which may include protecting and managing important habitats, improving public recreational access, or developing or expanding WMAs. MDIFW also works closely with conservation partners, towns, and land trusts to secure funding for their habitat conservation and restoration projects.

### FEDERAL AND STATE FUNDING

Most of MDIFW's land acquisition funding comes from federal and state sources. Federal sources include competitive National Coastal Wetlands Conservation grants, North American Wetland Conservation Act grants, and Recovery Land Acquisition grants, as well as noncompetitive Pittman Robertson Fund grants that are allocated to states. State grant sources include the Land for Maine's Future program, Maine Outdoor Heritage Fund, and the state Duck Stamp fund, as well as donations from private foundations, landowners, and partner organizations.

In 2021, after many years of no new funding, the Legislature funded the Land for Maine's Future Program, the state's primary land conservation grant fund, with \$40 million to be granted to deserving conservation projects over the subsequent four years. In the first year, MDIFW received two separate grants which will contribute significantly to our land acquisitions in Regions F and G. We also served as the designated State agency for another 11 land conservation projects being completed by partnering land trusts. On these projects, MDIFW commits to permanently partner with the conservation landowner to oversee the parcels' long-term stewardship.

### SPORTSMAN'S ACCESS GRANT

In late 2021, MDIFW completed its work under the federal Sportsman's Access Grant. This grant was funded through Pittman Robertson dollars matched with state funds including a Land for Maine's Future grant. We used it to acquire 18 parcels totaling nearly 3,700 acres in parts of central Maine that had little public access for hunting, fishing, and trapping. The largest parcel included over 1,000 acres of MDIFW's new Plymouth Bog WMA in Burnham. We purchased another 1,000 acres along the Carlton Pond headwaters in Detroit, as well as 425 acres in Embden, to establish the Fahi Pond WMA and provide previously non-existent public access to Hancock Pond. All of these properties now have permanent public access to benefit Maine sportsmen.

### DEER HABITAT CONSERVATION

MDIFW has long worked with the Land Use Planning Commission and private landowners to improve deer habitat management on private lands through voluntary cooperative agreements. LD 404, An Act to Conserve Deer, directs MDIFW to add a new tool to its deer conservation efforts: acquisition and management of deer habitat by the Department. In the past year, MDIFW has actively cultivated projects important for deer, with projects underway in Regions D (Rangeley), F (Reed Deadwater-Juniper Brook), and G (Woodland and Washburn). After we close on these properties, they will become new WMAs on which our highest management priority will be to restore or enhance year-round white-tailed deer habitat.



*Sandy Cove, Harrington*

### NATIONAL COASTAL WETLANDS CONSERVATION GRANT FOR SANDY COVE

Maine estuaries provide essential feeding and resting grounds for shorebird species as they acquire the energy stores they need for their long and arduous migrations between northern breeding grounds and southern wintering areas. The Mill, Harrington, and Pleasant River estuaries support some of the highest shorebird use in Maine. A recent single bird count recorded over 1,700 shorebirds using the flats around Sandy Cove in Harrington. Great blue herons, bald eagles, osprey, American black ducks, bufflehead, long-tailed ducks, and common eider also utilize the flats, Lords Island, and the nearby uplands.

One necessary tool to protect shorebird species is the prevention of shoreline disturbance and development. In 2021, MDIFW was awarded funds from the National Coastal Wetlands Conservation Program to protect the Sandy Cove shoreline. Working with willing landowners, we acquired five parcels, securing Sandy Cove's entire north side and most of the undeveloped frontage on its south side. The state now owns a total of 87 acres at Sandy Cove, with 1.5 miles of shorefront along one of Maine's most important shorebird areas.

### Water Access Program

Maine has an extensive and diverse water resource: nearly a million acres of lakes and ponds and thousands of miles of river brooks, streams, and coastline. MDIFW's Water Access Program works to ensure legal, appropriate, adequate, and equitable means of public access to waters where recreational opportunities exist. All MDIFW-owned water access sites provide a wide range of opportunities from trailered boat launches to hand-carry facilities, shore fishing, and walk-in access.

Population demographics and associated attitudes regarding public use are changing, and waterfront real estate costs are increasing as supply decreases. Continuing to make investments that secure public access is an urgent priority to ensure future generations have adequate fishing and boating access to public waters throughout the state.

In 1995, a Strategic Plan for Providing Public Access to Maine Waters for Boating and Fishing outlined priorities for acquiring and developing water access in Maine. These included preventing the loss of access sites, dispersing demand among priority waters, maintaining serviceability of existing sites, and expanding public access in areas where it is inadequate.

**FEDERAL FUNDING**

**U.S. Fish and Wildlife Service’s Sport Fish Restoration Program** – This program was created through the Pittman-Robertson Wildlife Restoration Act, which instituted federal excise taxes on sporting equipment used by hunters, anglers, boaters, archers, and recreational shooters. Revenues from these taxes are to be used for conservation, education, and public access. Federal taxes on motorboat and small engine fuels are also a source of funding.

**STATE FUNDING**

- **Boat Launch Facilities Fund (Maine Sportsman License Plate)** – Each initial plate purchased provides \$14 to the Boat Launch Facilities Fund, which is managed by the MDIFW Water Access Program. Subsequent renewals provide 15% of the renewal fee (\$3) to the fund. Since its inception, the sportsman plate has generated an average of \$124,704 per year for the Water Access Program.
- **Boating Facilities Fund (Maine Gas Tax)** – Through a cooperative agreement, the Maine Department of Agriculture, Conservation, and Forestry allots a portion of state gas tax revenues attributable to motorboats to MDIFW’s Boating Facilities Fund, up to \$150,000 each fiscal year.

- Creating a range of ADA-accessible water access opportunities and improvements
- Developing a broad-based maintenance and improvement regime at Department-owned access sites
- Implementing strategies to ensure public access sites are visible and easy to locate
- Engaging and supporting private landowners who provide traditional access to ensure their land remains open to the public
- Refining engineering designs to create low-maintenance access with long-term site durability

**TOGUS POND FAMILY FISHING AREA, AUGUSTA**

In the fall of 2021, MDIFW opened the Togus Pond Family Fishing Area along Route 105. It’s Maine’s first multimodal, fully ADA-accessible fishing facility. The site offers two hand-carry launches and two casting platforms on Togus and Lower Togus Ponds connected by paved pathways, along with a fully accessible trailered boat launch on Togus Pond. The project was the culmination of decades of work by the Department to acquire the appropriate lands and design a facility that would remove barriers for anglers and boaters with mobility challenges.



*Lower Togus Pond Casting Platform*

**ANNABESSACOOK LAKE ACCESS PROJECT, WINTHROP**

In the fall of 2022, the Department opened a new trailered water access facility on Annabessacook Lake. Located on Holmes Road, it is the lake’s first developed public access facility (a previous rudimentary public site was closed by the Town of Monmouth due to safety and environmental concerns). In 2019, working closely with the Annabessacook Lake Improvement Association, we were able to acquire 13 acres on the lake. The new facility is fully ADA-accessible and provides parking near the water for 11 vehicles with trailers, plus another eight trailered vehicle parking spots at the entrance.

When funds are available, the Water Access Program also utilizes competitive state funding programs to assist with land acquisition and site development. These programs include:

- a) Land for Maine’s Future
- b) Maine Outdoor Heritage Fund
- c) Shore and Harbor Management Fund

Some of the actions we are taking to help improve public water access include:

- Identifying and updating priorities for boating, shore fishing, and walk-in remote pond access, and developing and implementing corresponding strategies to retain or secure access



*Annabessacook Lake Water Access Site in Monmouth*



2021-2022

RESEARCH + MANAGEMENT REPORT

Habitat Conservation and Management



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# 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**  
**Wildlife Biologist and Senior  
Programmer Analyst**

Maintains the Department's mapping applications and databases. Develops and manages online mapping and data collection applications. Represents the Department's GIS needs on the state GIS Council. Provides assistance to Department staff on a wide range of technical issues and data needs.



**Amy McLaughlin**  
**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.



## Mapping Hunting Boundaries

Maine is a beautiful state, with its vast forested landscape interspersed with rugged mountains, thousands of water bodies, and an extensive coastline. Maine is also one of the country’s most privately owned states, with 94% of its land under private ownership. The voluntary access permitted by many landowners is an incredible gift to recreationists, including hunters and trappers; and it’s also vital for the preservation and management of Maine’s wildlife.

### HUNTING BOUNDARY GIS FILES NOW AVAILABLE TO THE PUBLIC

In 2021, aiming to make the process of boundary identification more user-friendly and accessible, the Habitat Group completed a review of the Department’s hunting boundary files and made them available to the public. We started by comparing the existing mapped boundary files with the written descriptions in the law for accuracy, and then editing one or the other where necessary so they would match.\* Once the mapped areas and written descriptions were fully aligned and documented, we published

them to ArcGIS Online and shared them via the **Maine Geolibrary data catalog** for public use. The completed hunting boundary files include:

- **Wildlife Management Districts (WMDs)**
- **Expanded Archery Areas**
- **Waterfowl Hunting Zones**

Having these digital boundary files available to use on their devices in the field will make it easier for hunters to stay within their hunt’s legal boundaries and will help to ensure respectful and appropriate use of private land.

**Chapter 16 (09-137c16)** of the MDIFW Rules contains the written descriptions of these boundaries. Refer to the following sections for written descriptions of each specific area:

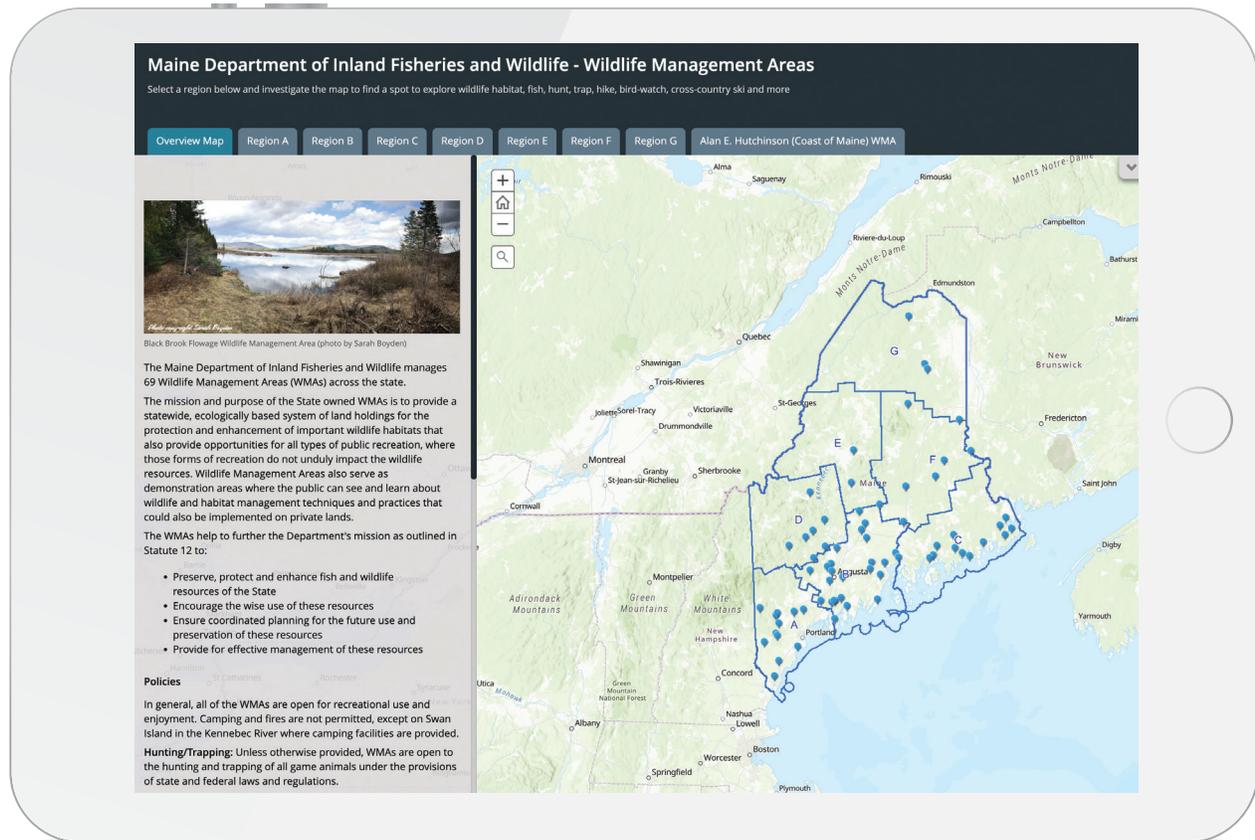
**Wildlife management districts – section 16.15**

**Expanded archery – section 16.07.7**

**Waterfowl hunting zones – section 16.11.12**



*\*Mapped boundaries are for reference purposes only. For precise boundary delineation, please refer to the written boundary description. Boundaries and imagery may not overlay precisely due to digitizing errors, differences in projections, and the scale at which these boundaries were drawn. Where any discrepancies occur between a mapped feature and the written description, the written description takes precedence.*



### NEW GIS STORYMAP PROVIDES IN-DEPTH INFO ON WILDLIFE MANAGEMENT AREAS

In addition to making these boundaries available, the Habitat Group produced a **Wildlife Management Area ArcGIS StoryMap**. MDIFW owns 61 Wildlife Management Areas (WMAs) covering roughly 106,000 acres of land. WMAs provide statewide, ecologically based land systems for the protection and enhancement of important wildlife habitats; and they also create opportunities for all types of public recreation including hunting and trapping. This StoryMap provides information on each WMA, including its purpose, management strategy, wildlife, habitat, and recreational opportunities, as well as access points and boundaries. You can find the WMA StoryMap at [mefishwildlife.com/wma](http://mefishwildlife.com/wma).

You can also view **Maine's Wildlife Management Areas** and **WMA Access Points** via the Maine Geolibary data catalog.

### MORE MAPPING TOOLS COMING SOON

The Department is currently working on a webmap of hunting boundaries compatible with the ArcGIS Explorer mobile application. If you have ArcGIS Explorer, or plan to install it on your mobile device, look for the Maine Hunting Boundaries Webmap in Fall 2022. Future plans also include a dashboard/interactive mapping application for the web including hunting boundaries; and eventually, an MDIFW mobile app for hunters.

## Going Paperless and Capturing Volunteer Effort

Don Katnik

Like many government agencies, Maine Department of Inland Fisheries and Wildlife has a lot of different forms that we use to collect information from the public. Some are for hunters and anglers to report their success, while others are for citizen scientists submitting biological data to the Maine Amphibian and Reptile Atlas Project (MARAP), New England Cottontail sightings, and more.



Traditionally, these forms have all been paper documents that had to be distributed, filled out, collected, and manually entered into a database before we could use the information. We are now working to replace them with electronic (web-based) forms to save paper and to improve efficiency. In most cases, a web “form” is just a web page that has text boxes and drop-down lists to capture information. We use them all the time to do things like purchasing airline tickets, buying stuff online, or ordering take-out food. The user just needs a web browser to access the form, and the information is automatically saved into the database with no need to distribute or collect the form or to key data in manually.

### ARE YOU A BIOLOGIST, OR A WEB PROGRAMMER?

Web programming, as the name implies, is the process of creating a web page and all the content on it. Some types of content, like text and images, are static. Other types, like web forms, are dynamic – they do things when the user interacts with them. There is computer code behind the web page that makes all this magic happen. If you want to see what it looks like, go to any web page and right click your mouse button, then select the option, “View Source” (in Chrome) or “View Page Source” (Microsoft Edge). What you will see behind the web page is probably a mix of web programming languages like JavaScript, HTML, and CSS. There are many other languages. It can get complicated, and the technologies involved are constantly evolving.

When I was in graduate school learning to be a wildlife biologist, the Internet existed (sort of), but Microsoft Windows/Office did not. Flash drives had not been invented yet and phones were not mobile. Needless to say, there were no web programming courses in the wildlife curriculum (I doubt there are now). So most biologists consider web programming “outside their wheelhouse.” And for those of us tasked with doing it, we have to learn it on the job.

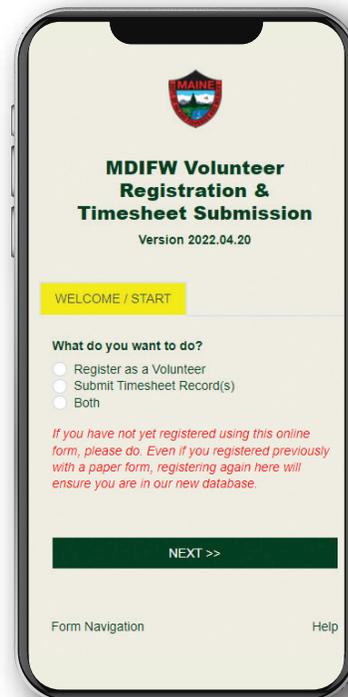




### CAPTURING VOLUNTEER EFFORTS

Some of the work that the Department does, like conducting wildlife surveys, is beyond what we can accomplish with existing permanent staff. Volunteer assistance from the public not only allows us to do this valuable work; it also helps with our funding, much of which comes from Federal grants that require matching funds from the state. Our volunteers' efforts essentially allow the Department to accomplish more without adding more permanent staff, and that cost savings can be used as stateside match for Federal grants. But we have to document those efforts.

We used to use paper forms to document volunteer efforts — a process that was slow and inefficient. This past year, the Department launched a web form to replace those paper ones. The new web form allows volunteers to register with the Department for a particular project, submit a timesheet documenting the hours they worked, or both. It's a work in progress — right now we are only using it for one project— but we plan to expand it to many of our projects that rely on volunteers.





2021-2022

RESEARCH + MANAGEMENT REPORT

Bird Conservation & Management



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# BIRD CONSERVATION & MANAGEMENT

## Meet the Bird Group



### **Brad Allen, Wildlife Biologist and Bird Group Leader**

Brad retired in August 2022 after a 41-year career with the Department, over half of which had been as the Bird Group Leader. He oversaw bird group activities and budgets, and was intimately involved in waterfowl and woodcock management, common eider research, and seabird monitoring and conservation. Brad's work often involved many collaborations with others, repeatedly bringing various groups together including state, federal, international, non-governmental organizations, and academic researchers to work towards common research and management goals. Brad's leadership and passion for the resource will be missed, but we wish him all the best in retirement!



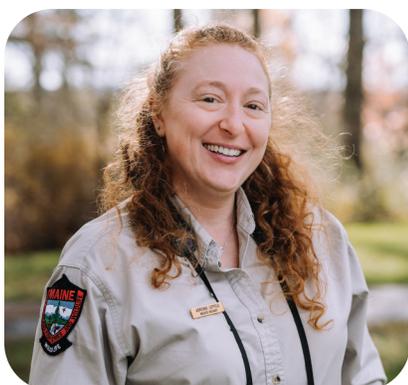
### **Erynn Call, Ph.D. Wildlife Biologist**

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 nonprofit organizations.



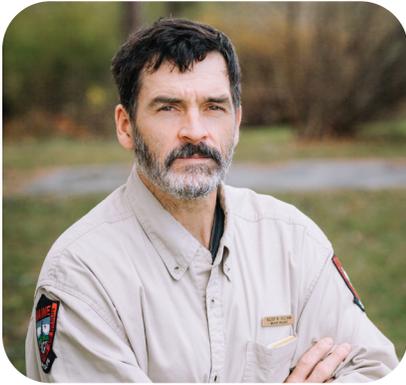
### **Danielle D'Auria Wildlife Biologist**

Danielle is the Department's species expert on secretive marsh birds, colonial wading birds, common loons, and black terns. Her work focuses on understanding statewide populations of these species as well as land management issues affecting the wetland habitats they depend on. Over the past 14 years, she has also devoted a great deal of effort to heron surveys and research, including coordination of a volunteer monitoring program called the Heron Observation Network of Maine and has used GPS transmitters to track great blue herons during breeding, migration, and wintering.



### **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.



**Brad Zitske  
Wildlife Biologist**

Brad specializes on shorebird conservation and management throughout Maine. Much of his work focuses on state-endangered piping plovers along the sandy beaches of southern Maine. This involves a robust network of volunteers and partners throughout coastal communities. He has been working on a collaborative research project on upland sandpipers for the past two years, aiming to fill an information gap on habitat use of this species and migratory movements. Other work includes environmental review and participation in Atlantic Flyway Shorebird Initiative efforts to conserve and protect shorebirds range-wide.

**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	Todd Jackson	Bill Sheehan	Island Heritage Trust
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Doug Hitchcox	Stephanie Shea		

# Expanding Tracking Technologies and Uncovering Migration Mysteries

Adrienne Leppold

Rusty blackbird, bobolink, northern saw-whet owl, salt-marsh sparrow, Bicknell’s thrush, and monarch butterflies. These are just some of the species the **Northeast Motus Collaboration (Figure 1)** is now tracking throughout Maine thanks in large part to funding from a competitive U.S. Fish and Wildlife Service State Wildlife Grant which enabled the expansion of an automated telemetry receiver (i.e., antenna) network (**Figure 2**). Part of the international **Motus Wildlife Tracking Network** developed and managed by Birds Canada, the northeast collaboration has been working for the last few years to dot our landscape with receivers, all with the goal of advancing our understanding of animal behavior and movement patterns.



Figure 1. Northeast Motus Collaboration signage affixed to automated telemetry tower.

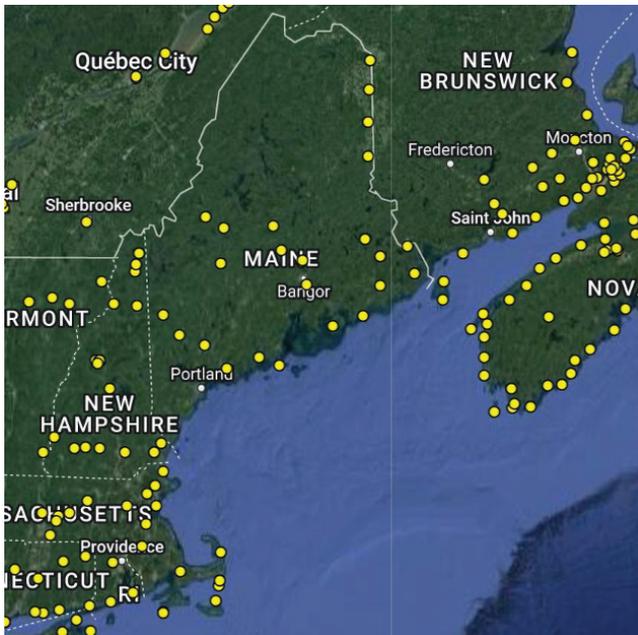


Figure 2. Map depicting receiver locations throughout the Northeast. More than ten towers have been erected or maintained through State Wildlife Grant funding over the last three years.

## What are automated telemetry receivers?

Telemetry receivers are solar-powered antenna/receiving towers (**Figure 3**) that automatically record signals when animals carrying corresponding radio transmission tags pass within the tower’s range. This technology allows biologists to gather information on organisms previously difficult or impossible to track over any distance due to the size limitations of cellular or satellite tracking technologies.



Figure 3a. A rooftop receiving array with two sets of quad-directional antennae and solar-powered receiving station.



Figure 3b. A guyed, stand-alone tower array with two sets of quad-directional antennae.



Figure 3c. Ideal open view for optimizing antenna tag detection as seen from the top of an array fixed to an old fire tower.

The magic with Motus, which means *movement* or *motion* in Latin, is in the collaborations. Any tower in the network can register any specifically programmed tag such that infrastructure and data can be shared across projects. So, the more antennas there are across the landscape, the more potential there is to detect a tagged animal and learn about its movement and even habitat use. That said, the network’s success also depends upon researchers capturing and deploying radio tags (e.g., nanotags) on animals.

One such effort has focused on bobolinks, a grassland bird species in steep decline (**Figure 4**). One of the longest-migrating songbirds, bobolinks travel 12,500 miles round trip annually between breeding grounds in Maine and wintering grounds in central and southern South America. During migration, they face numerous threats, chief of which is the disappearance of grassland habitat throughout North America. In partnership with Amber Roth from the University of Maine and Maine Audubon, we have tagged 20 bobolinks over the past two years.



Figure 4. Male bobolink after capture and with a properly fitted Nanotag transmitter, just before release. Photo by Joanne Alex, UMaine Witter Farm.

### What have we learned?

While additional years of tracking data will add important information to confirm these observed patterns, valuable discoveries are already being made from this small sample. By combining our data with that of tagged birds from other New England states, we have determined the Delmarva Peninsula is a critical migration stopover/staging area for our birds, at least during fall migration (**Figure 5**). Additionally, individual track data is starting to elucidate at least two different bobolink migration strategies: 1) departing from the Delmarva Peninsula on a trans-oceanic journey to South America; and 2) continuing south by land from the Delmarva to the southeastern U.S. before departing out over the Atlantic (**Figure 6**), male #34246.

Despite South America not yet having as big of a receiving tower network (**Figure 7**), male #34246 (**Figure 6**) also became the first of its species to be detected outside of North America. It flew 3,035 miles from Maine to Colombia in 32 days, with its final winter destination being somewhere in southwestern Brazil, Paraguay, northern Argentina, or central Bolivia.

This is all critical knowledge to inform conservation management actions, such as promoting grassland habitat along bobolinks' migration route (which would also benefit other species by association). All of this is made possible through the power of partnerships and this network. With so much potential, the Northeast Motus Collaboration is just getting started.

Animated maps of tagged animals' movements are publicly available on motus.org. Just click on 'Explore Data' to view tracks of selected species.

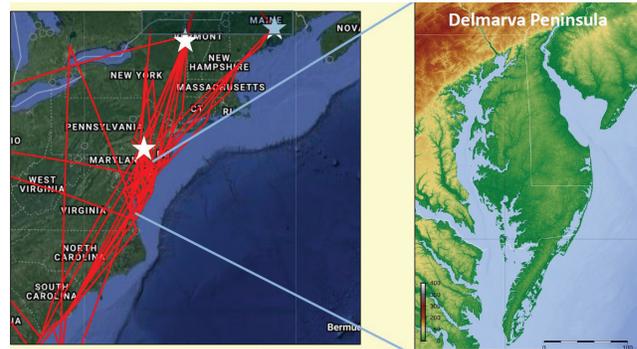


Figure 5. Map showing convergence of individual Bobolink migration tracks from nanotag detection on the Delmarva Peninsula (inset). Stars represent departure points of tagged birds and also the convergent point on the Delmarva. Graphic credit: Amber Roth.

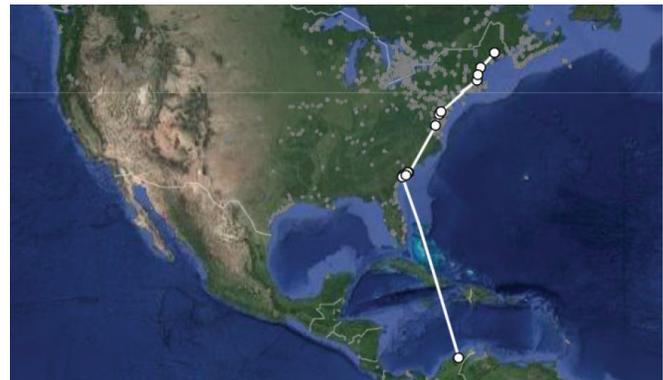


Figure 6. Male bobolink #34246 fall migratory track over land to southeastern U.S. and subsequent detection on the north coast of South America.



Figure 7. Map depicting receiver locations along the Gulf Coast of U.S., and in Mexico, Central and South America.

# Research on Maine’s Rarest Tern

Danielle D’Auria

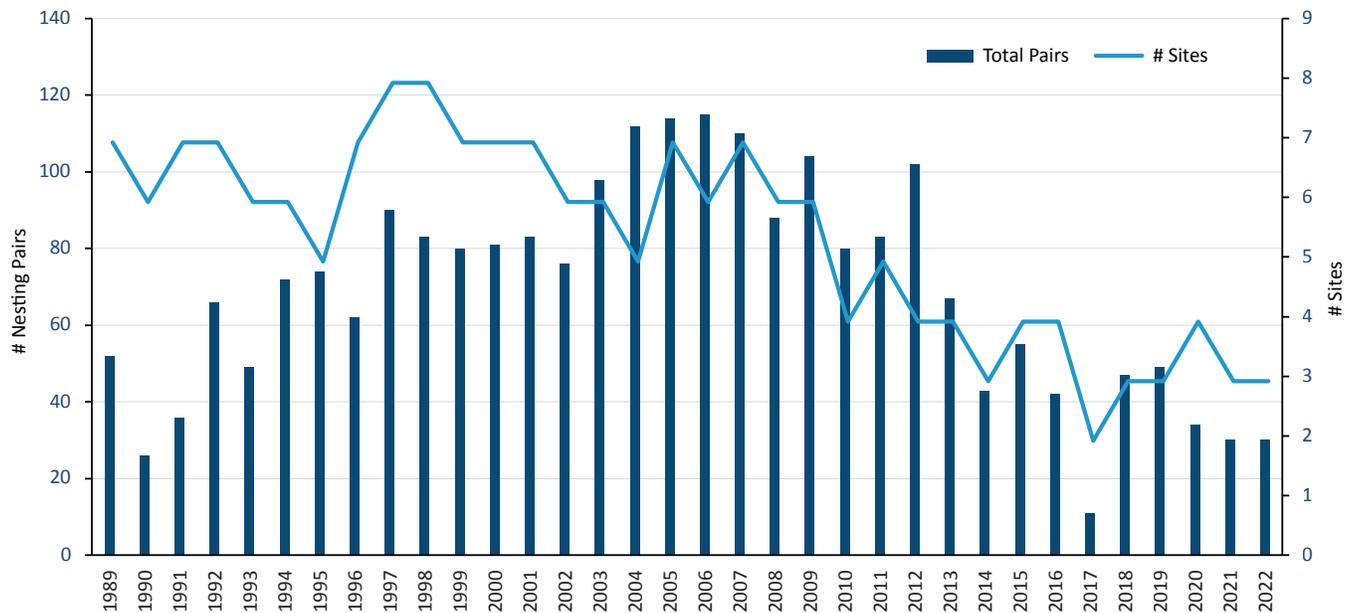
The black tern (*Chlidonias niger*) is the rarest tern in Maine, nesting in just a handful of the state’s freshwater marshes. Since 1989, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has been monitoring the number of nesting pairs, which peaked in 2006 at 115 before declining to a low of 30 pairs (at three sites) in 2022.

This decline is not just occurring in Maine, which is on the periphery of the black tern’s North American range. The black tern has experienced a long-term decline throughout its range, even at its core in the Prairie Pothole Region of the U.S. and Canada. The cause is unclear. While habitat loss and degradation have occurred, breeding habitat availability does not appear to be a primary limiting factor. In areas where survival and productivity have been studied, estimated vital rates fall far below those required to maintain a stable population.



*Black tern on exposed mud, a typical site for a nest.*

Black Tern Nesting Pairs in Maine, 1989 - 2022



To better understand the return rates of Maine's black terns to their breeding wetlands year after year, MDIFW began color-banding adults in 2021. Each adult has a unique color band combination on one of its legs and a silver metal USGS band on the other. Biologists spend time watching the birds with binoculars and spotting scopes with the hope of "re-sighting" a color-banded bird.

MDIFW has also contributed to a larger migratory connectivity project in partnership with the University of Saskatchewan by equipping 10 adults (five in 2021, and five in 2022) with geolocators attached to a plastic leg band. Support for this work is also being provided by the Smithsonian Migratory Bird Center's Migratory Connectivity Project. Each geocator has a light sensor that uses changes in ambient light levels to estimate sunrise and sunset times, from which latitude and longitude can be calculated. The derived locations will tell us where the birds go during migration, including important stopover and overwintering locations and areas where different sub-populations mix, so that we can potentially discover priority conservation issues at these sites.



*Black tern with geocator attached to yellow plastic band. Photo by Don Lyons.*



*Black tern with metal leg band on its right leg and two color bands (orange over yellow) on its left leg. MDIFW photo.*

To obtain the data collected by the geolocators, the birds need to be recaptured and the geolocators removed and analyzed. This summer we recaptured three black terns with geolocators that had been deployed in 2021 and are looking forward to discovering where they traveled after the nesting season.

Over the next few years, we will continue to color-band adults and re-sight them to look at return rates, and hope to deploy more geolocators. We will also need to recapture birds with geolocators. If you spot a black tern with color bands or a geocator (see photos for what to look for), please be sure to report your observation to the Bird Banding Laboratory and email [danielle.dauria@maine.gov](mailto:danielle.dauria@maine.gov) with the color band combination, location, and date.

## Keeping Up with the Uppies and their Changing Habitats

Brad Zitske

Upland sandpipers, also affectionately known as “uppies”, are an unusual member of the shorebird family in that they don’t spend much time on the shore. In Maine, their habitat is mostly open-field grassland and barrens. They occur in low densities and are area-sensitive, meaning they require a minimum amount of open space to settle and breed (typically 70-100 acres, with a preference for expanses over 150 acres). Sometimes that includes managed grassland like Kennebunk Plains Wildlife Management Area in southern Maine, the fields surrounding airports, and expansive agricultural operations in Aroostook County. But most often, you’ll find them nesting in Downeast Maine’s heavily managed blueberry barrens.

Over the past 100 years, their preferred field habitats throughout the state have diminished considerably, having been left to grow, developed, or turned into other uses. With that habitat change, upland sandpiper numbers have decreased and are declining statewide by almost all accounts, and they are currently listed as threatened in the state.

To date, minimal efforts have been made to document how upland sandpipers use breeding habitat in Maine or what their habitat needs are throughout the year. Research is also needed to understand how upland sandpipers could be impacted by, or will respond to, grasslands, blueberry fields, and other open space habitats being developed for various uses including solar energy facilities. The lack of information about upland sandpiper habitat use in Maine limits our ability to properly develop conservation strategies for this species and to find compatibility between upland sandpipers and the industries putting pressure on their habitats.

The summer of 2022 marked the second year MDIFW collaborated with the Biodiversity Research Institute (BRI) on a study of upland sandpiper habitat use and movement, generously aided by an award from the Maine Outdoor Heritage Fund (MOHF) with additional support from The Nature Conservancy in Maine. This is a much-needed and valuable opportunity to start addressing notable data gaps that limit our ability to conserve and manage for upland sandpipers.



*Biodiversity Research Institute biologist Kevin Regan holds a satellite-tagged upland sandpiper before releasing. Photo by K. Regan.*

This summer, biologists from BRI captured five upland sandpipers and tagged them with satellite transmitters to study their movement patterns and habitat associations during the nesting season, as well as to establish migratory connectivity between breeding grounds in Maine and wintering areas in South America. Early movement data is being collected on the four remaining transmitting birds (one stopped reporting on July 31, either due to a failed or lost transmitter or possibly a mortality).

Some movement highlights include one individual leaving its breeding grounds and flying approximately 118 miles to New Brunswick, Canada, on July 26. It spent the next two days in fields in and around Norton, NB, and on July 28 began working its way back down the Maine coast to its original banded location, where it arrived on July 29 (see photo on the first map! **Figure 1**).

Between August 26 and September 1, all four tagged uppies departed North America, flying over the Atlantic Ocean to the southeast along roughly similar paths. Over five days, they each flew an estimated 3,500 miles! As of this writing (November 2022), the birds were in South America, spread from Venezuela to Brazil.

Results are still preliminary, but we receive exciting new information each day and look forward to observing their movements this winter. Each new transmittal we receive informs us of where these birds spend the winter and what areas on the wintering grounds are being used. It will be interesting to observe if some survive the winter and return to our area next spring; and if so, what routes they take and if they return to the same breeding grounds. All of this information is new for Maine – truly an exciting time to learn more about this fascinating species!

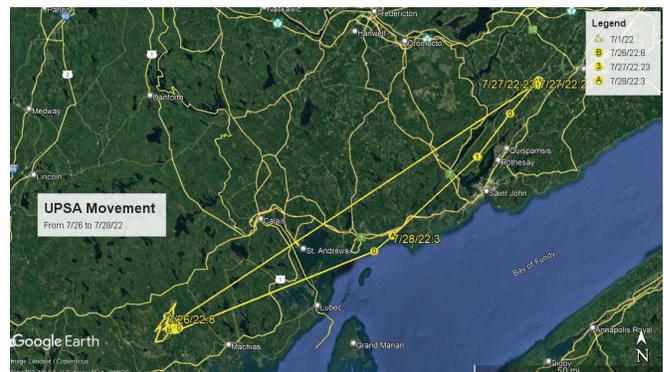


Figure 1. Movement of one individual upland sandpiper moving from its breeding territory to New Brunswick, Canada, and returning just three days later.



Satellite-tagged upland sandpiper with color bands perches after release. Photo by K. Regan.



Southbound migratory flight paths of four satellite-tagged upland sandpipers from 8/26/22 to 9/1/22.

## Bald Eagles Made a Spectacular Recovery – What Now?

Erynn Call

**It's a species recovery success story:** Maine's bald eagle population has increased from just 21 pairs in 1967 to an estimated 800+ pairs today, making it by far the largest bald eagle population in New England and among the top 10 in all the lower 48 states.

In 1978, when the bald eagle was listed as an endangered species, there were approximately 600 known nests in the lower 48 states. In 1995, bald eagles were downlisted from endangered to threatened at both the state and federal levels; and in 2007, they were removed from the federal threatened and endangered species list. In 2009, they were removed from Maine's state list; and in 2018, MDIFW discontinued statewide aerial surveys (Todd et al. 2019).

This tremendous comeback was due to the collaboration of MDIFW, USFWS, and many private landowners. Protecting nesting birds from habitat loss and disturbance was key to helping this species recover from its exposure to DDT, a pesticide that caused eggs to thin and then crack during incubation.

More recent efforts to bolster and protect sea-run fisheries have further benefited bald eagles. Large numbers of non-breeding adult and subadult eagles congregate in places like the Sebasticook River in central Maine, where 2.8 million river herring were documented passing through the Benton Falls Dam in 2022 (DeSorbo et al. 2015, Maine Department of Marine Resources). These seasonal food sources boost the survival of eagles and ultimately stabilize the population.

### Federal Eagle Act

Even though bald eagles were removed from both federal and state endangered and threatened species lists and their populations are increasing, they still are protected under the Federal Bald and Golden Eagle Protection Act (Eagle Act), which prohibits the take and disturbance of eagles. The Eagle Act is currently undergoing an **update** given the positive trajectory of the population, with the intent to improve the conservation benefit for eagles.

MDIFW continues to work closely with USFWS to collect and manage bald eagle productivity data, apply the **Management Guidelines**, and update the Eagle Act. The Department provides funding, participates in grant applications, reviews permits, and offers expertise and technical support on field research and reporting.



*Subadult bald eagle. Photo by Laura Zamfirescu.*

### Movement Studies

In recent years, MDIFW supported and participated in multiple research efforts focused on eagle movements. Documenting the movement patterns of Maine's bald eagles helps us to understand and limit risks to eagles. To date, several studies identified areas of notable importance to eagles (e.g., aggregation areas). Such information is critical to informing broader conservation and management decisions and promoting responsible land management practices.

Using tools such as field-readable colored leg bands (**Figure 1**) and tracking devices, wildlife managers can learn a lot about Maine bald eagles' longevity and habits. Observations of eagles with leg bands are reported to MDIFW and partners regularly. The color bands uniquely identify individuals with an alphanumeric code and can be read from a distance with a spotting scope or digital camera. Silver USGS leg bands are also placed on the bird and contain a unique ID; however, this ID can typically only be read if the eagle is in hand.



Figure 1. A red alphanumeric band (left) and USGS band (right) from an adult bald eagle recaptured during a research study in Maine. Photo by Blake Massey.

“Over 950 Maine bald eagles – mostly nestlings – have been banded since 2001 as a part of research and wildlife rehabilitation efforts. Of those, nearly 300 have been re-observed – some up to 15 times!” [C. DeSorbo, personal communication, November 2, 2022]

We have gained some fascinating insights thanks to several collaborative research projects wherein transmitters were placed on fledgling and resident adult bald eagles (DeSorbo et al. 2015, DeSorbo et al. 2020, DeSorbo et al. 2021, Massey in prep). Specifically, we’ve learned that certain areas are especially important to eagles during different times of the year. We’ve characterized various movement patterns and home ranges (where the eagle spends its time) of both adult and subadult (< 5 years of age) bald eagles during breeding and non-breeding seasons, and have learned, for example, that subadult eagles are likely to wander widely throughout Maine and New England throughout their first few years of life until they eventually establish their territories. Meanwhile, adult eagles may remain in the vicinity of their nesting territory year-round depending on a variety of factors (for example, they’re likely to stay throughout the winter months unless food scarcity forces them to relocate or migrate).

Studies tracking bald eagle fledglings reveal that nestlings raised in Maine predominantly use habitats throughout Maine, New Hampshire, and New Brunswick; however, individuals can travel as far west as Lake Erie, as far south as the upper reaches of Chesapeake Bay, as far north as central Quebec east of Hudson Bay, and as far east as the Churchill River region of Newfoundland and Labrador (DeSorbo et al. 2020). This research shows that the range of these young Maine eagles contracts and shifts southward during the winter, but that many areas are important year-round, particularly portions of major rivers such as the Penobscot, Androscoggin, and Kennebec Rivers in Maine and the Connecticut River between New Hampshire and Vermont.

One research project, initiated in 2015, revealed which factors drive habitat use around nest sites at the landscape scale (Massey in prep). This study involves capturing resident adult eagles and monitoring their movements using GPS transmitters. Using the tracking data, the researchers built computer models that predict eagle habitat preferences at different scales (**Figure 2**). The GPS location data is matched with remote-sensed GIS data to identify important environment variables and flight paths around nests. Results are incorporated into an individual-based movement model that represents individual eagles in a realistic environment.

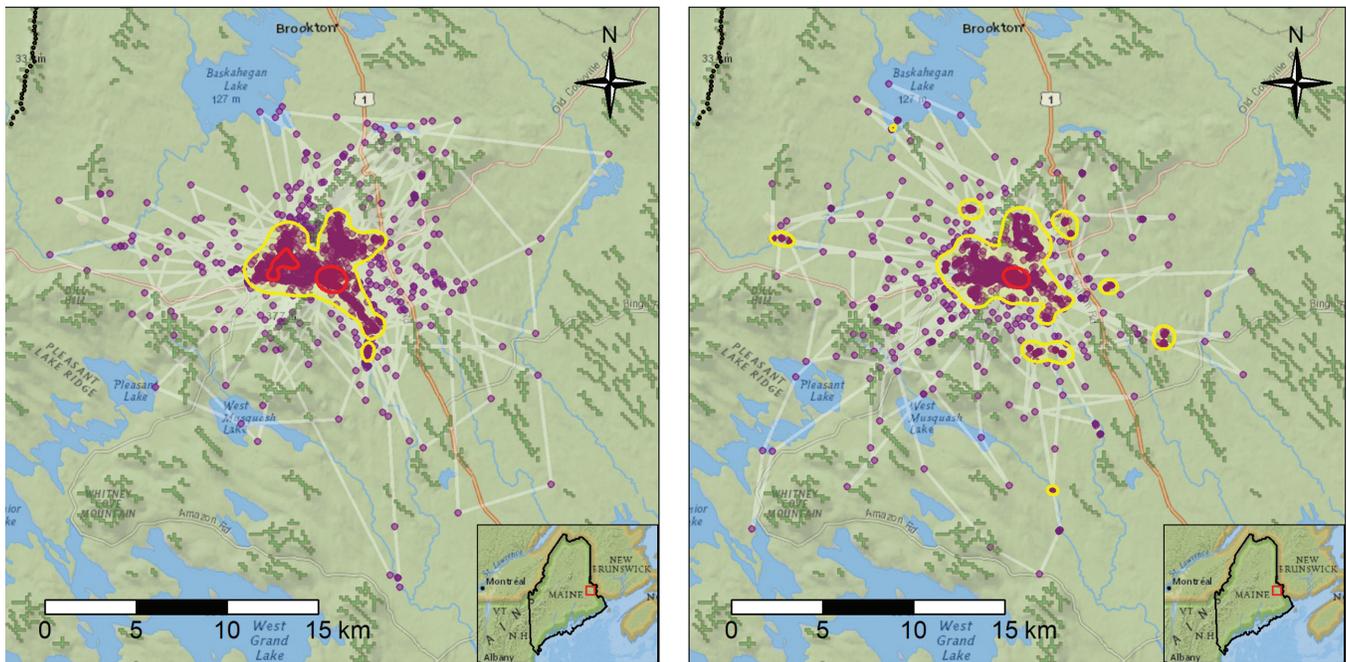


Figure 2. Example results from the individual-based model comparing actual movement data from GPS transmitters on a bald eagle at East Musquash Lake in 2016 (left map) to simulated eagle movements for the same location (right map). Purple dots represent point locations and white lines are interpolated movement paths. Yellow and red lines represent 95% and 50% habitat utilization areas, respectively (i.e., areas of high use).

Using behavioral, movement, and habitat-selection rules, the model can simulate each eagle moving around its territory. These simulations estimate habitat use, including important perching areas, flight corridors, and spatial distributions of territorial bald eagles.

The model can also simulate eagle movement patterns across existing landscapes and under various land use change scenarios. For example, eagle movements around a nest could be estimated and help guide landscape planning and minimize adverse effects on nesting bald eagles.

### Sources of Mortality

Although Maine’s bald eagle population is increasing, wildlife managers still monitor sources and incidences of mortality. Vehicle collisions and territorial fights are relatively common sources of mortality, while line collisions and electrocutions occur more sporadically. Another source of annual mortality for bald eagles in Maine and neighboring states is lead poisoning, which several recent studies have found leads to slower growth and lower resilience in U.S. bald eagle populations (Hanley et al. 2022, Slabe et al. 2022).

Bald eagles are exposed to lead when they inadvertently consume lead ammunition fragments in carcass remnants left on the landscape. When an animal is shot with a lead bullet, a third or more of the bullet’s total weight is fragmented into hundreds of tiny pieces upon impact, dispersing internally as far as 18 inches from the pathway of the bullet. This happens even if the bullet passes through the intended target. Some of these lead fragments are so small that they are not visible to the naked eye but are detectable in x-rays. When eagles consume lead, it doesn’t take much to make them sick. A piece the size of a grain of rice is toxic and often lethal. Because bald eagles are among the most valuable bioindicators of environmental contaminants, MDIFW is working with several research partners to measure concentrations of lead and other contaminants such as mercury in Maine’s bald eagle population.

Another developing source of mortality for eagles as of January 2022 is the highly pathogenic form of avian influenza (HPAI), or bird flu. HPAI was last detected in wild birds in the U.S. in 2016. Migratory waterfowl can carry and spread this virus without any symptoms, but raptors and domestic birds such as chickens are severely affected and quickly die. Humans are very rarely susceptible to HPAI and only one human case was reported in the U.S. this year. Still, MDIFW is adjusting bird handling procedures associated with research and working closely with partners such as the **Maine Department of Agriculture, Conservation, and Forestry** and **U.S. Department of Agriculture Wildlife Services** to understand the status of the virus in Maine and educate the public.

We are fortunate in Maine to avoid many eagle deaths thanks to the care and expertise of wildlife rehabilitators at places such as Avian Haven and the Center for Wildlife. Avian Haven has admitted 449 eagles since 2001 and released 170 (D. Winn, personal communication, 4 November 2022). Their efforts continue to make a positive difference for eagles.

#### WHAT CAN YOU DO TO HELP MAINE'S BALD EAGLES?

- Protect sea-run fisheries. Learn more about the Sebasticook River [here](#) and [here](#).
- Share the benefits of using nonlead ammunition. Learn more [here](#) and [here](#).
- Avoid leaving carcasses harvested with lead ammunition on the landscape.
- Report nest locations with date, photos, and # of eaglets to [erynn.call@maine.gov](mailto:erynn.call@maine.gov).
- Report injured or sick eagles to a local **wildlife rehabilitator**, **MDIFW warden**, or **biologist** (dead eagles can be reported to MDIFW).
- **Support wildlife conservation in Maine** through your donations.
- Learn more about **Maine's bald eagles**.

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Todd, C., T. Schaeffer, K. Marden, A. Meehan, and M. Caron. Maine's 2018 Survey of Nesting Bald Eagles: Evaluating the Health and Conservation Needs of a Recovered Endangered Species. Maine Department of Inland Fisheries and Wildlife, Bangor, Maine. 39 pp.

## Maine Partners with other States and Canadian Provinces on Two Atlantic Flyway Duck Research Projects

Kelsey Sullivan, Game Bird Specialist and Brittany Currier, Satellite Unit Project Field Leader



*Left to right, top: Callie Knudson (Unity College) and Connor White (MDIFW Assistant Regional Biologist, Enfield). Left to right, bottom - Ilsa Griebel (University of Saskatchewan) and Steve Dunham (Regional Biologist, Jonesboro) work on deploying units on mallards and American black ducks at a rocket net capture site in Bucksport, January 19, 2022.*

Two large-scale Atlantic Flyway satellite transmitter studies were initiated in the last two years to study the migration ecology and demographics of mallards and American black ducks (black ducks). These studies will give us a better understanding of the two species' breeding effort and habitat use and will inform our population estimates and harvest strategies.

Studying a species' survival and the factors that influence its productivity allows for researchers to estimate population sizes. However, with migratory birds, it's challenging to understand which factors contribute to population dynamics (i.e., low productivity or survival) given that specific individuals are difficult to follow throughout the year. Global Positioning System (GPS) and tri-axial acceleration (ACC) tracking devices help to fill this gap. GPS information provides the location of individuals and ACC devices collect spatial data and record movement in three dimensions.

In the winter of 2022, biologists captured mallards and black ducks using walk-in traps and rocket nets, then fitted them with individually numbered metal leg bands with contact information for reporting future encounters. We also equipped some females with GPS-ACC backpack tracking devices. These lightweight, solar-rechargeable devices record 12 GPS fixes and 240 ACC fixes per day. Analyzing these data will give us a better understanding of nesting attempts and success, brood rearing, mortality, and habitat use (e.g., for breeding, roosting, or foraging).

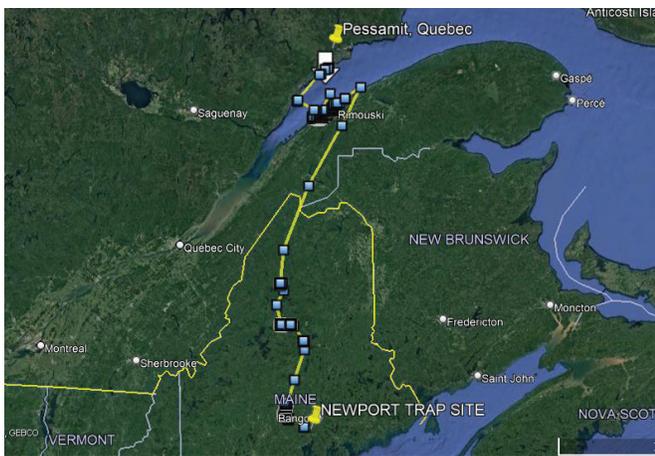
In all, Atlantic Flyway states and Canadian provinces deployed 270 satellite units on female mallards (23 from Maine) and 150 on female black ducks (9 from Maine). All of the Maine mallards that were determined to have nested remained in Maine. Two of the Maine black ducks settled in Canada — one in New Brunswick and one in Quebec. When these two ducks return to areas of cell coverage, data from the breeding season will be uploaded to satellites and available for analysis.

The mallard project was developed by New York and Pennsylvania out of a need to understand recent mallard population declines in the Northeastern U.S., contrasted with the stable mallard population trend in Eastern Canada. The black duck project is funded by the Black Duck Joint Venture and supported by state and provincial partners who deploy and monitor the transmitters. Coordination and data analysis for these projects are being led by graduate students at the State University of New York at Brockport and the University of Saskatchewan. This is a great opportunity for us to learn more about the breeding ecology, migration, and habitat use of these two species across their range as well as mallards and black ducks that winter in Maine. This winter, the Department plans to deploy 33 mallard transmitters and 30 black duck transmitters to contribute to the larger project.



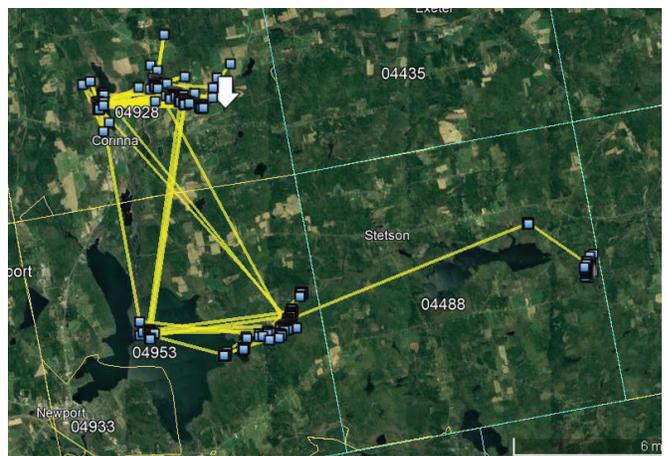
Satellite transmitter deployed on an American black duck female - Verona Island capture site, January 16, 2022.

**AMERICAN BLACK DUCK UNIT 215017 MIGRATORY ROUTE WINTER TO SPRING 2022**



Unit 215017 – American black duck female captured in Newport, Maine on February 1, 2022; migrated to Pessamit, Quebec for the breeding season.

**MALLARD UNIT 215488 FALL 2022 MOVEMENTS**



Unit 215488 – Mallard female captured in Newport, Maine on February 1, 2022, remained in Maine for the breeding season and is now moving between Stetson, Newport, and Corinna.



2021-2022

RESEARCH + MANAGEMENT REPORT

Game Species Conservation and Management



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## 2021-22 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

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- » Habitat Conservation & Management
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- » Non-Game Species Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management
- » Regional Wildlife Management

Compiled and edited by  
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# 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



**Craig McLaughlin, Ph.D.**  
**Wildlife Research and Assessment Section Supervisor/Acting Mammal Group Leader**

Craig supervises the Section and supports the Mammal Group’s conservation and management programs. As one of the Department’s primary liaisons with research programs at the University of Maine and other regional universities, he facilitates partnerships that strengthen the Department’s research programs. These programs provide science to inform management that conserves both common and uncommon species statewide.



**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.



**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 led research on Adult Cow and Calf Survival (2014-2020) with cooperators and counterparts in NH/VT. He is continuing research on moose and winter ticks thru the implementation of an Adaptive Hunt Unit in north-western Maine as well as continued collaboration with northeastern wildlife agencies and universities to assess moose populations in Maine as well as the northeast. This work will continue to inform the moose management system to address priorities described in the Department’s 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***

Shevenell oversees the management of furbearers, work that involves monitoring populations, developing a new Furbearer Management Plan, conducting research, recommending trapping regulations, and serving as the departmental spokesperson for furbearers. Shevenell is participating in several research projects, including a study to determine the most effective way to monitor Maine’s marten and fisher populations.

**MAMMAL GROUP CONTRACT WORKERS AND VOLUNTEERS**

**Deer Project**

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- Wendell Harvey
- Sue Kelly
- Holly Bates
- Gerry Lavigne
- Eldon McLean
- Paul Campbell
- Tim Lentz
- Braden Richard
- Jackie Morton
- Jacob Seehusen
- Bailey Clock
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- Jake Feener
- Zack Gadow
- Colleen Kostovick
- Ethan Lamb
- Evan Whidden
- Carl Tugend

**Furbearers**

- Bryn Evans
- Jacob Seehusen
- Tegwin Taylor
- Sara Beck
- Valerie Wright
- Maggie Hayes
- Tessa Baillargeon

# WHITE-TAILED DEER

Nathan Bieber



Few species conjure up images of wilderness while simultaneously bringing wilderness close to home like the white-tailed deer. This adaptable creature's range stretches across all 48 lower U.S. states, north to the Yukon Territory, and south to Peru. Whitetails inhabit all corners of Maine, so whether you are an avid wildlife watcher or photographer, big woods tracker, or urban archer, there's an experience with Maine's whitetails waiting for you.

# 2021 Harvest Information

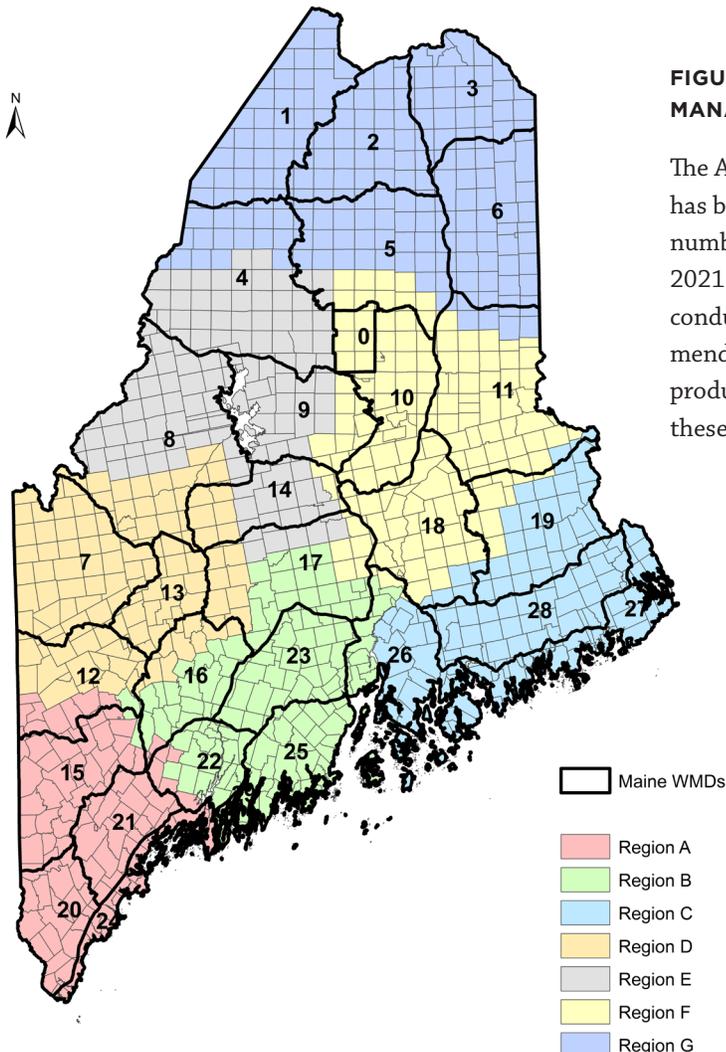
## SEASON DATES AND STRUCTURE

MDIFW manages deer primarily by issuing any-deer permits and establishing regulated hunting seasons, including the expanded archery season, the regular archery and crossbow season, Youth Day, Residents' Day, the regular firearms season, and two muzzleloader seasons. In 2021, there were 79 hunting days for Maine deer hunters to pursue whitetails.

## PERMIT ALLOCATION

MDIFW develops any-deer permit (ADP) recommendations for each Wildlife Management District (WMD; **Figure 1**) on an annual basis, relying on a wide variety of data sources such as harvest data, biological data collected from harvested deer, winter severity data, and observation data from citizen scientists. A hunter with an ADP may take an antlered deer anywhere in the state or an antlerless deer in a designated area.

In 2021, we distributed 153,910 ADPs among 26 WMDs and two deer management subunits to meet a statewide doe harvest objective of 15,187. Because many ADP holders choose not to harvest a doe or not to hunt, MDIFW applies an expansion factor to each WMD to ensure we issue enough ADPs to meet each district's doe removal goals. In other words, we issue more permits than the number of does we expect will be harvested. An expansion factor of 10 indicates that MDIFW estimates it will need to issue 10 permits for every adult doe harvested. In 2021, applied expansion factors ranged by WMD from 0.5 to 15. We distribute permits by lottery, and there were 91,460 permit applicants in 2021. In districts with more permits available than applicants, bonus permits may be distributed, allowing hunters to harvest an extra antlerless deer in a designated area.



**FIGURE 1. MDIFW REGIONAL AND WILDLIFE MANAGEMENT DISTRICT (WMD) BOUNDARIES.**

The ADP system was developed in 1986. Since then, it has become increasingly difficult to harvest the desired number of does each year through ADPs alone. Throughout 2021, MDIFW worked with legislators and stakeholders to conduct an ADP system review and develop a list of recommended changes that would improve the system's ability to produce desired doe harvest levels. We expect to implement these changes for the 2022 deer hunting seasons.



Maine’s deer hunters registered 38,947 deer during the 2021 hunting seasons (Tables 1, 2). This was 5,788 more deer than 2020 — a 17.5% increase. Roughly 85% of that harvest occurred during the regular firearms season (including Opening Saturday).

**HARVEST STATISTICS**

The statewide antlered (adult) buck harvest totaled 21,697, a 13.3% increase from 2020 (Table 1). The five WMDs producing the most bucks per square mile in 2021 were (in descending order) districts 22, 21, 24, 23, and 25. Overall, hunters registered 17,250 antlerless deer, 3,313 of which were male fawns, 2,871 of which were female fawns, and 11,066 of which were adult (yearling and older) does. The adult doe harvest was below the Department’s objective of 15,187, following a decade-long trend of adult doe harvests averaging ~23% below objective.



2021

**TABLE 1. MAINE DEER HARVEST IN 2021 BY WILDLIFE MANAGEMENT DISTRICT (WMD).**

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	0	0	0	0	71	0	0	5	5	0
2	63	7	3	2	12	75	11	19	5	6	1
3	133	12	10	2	24	157	9	18	15	18	1
4	97	0	0	0	0	97	0	0	5	5	0
5	73	2	0	0	2	75	3	3	5	5	0
6	307	73	23	17	113	420	24	37	22	29	5
7	417	58	23	13	94	511	14	23	30	37	4
8	329	20	17	6	43	372	6	13	17	19	1
9	74	4	3	2	9	83	5	12	8	9	0
10	73	6	3	1	10	83	8	14	8	9	1
11	297	27	16	6	49	346	9	16	18	21	2
12	590	56	36	12	104	694	9	18	64	76	6
13	516	93	35	21	149	665	18	29	92	118	17
14	250	32	17	8	57	307	13	23	34	42	4
15	1,596	923	253	226	1,402	2,998	58	88	171	321	99
16	1,594	822	260	222	1,304	2,898	52	82	207	375	106
17	2,438	1,098	325	268	1,691	4,129	45	69	182	309	82
18	412	60	31	16	107	519	15	26	33	42	5
19	188	14	8	3	25	213	7	13	16	18	1
20	1,356	714	190	167	1,071	2,427	53	79	234	418	123
21	1,514	1,219	392	377	1,988	3,502	81	131	315	728	253
22	1,496	1,246	410	363	2,019	3,515	83	135	345	811	288
23	2,228	1,655	459	414	2,528	4,756	74	113	285	609	212
24	653	564	146	152	862	1,515	86	132	298	691	257
25	1,836	1,460	373	375	2,208	4,044	80	120	262	576	208
26	1,650	508	154	108	770	2,420	31	47	183	269	56
27	709	85	42	19	146	855	12	21	97	117	12
28	378	30	18	6	54	432	8	14	35	40	3
29	358	278	66	65	409	767	78	114	247	528	191
UNKNOWN	1	0	0	0	0	1	0	0	1	1	0
STATEWIDE	21,697	11,066	3,313	2,871	17,250	38,947	51	80	75	135	38



TABLE 2. MAINE DEER HARVEST IN 2021 BY HUNTING SEASON.

SEASON	ADULT		FAWN		TOTAL DEER	TOTAL ANTLERLESS DEER	PERCENT BY SEASON AND WEEK		
	BUCK	DOE	BUCK	DOE			TOTAL	ADULT BUCK	ANTLERLESS
ARCHERY	1,138	1,322	311	353	3,124	1,986	8	5	11
Expanded	632	701	168	196	1,697	1,065	4	3	6
Oct	506	621	143	157	1,427	921	4	2	5
YOUTH DAY	380	421	122	120	1,043	663	3	2	4
REGULAR FIREARMS	19,435	8,744	2,734	2,264	33,177	13,742	85	90	80
Opening Sat	1,568	935	297	251	3,051	1,483	8	7	9
Nov 2 - 7	5,332	2,942	887	762	9,923	4,591	25	25	27
Nov 9 - 14	4,160	1,483	501	376	6,520	2,360	17	19	14
Nov 16 - 21	4,544	1,447	493	359	6,843	2,299	17	21	13
Nov 23 - 28	3,831	1,937	556	516	6,840	3,009	18	18	17
MUZZLELOADER	730	577	151	137	1,595	865	4	3	5
Nov 30 - Dec 5	395	247	63	57	762	367	2	2	2
Dec 7 - 12	335	330	88	80	833	498	2	1	3
UNKNOWN	5	3	0	0	8	3	0	0	0
TOTAL	21,688	11,067	3,318	2,874	38,947	17,259	100	100	100

Corrections applied for errors in sex-age. Estimated error rates are applied independently for each table, so estimates will vary. 8 records with no season recorded.





### HUNTER PARTICIPATION

Each year, MDIFW sends an online deer hunter effort survey to a randomly selected group of Maine deer hunters to determine how much time they are spending hunting during the regular firearms deer season. In 2021, Maine deer hunters spent an average of 7.2 days and 4.9 hours per day hunting deer during this season. This means that the average hunter spent ~35 hours in the field pursuing deer during the firearms season, which was close to the 34 hours they spent in 2020. Distribution of effort followed a typical pattern, with high hunting effort resulting in high buck harvest (Figure 2). We use effort data to define one parameter in a sex-age-kill (SAK) model to estimate deer density and abundance. These data bring valuable context to discussions about deer populations and permit recommendations.

### This year’s survey included the following additional questions:

*“Did you observe any bucks mounting (breeding) does during the regular firearms season? If so, when?”*

We added this question to see if the deer hunter effort survey could provide a small amount of additional data about conception dates. Only 17 of the 718 hunters who answered the question had witnessed breeding behavior, with most of it occurring in the third week of the regular firearms season. This question will be continued in the future.

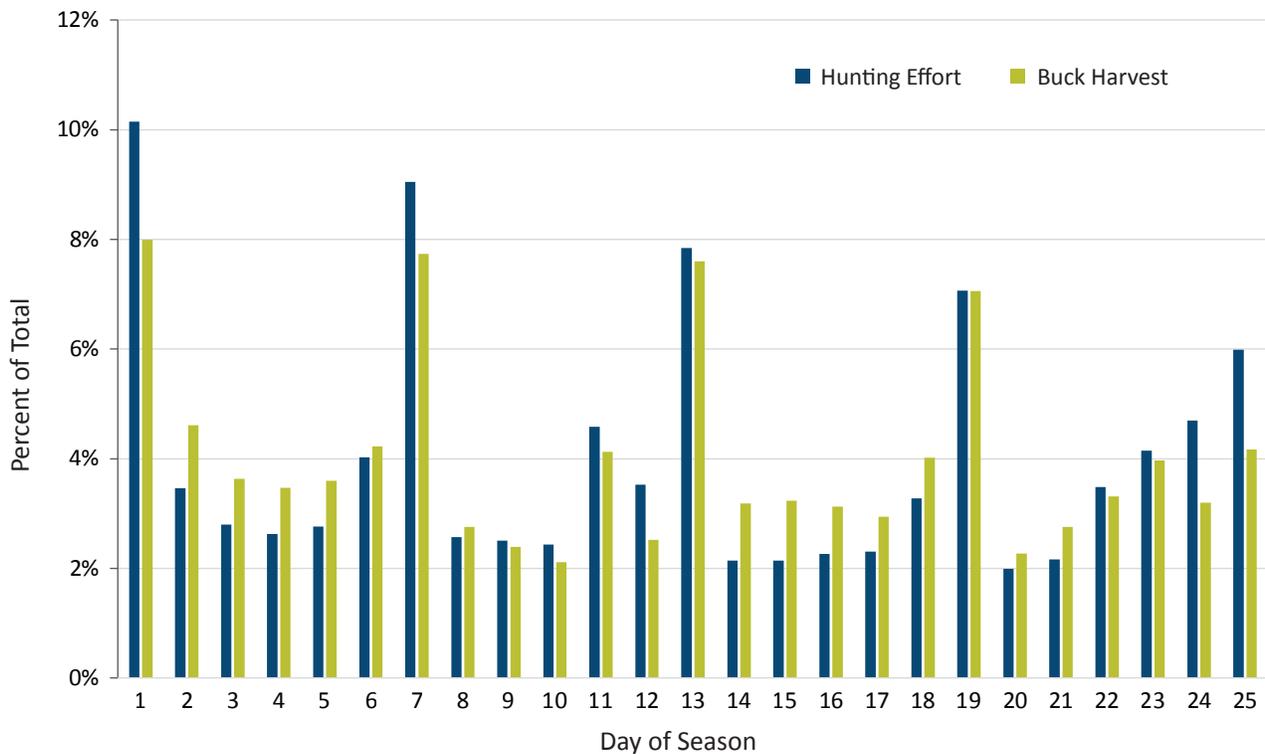
*“What best describes where you stay and how you travel to your hunting sites most often during the regular firearms season?”*

Roughly 50% of respondents said that they travel to hunt on land owned by somebody else and return home at the end of the day. Nearly 25% said they hunt on the same property where they live, 12% stay at a “camp” and either hunt there or travel to their hunting location from there, and 8% travel to hunt on land that they own elsewhere and return home at the end of the day. The rest of respondents voted “other.”

*“Did you use any of the following to hunt deer during the regular firearms season? Check all that apply.”*

Roughly 76% of hunters used deer calls, 50% used a scent eliminating product, 44% used a portable deer stand, 29% used a natural deer urine lure, 16% used a synthetic deer lure, 3% used a natural lure such as a tarsal gland, and less than 1% used a deer decoy.

**2021** FIGURE 2. MAINE DEER HUNTER EFFORT AND BUCK HARVEST DURING THE 2021 REGULAR FIREARMS DEER HUNTING SEASON.



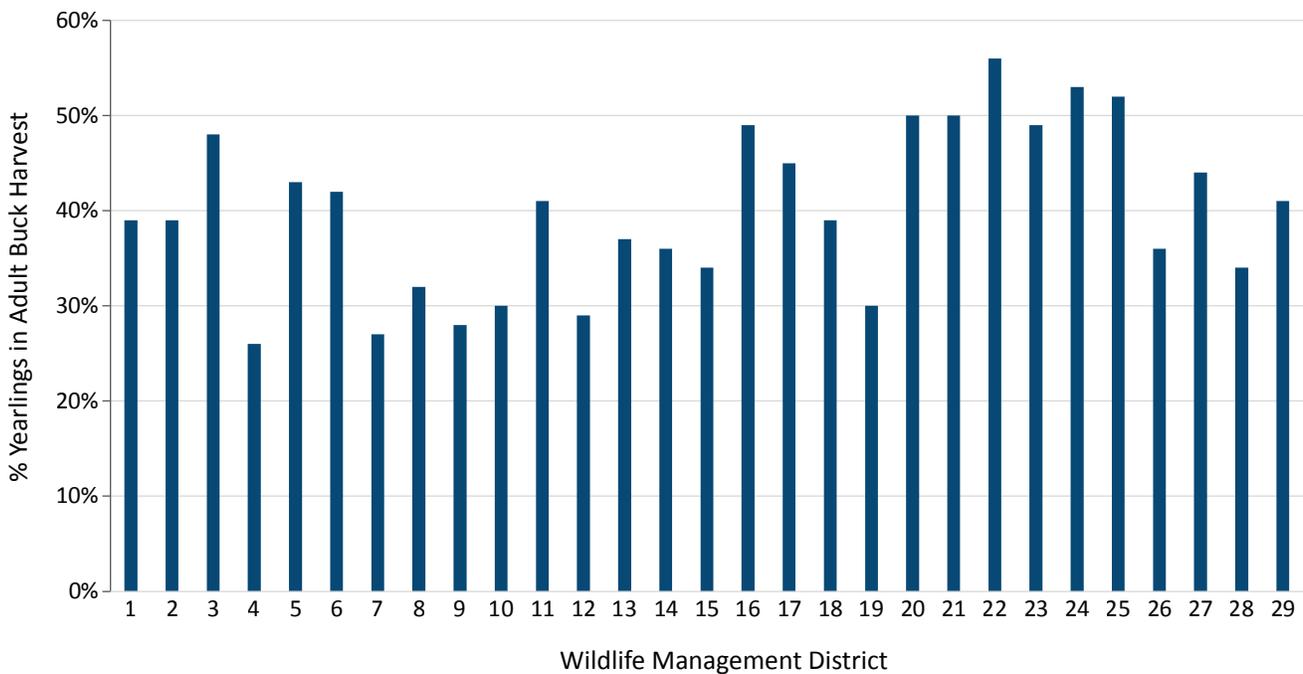
## Biological Data

### AGE AND SEX STRUCTURE

Age and sex structure data provide insight into mortality rates and adult sex ratios, and they are among the most important data we collect each year. To gather age structure data, trained staff examine deer harvested during the regular firearms season to differentiate between yearlings and “adults” (2+ years old). MDIFW also collects a sample of incisor teeth each year at the Regional scale (**Figure 1**). These teeth are sent to a laboratory for cementum annuli analysis, which provides insight into advanced age structure. This data may be viewed at the end of the annual deer age report on our website [maine.gov/ifw/hunting-trapping/hunting/harvest-information.html](http://maine.gov/ifw/hunting-trapping/hunting/harvest-information.html).

Monitoring yearling frequencies gives us a way to estimate adult sex ratios (number of adult does per adult buck; **Figure 4**). The yearling frequencies that we use in management decision making are 7-year running averages (**Figure 3**). This ensures that values track with population changes over time while avoiding high single-year variability from stochastic events such as very severe or very mild winters.

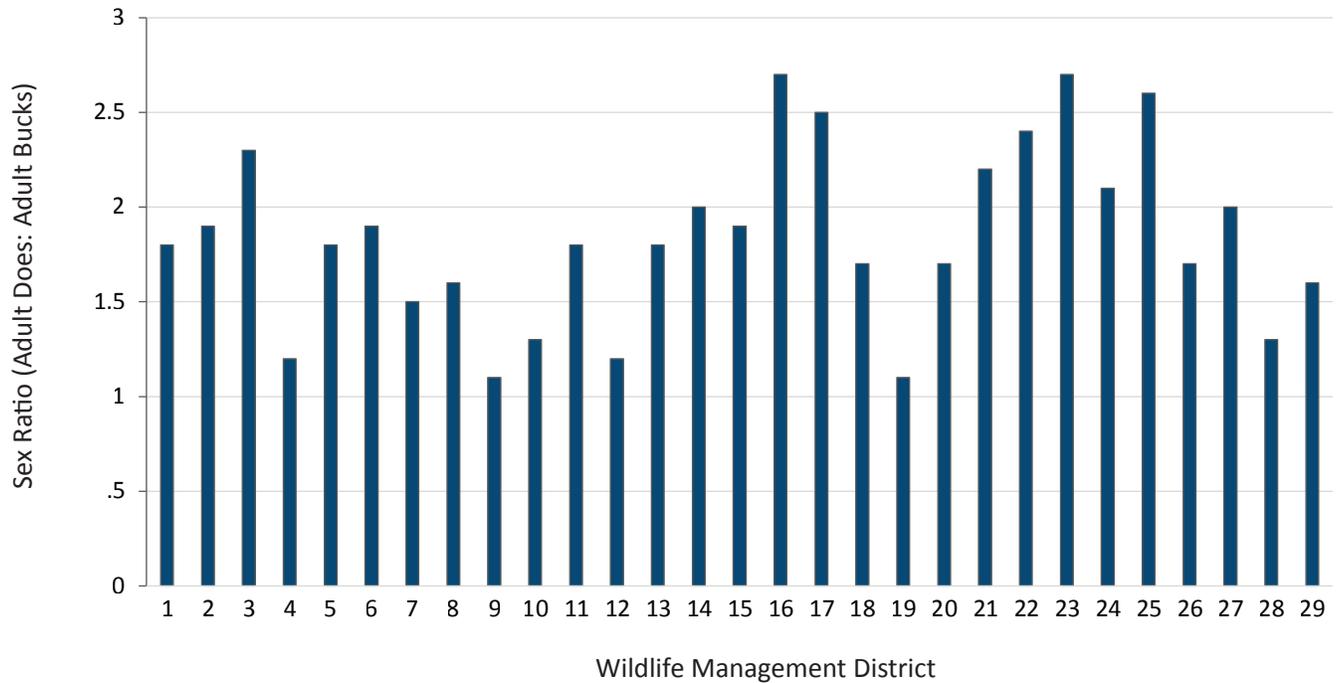
 2021 **FIGURE 3. YEARLING MALE FREQUENCIES USED IN MANAGEMENT DECISION MAKING IN MAINE, 2021.**





# ♀ 2021

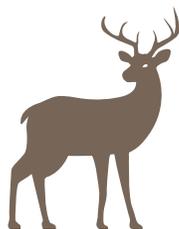
FIGURE 4. ESTIMATED ADULT SEX RATIOS (ADULT DOES PER ADULT BUCK) IN MAINE, 2021.



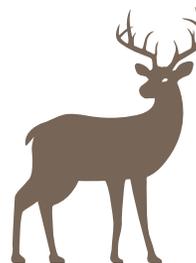
### BUCK AGE STRUCTURE MANAGEMENT

MDIFW prefers that all hunters be able to choose to take the deer that best fits their hunting values and the hunting experience that they are looking for; we don't want to restrict someone's ability to take the buck they want. We recognize that a number of Maine's deer hunters want to see more older bucks, so we have begun to provide information to hunters about the benefits of voluntarily passing on young bucks.

While a Maine buck reaches its peak growth around years 6 or 7, it unlocks a lot of its growth potential between its first and second years. Our average yearling buck sports three to four antler points and has a dressed weight of 120-125 pounds. By Year Two, he has six or seven points and a dressed weight of 145-150 pounds. If managing for older, bigger bucks is appealing to you, consider allowing a young buck to pass by and grow for another year.



**YEAR 1**  
3-4 Antler Points  
120-125 Pounds



**YEAR 2**  
6-7 Antler Points  
145-150 Pounds

### DEER WEIGHTS AND ANTLER CHARACTERISTICS

During annual biological data collection, MDIFW collects dressed weight and antler characteristic data. We consider yearling antler beam diameters (YABD) as an index, which tells us the deer population level relative to carrying capacity. Higher YABD measurements suggest a higher plane of nutrition and a population well below the land's carrying capacity, while lower YABD measurements suggest a lower plane of nutrition and a population closer to the land's carrying capacity. YABD measurements between 15.5 and 16.8mm are considered to be at-target. YABD values used in management decision making for 2021 ranged by WMD from 16.5 to 18.2.

The average adult Maine buck sported 7.0 points in 2021 with little variation north-to-south. The average yearling buck had 3.5 points. YABDs averaged 18.1 mm statewide with little variation north-to-south, suggesting that populations are generally below the carrying capacity of the land.

The average dressed weight for a Maine adult buck in 2021 was 154 pounds. Average weights varied by WMD north-to-south, with bucks in the northern WMDs averaging around 175 pounds and bucks in southern Maine closer to 150 pounds, though this is influenced both by latitude and age. Yearling bucks averaged 118 pounds statewide. The average dressed weight of an adult doe was 112 pounds statewide, and the average for a yearling doe was 98 pounds. Buck fawns dressed at 66 pounds on average and doe fawns 57 pounds.

### RECRUITMENT

To better understand recruitment trends, a citizen science project called "Maine Deer Spy" was initiated in 2020 to collect deer observation data from Mainers with a particular interest in doe-fawn group observations. In 2021, 2,437 observations were collected from 790 different observers between August 1 and September 30. After quality control measures, which included removing data outside of the observation range, removing outliers and incorrectly entered values, and thinning data by observers, the dataset consisted of 1,968 deer group observations. Observations of single does and their fawns are particularly valuable as they provide the highest-confidence data of the number of fawns with each doe. There were 632 such observations in 2021, and the average number of fawns per doe was 1.59. Among all observed does, 53.8% had fawns with them.

After two years of data collection through Maine Deer Spy, we've been extremely pleased with the amount of interest and participation, and we plan to continue this effort into the future. As more years of data are collected, we will be able to provide additional summary statistics and trend data.



*This Maine doe has successfully raised four fawns in each of the last two years. Photos submitted to Maine Deer Spy project by an anonymous photographer.*

## Winter Severity Monitoring

### WINTER SEVERITY INDEX

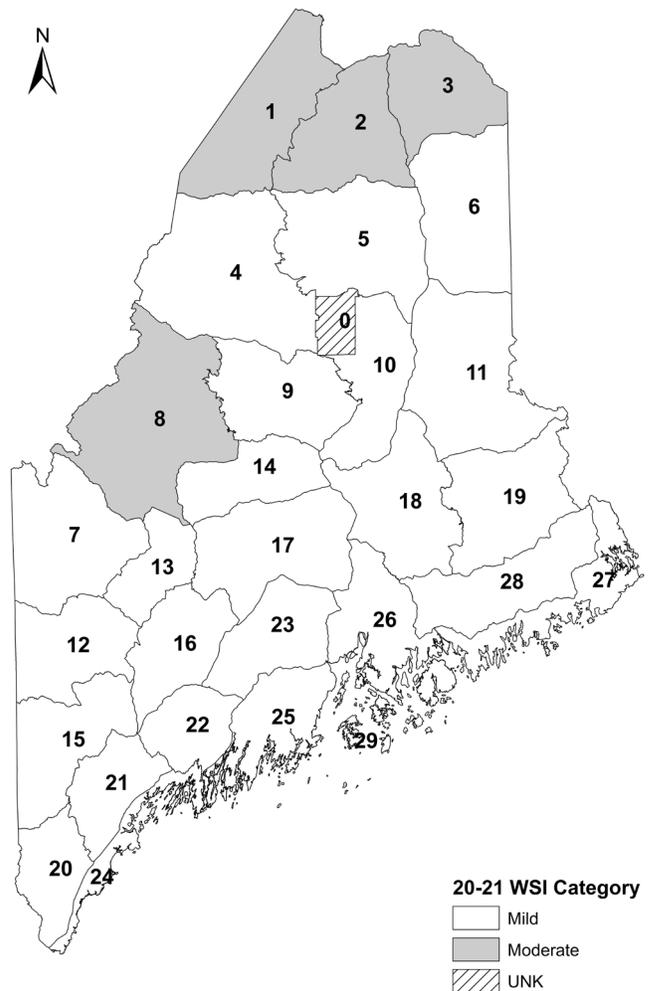
MDIFW monitors winter severity at 26 stations statewide, collecting data on snow depths, deer sinking depths, and temperature. We use these data to calculate a winter severity index (WSI) value, which we use to estimate deer winter mortality rates. These estimates play an important role in developing permit recommendations, particularly in northern Maine. The winter of 2020-2021 was a relatively mild one statewide, with WSI values below the long-term mean in all 29 WMDs. In terms of WSI rating, four WMDs experienced a “moderate” severity winter and the other 25 experienced a “mild” severity winter (Figure 5).

### DEER COLLARING PROJECT

Since 2015, MDIFW has been capturing and GPS-collaring white-tailed deer in four study sites: WMD 1 near Allagash, WMD 5 near the Scraggly Lake Maine Public Reserved Land, WMD 6 throughout, and WMD 17 throughout. We created this study to improve our understanding of how winter severity impacts deer winter mortality rates. The results will aid MDIFW in decision making and permit allocation processes each year. Additional data on cause-specific mortality are collected as well.

Through 2021, we have collared 268 unique deer: 61 in WMD 1, 39 in WMD 5, 99 in WMD 6, and 69 in WMD 17. The winter of 2020-21 was the seventh and final capture year. The batteries on our collars typically last for 2-2.5 years, so we expect data collection to be completed or near enough to completion for final data analysis by 2023.

**FIGURE 5. WINTER SEVERITY INDEX (WSI) RATINGS BY WILDLIFE MANAGEMENT DISTRICT (WMD) IN MAINE, 2021.**



## Health and Diseases

### CHRONIC WASTING DISEASE

Chronic wasting disease (CWD) is an always-fatal brain disease that impacts cervids such as white-tailed deer, mule deer, caribou, moose, and elk. CWD has been found in wild deer populations in 29 U.S. states and three 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 plants can uptake the disease agent and subsequently become a potential disease vector. The nearest state or province where CWD is found in wild cervids is Pennsylvania. 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.

MDIFW has monitored white-tailed deer for CWD since 1999, during which time we have screened over 12,750 wild deer. In 2021, we collected 497 samples for lab testing (494 from white-tailed deer and 3 from moose or captive cervids), and all samples tested negative. 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 has drafted a response plan for CWD, which outlines steps and protocols to follow if CWD is detected in an adjacent jurisdiction or in Maine.

*There are many ways that you can help prevent the introduction of CWD into Maine or limit its spread if found:*

**Prevent the spread:** If you feed deer, keep your feeding sites small and spread out on the landscape, and rotate sites periodically. Consider using synthetic deer lures instead of natural deer urine lures. Know and follow the state laws and rules around carcass processing and movement.

**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, excessive drooling or urinating, loss of coordination, 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.

### PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

PFAS are human-made chemicals that are resistant to heat, water, and oil. For decades, PFAS have been used in industrial applications and consumer products such as carpeting, waterproof clothing, upholstery, food wrappings, personal care products, fire-fighting foams, and metal plating. Long-term human exposure to PFAS chemicals may negatively impact cholesterol levels, liver enzyme chemistry, and immune response, and may lead to higher incidences of certain cancers.

In November 2021, MDIFW and the Maine Center for Disease Control and Prevention (MECDC) issued a “Do Not Eat” advisory for deer taken in the greater Fairfield, Maine area. A “Do Not Eat” advisory is a recommendation to not eat game harvested within a specified area issued in response to a possible health concern. The “Do Not Eat” advisory was issued due to high levels of a PFAS chemical known as PFOS (perfluorooctane sulfonic acid) found in five of eight deer collected in Fairfield close to fields known to have high PFOS soil levels and high PFOS surface water levels. PFOS levels in meat were approximately 40 ng/g and were similar in a fawn, yearling, and adult animal. These levels of PFOS in meat were high enough to warrant a recommendation to eat less than two to three meals per year.

Additional sampling will be conducted on deer and other species in the Fairfield area and other areas of the state to inform new advisories and refine those that already exist.



*A group of three Maine piebald deer in 2021. Photo by Alexander Wall.*

### DEER HEALTH NOTES

MDIFW collects reports of deer exhibiting signs of illness or injury as well as other unusual characteristics. If you see deer with conditions such as noteworthy hair loss, abnormal growths, behavior, or coloration, or injuries, please report these sightings and the town of observation to your nearest MDIFW regional office. Try to take and provide photos. While most cases require no management response, these reports are valuable for documenting trends and creating case histories.

# MOOSE

Lee Kantar



## Season Dates

### 2021

---

#### WMDs 1-6

Sep 27-Oct 2

Oct 11-16

Oct 25-Oct 30

#### WMDs 4a

Oct 18-24

Oct 25-Oct 30

Nov 1-6

#### WMDs 15-16

Nov 2-Nov 28

### 2020

---

#### WMDs 1-6

Sep 28-Oct 3

Oct 12-17

Oct 26-Oct 31

#### WMDs 15-16

Nov 2-Nov 27

## Statistics

### 2021

---

**2,607 moose  
were registered**

### 2020

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**2,366 moose  
were registered**

## 2021 Moose Harvest

### SEASON DATES AND STRUCTURE

The 2021 season framework allowed moose hunters to hunt for six days in September, October, and/or November.

## Moose Permits and Applicants

### TOTAL MOOSE PERMITS

The annual allocation of moose hunting permits is developed in relation to the Big Game Management Plan (BGMP) for moose. Permit levels changed in eight WMDs from 2020 to 2021, resulting in an increase of 345 permits issued statewide (3,480 total). In WMD 4a, another 550 antlerless permits were allocated for the Adaptive Hunt, bringing the grand total to 4,030. Permit changes reflect the implementation of the BGMP, which increases cow permits in the core range to promote a healthier moose population, opens additional WMDs during the September season, and increases bull hunting opportunity in the northwest portion of the core range.

MDIFW allocates moose hunting permits to qualified applicants through a random computerized lottery and may issue additional permits to prior-year permittees who deferred a year due to illness, military service, or similar situations.

### ANTLERLESS-ONLY PERMITS (AOPS)

In 2021, a total of 1,360 Antlerless Only Permits (AOPs) were allotted to seven WMDs (1-6 and 8, including 4a).

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

### ANY-MOOSE PERMITS (AMPS)

Any-moose Permits (AMPs; Bull, cow or calf) are allocated in 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 2021

2,608 moose were registered in 2021 (Table 1).



# 2021

**TABLE 1. 2021 MAINE MOOSE SEASON REGISTERED KILL BY WILDLIFE MANAGEMENT DISTRICT (WMD), SEASON, AND PERMIT TYPE. THE PERCENTAGE OF HUNTERS SUCCESSFULLY HARVESTING A MOOSE ARE GIVEN BY SEASON FOR EACH WMD.**

2021 Maine moose season registered kill by WMD, season, permit type, and success rates.

WMD	SEASON	PERMIT TYPE	# OF PERMITS	2021 REGISTRATIONS		WMD	SEASON	PERMIT TYPE	# OF PERMITS	2021 REGISTRATIONS		
				KILL	SUCCESS RATE					KILL	SUCCESS RATE	
1	SEP	BOP	225	171	76%	9	OCT	BOP	125	76	61%	
	OCT	BOP	225	123	55%		*WMD Subtotals		125	76	61%	
	2nd OCT	AOP	175	159	91%	10	SEP	BOP	30	24	80%	
	*WMD Subtotals		625	453	72%		OCT	BOP	30	20	67%	
2	SEP	BOP	175	126	72%	*WMD Subtotals		60	44	73%		
	OCT	BOP	175	84	48%	11	SEP	BOP	25	22	88%	
	2nd OCT	AOP	175	137	78%		OCT	BOP	25	12	48%	
	*WMD Subtotals		525	347	66%	*WMD Subtotals		50	34	68%		
3	SEP	BOP	100	71	71%	12	OCT	BOP	25	16	64%	
	OCT	BOP	100	73	73%		*WMD Subtotals		25	16	64%	
	2nd OCT	AOP	125	95	76%	13	OCT	BOP	15	7	47%	
	*WMD Subtotals		325	239	74%		*WMD Subtotals		15	7	47%	
4	SEP	BOP	200	153	77%	14	OCT	BOP	30	19	63%	
	OCT	BOP	200	82	41%		WMD Subtotals		30	19	63%	
	2nd OCT	AOP	100	63	63%	15	NOV	AMP-B		4	NA	
	*WMD Subtotals		500	298	60%		NOV	AMP-C		2	NA	
4a	SEP	AOP	169	96	57%	WMD Subtotals		25	6	24%		
	OCT	AOP	143	84	59%	16	NOV	AMP-B		0	NA	
	2nd OCT	AOP	177	73	41%		NOV	AMP-C		3	NA	
	*WMD Subtotals		489	254	52%	WMD Subtotals		15	3	20%		
5	SEP	BOP	125	106	85%	17	OCT	BOP	10	4	40%	
	OCT	BOP	125	83	66%		WMD Subtotals		10	4	40%	
	2nd OCT	AOP	125	94	75%	18	SEP	BOP	20	14	70%	
	*WMD Subtotals		375	283	75%		OCT	BOP	20	10	50%	
6	SEP	BOP	100	83	83%	*WMD Subtotals		40	24	60%		
	OCT	BOP	100	51	51%	19	SEP	BOP	30	23	77%	
	2nd OCT	AOP	60	48	80%		OCT	BOP	30	15	50%	
	*WMD Subtotals		260	182	70%	*WMD Subtotals		60	38	63%		
7	OCT	BOP	125	75	60%	27/28	SEP	BOP	20	16	80%	
	*WMD Subtotals		125	75	60%		OCT	BOP	20	11	55%	
8	OCT	BOP	200	134	67%	WMD Subtotals		40	27	68%		
	2nd OCT	AOP	50	46	92%	TRADITIONAL WMD TOTALS		3,480	2,355	68%		
								PLUS ADAPTIVE		3,969	2,607	66%

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

AOP = The holder may kill a cow or a calf (male or female); by definition an antlerless moose is a moose without antlers.

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.

## 2021 Bull Harvest

### TOTAL HARVEST, AGE DISTRIBUTION

Among the 1,718 antlered bulls killed during the Sep/Oct 2021 season (totaling 81 less than the 2020 harvest of 1,799), biologists aged 1,363 of them by counting the cementum annuli on a canine 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: 23% (319)
- 3½ years old: 17% (233)
- Mature bulls (aged at 4½ to 15½ years): 54% (735)

### AVERAGE WEIGHT

On average, breeding bulls lose approximately 15% of their body mass during the rut (September to October). In 2021, this translated to a 9% decrease in average dressed weights from the September to October seasons (707 in Sept. vs. 645 in Oct).

### RECORD WEIGHT

The heaviest bull weighed in at 1,038 lbs. field dressed (no digestive tract, heart, lungs, or liver). He was 7½ years old and was killed in WMD 5 during the September season.

### RECORD ANTLER SPREAD

The largest antler spread was 65 inches with 20 legal points.

### ANTLER STATS

Of the antlered bulls, 13% sported cervicorn antlers (antlers without a defined palm), 30% were yearlings, and 11% were mature bulls (>4 years old). The oldest was 12½ years old.

## Antlerless Harvest

### TOTAL HARVEST

The 2021 statewide harvest of adult (yearling and older) cows was 809 (up from 565 in 2020). In addition, 81 calves (48 males and 33 females) were harvested for a total harvest of 890 antlerless moose, including those taken as part of the AMPs issued within the southern zones and the Adaptive Hunt.

### 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 2021, hunters in WMDs 1-6 and 8 removed and brought in 163 sets of moose ovaries for examination by biological staff.

Typically, a cow moose will not become pregnant until 2½ years old. The number of offspring she will produce depends upon her body weight and condition – factors influenced strongly by diseases and parasites such as the winter tick. Of the cow moose examined in 2021, 90% of those older than 2½ years were pregnant.

MDIFW biologists can forecast a cow's reproduction rates (number of calves being born to a cow) by looking at corpora lutea, which are identifiable structures within the ovaries that indicate ovulation and potential pregnancy rates. Overall, there were 0.96 corpora lutea per cow for cows older than 3½ years (maturity).

This is an **increase** from 2020, yet still represents depressed 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 2021, 3,548 residents, 314 nonresidents, and 62 lodge owners won permits to hunt moose. Most nonresidents were successful in their hunt (88% success rate). Out-of-state hunters came from 39 states (as far away as Alaska). The majority (12%) of out-of-state hunters came up from Massachusetts.

Resident success rates were 64% and when combined with the outstanding success by out-of-staters equaled 66%. The higher success rate 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%.

Conditions for September and October were highly variable with September starting out extremely warm; unseasonable warm conditions typically lead to lower success rates.

In 2022, there will be four separate “traditional” moose hunting periods in Maine.

- The September season will run from Sep 26–Oct 1 in WMDs 1-6, 10, 11, 18, 19, and 27/28.
- The October season will run from Oct 10-15 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 Oct 31 through Nov 26. Opening day for Mainers will be on Saturday, Oct 29.
- WMDs 1-6 and 8 will have a cow moose hunt from Oct 24-Oct 29.

Moose hunters who have a permit to hunt WMD 27 or WMD 28 can hunt in either WMD.

In addition, there will be 3 additional moose hunt weeks as part of the Adaptive Moose Hunt Unit (see below), these weeks will run consecutively starting Oct 17-22, Oct 24-29, and Oct 31-Nov 5.

## Comprehensive Moose Management in Maine

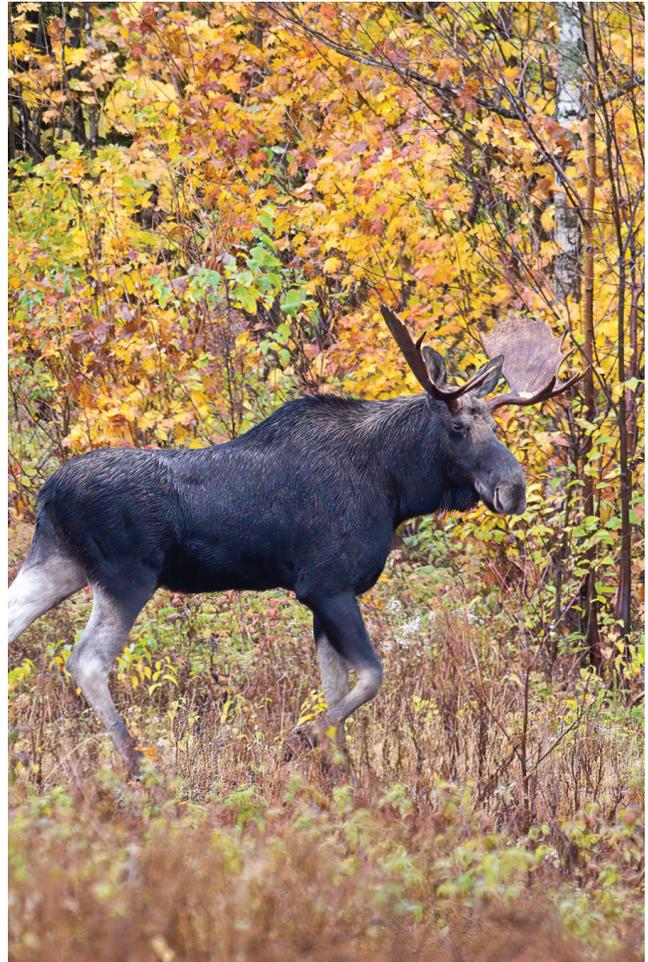
The Department has conducted aerial surveys to estimate moose abundance and composition (bull, cow, and calf) across Maine's core range of moose (roughly a line from Grafton Notch to Calais) since 2011. Aerial survey data combined with reproduction (ovaries-corpora lutea) and age data from moose teeth (from harvest) provides biologists with a more complete picture of Maine's moose population size and composition than ever before. Biologists and the Commissioner's Advisory Council (rulemaking body), use these data to align moose permit levels with publicly derived management goals including 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 fluctuates in response to many factors, especially calf birth and overwintering calf survival rates. The winter of 2019-2020 signified the last aerial capture and GPS collaring of calves (~8 months old) in WMDs 2 and 8. This was the final round in our study of Adult Cow and Calf survival after seven years of intensive work. The study examined calf and adult survival rates and causes of mortality.

The study began in the winter of 2014 in WMD 8 and in 2016 a second study area in northern Maine (WMD 2) was added. Since 2014, we have captured over 675 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.

During the course of our work in WMD 8 and 2 we observed adult cows each spring and summer to determine reproduction rates 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 a comprehensive look at moose health, including the impact of parasites on survival and reproduction.



### Adaptive Management Unit

This past winter we fit an additional 70 calves (~8-month-old) with GPS collars in WMD 4 to compare calf survival with the work in WMD 2 and 8. This unit will be monitored for the coming years to assess winter tick impacts on calves their first winter and cow reproductive rates. After public consultation the Department has begun implementing the Adaptive Unit Hunt in western half of WMD 4 to decrease the local moose population and determine if it can lessen the impacts of winter tick on overwintering calf mortality while improving reproductive success of cows.

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*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

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 – by wildlife watchers and hunters alike.

Today, Maine’s expansive northern, eastern, and western forest supports one of the largest black bear populations in the lower 48 states (**Figure 1**). MDIFW strives to balance its 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. Over the last 46 years, Department biologists have captured and tracked more than 4,000 bears to determine their health and condition, estimate how many cubs are born each year, and determine annual cause-specific mortality rates.

**Population Management**

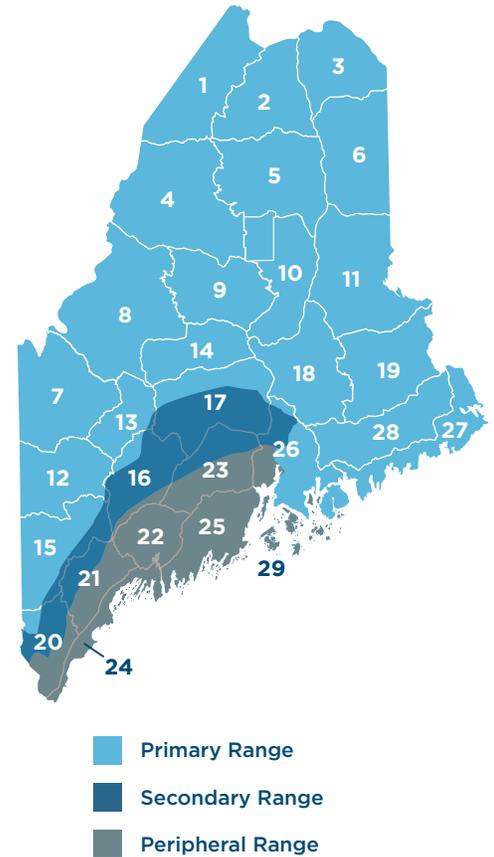
In 2017, the Department completed a 10-year black bear management plan that set a goal of maintaining a healthy, sustainable bear population overall, while minimizing population growth in areas of higher human density. To maintain the bear population at a healthy and socially acceptable level, the Department’s primary tool is hunting.

Maine offers a variety of traditional bear hunting methods, but the odds of taking a bear are low. Most bears (~95%) 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. It includes goals, objectives, and 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 human-black bear conflicts 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. But if Maine’s bear population continues to grow and expand 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

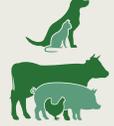
Most human-bear conflicts occur in the spring and early summer, after bears emerge from their winter dens and find it difficult to locate high-quality natural foods. As they search, they sometimes encounter food odors (bird seed, garbage, compost, and grills) that attract them to backyards

and neighborhoods. Once berries begin to ripen in late summer, bears typically 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, 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><b>YOU CAN PREVENT BEAR CONFLICTS</b> by simply removing or securing bear attractants each spring.</p>	<p><b>1 REMOVE &amp; STORE INSIDE</b> Between Apr 1 and Nov 1</p>	<p><b>2 SECURE &amp; CLEAN</b></p>
<p><b>BIRD SEED</b></p> 	<ul style="list-style-type: none"> <li>• Take bird feeders down</li> <li>• Store seed and feeders indoors (you can still feed birds in the winter)</li> </ul>	<ul style="list-style-type: none"> <li>• Rake up bird seed from the ground</li> </ul>
<p><b>GARBAGE</b></p> 	<ul style="list-style-type: none"> <li>• Store garbage cans in a building or electric-fence enclosure</li> <li>• Take to curb on morning of pickup</li> </ul>	<ul style="list-style-type: none"> <li>• Keep outbuilding and garage doors closed at all times and repair broken window and doors</li> <li>• Keep dumpster lids and doors closed and latched</li> <li>• Use bear-resistant dumpsters or garbage cans</li> </ul>
<p><b>GRILLS</b></p> 	<ul style="list-style-type: none"> <li>• Store grill inside when not in use</li> <li>• If you are having bear conflicts, stop grilling until bear moves on</li> </ul>	<ul style="list-style-type: none"> <li>• Burn off food residue</li> <li>• Dispose of food wrappers and grease cups</li> </ul>
<p><b>PETS AND LIVESTOCK</b></p> 	<ul style="list-style-type: none"> <li>• Feed pets inside</li> <li>• Store livestock and pet food inside</li> <li>• Keep livestock in buildings at night</li> <li>• Install and maintain effective livestock fencing</li> </ul>	<p>If you feed your pets or livestock outside:</p> <ul style="list-style-type: none"> <li>• Clean dishes daily</li> <li>• Remove leftover food daily</li> </ul>

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](http://mefishwildlife.com/livingwithblackbears).

## Black Bear Hunting and Trapping

### SEASONS & PERMITS

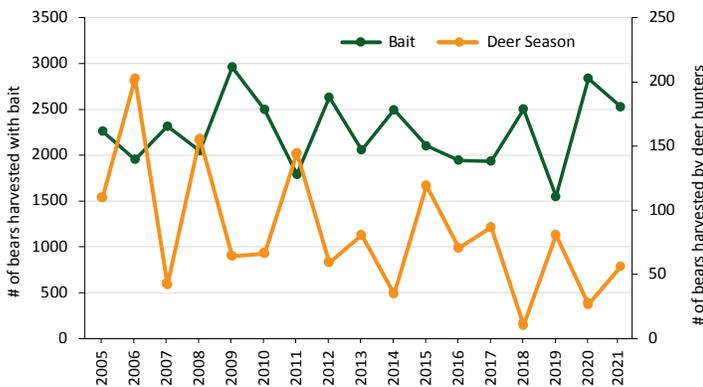
MDIFW’s management of Maine’s black bears includes setting the season length, bag limit, and legal methods of hunting. In addition to a hunting license, hunters (except for resident deer hunters during the firearm season) must purchase a bear permit to hunt black bears, and each successful hunter must 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 2020, hunting over bait was permitted from August 29 through September 26. The hound (trained bear dogs) season overlaps with the last two weeks of the bait season, spanning September 14 to October 30. Annually, the trapping season opens on September 1 and closes October 31 and hunters can hunt bears near natural food sources or by still-hunting throughout the entire three-month season.

Since 2011, properly licensed individuals have been allowed to harvest two bears a year if one is taken by hunting and the other by trapping. While 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 then stabilized. However, in 2020 the number of hunters harvesting two bears nearly doubled to 41 hunters. In 2021, 44 hunters harvested two bears – more than any previous year.

**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.**



Starting in 2015, the Saturday prior to the opening day of the season is designated for youth hunters. Although the 2021 youth day harvest (51) did not exceed the 2018 record of 64 bears, the 2021 youth day harvest was higher than average.

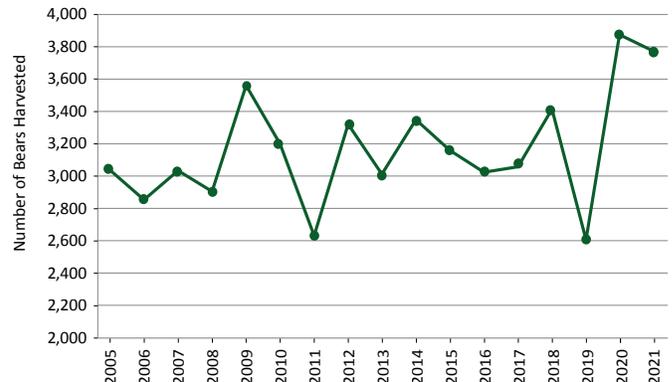
### ANNUAL HARVEST

Although many factors, including weather and hunter numbers, influence the black bear harvest, natural food levels play a significant 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 natural 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 3).

We expected 2021 to be a good natural food year, leading to a lower bait-hunter (and therefore, lower overall) harvest. However, despite a relatively good natural food level, the 2021 harvest (3,779 bears) was similar to 2020’s near-record harvest of 3,883 bears. We attribute this to an increased interest in outdoor pursuits that began during the pandemic and has continued to date. In 2021, nearly 12,500 hunters pursued bears (up 300 from 2020 and 1,500 above average) (Table 1, Figure 3).

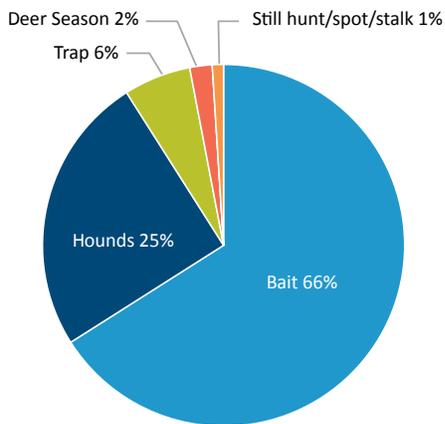
**FIGURE 3. HARVEST GENERALLY ALTERNATES FROM YEAR TO YEAR IN RESPONSE TO NATURAL FOOD ABUNDANCE.**





During the 2021 season, although 2,510 bears (67% of the total harvest) were taken by hunters using bait, the harvest by hunters using trained dogs reached a record high of 929, accounting for 25% of the total; and harvest by trappers also reached a record high of 239 – double the annual average. Meanwhile, harvest of bears by deer hunters in November remained low at just 57. (Table 1 and Figure 4).

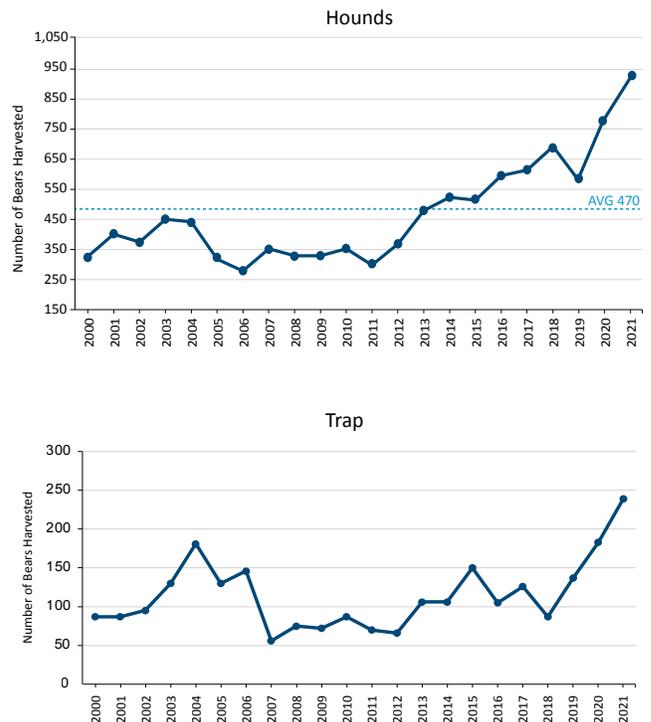
**FIGURE 4. MOST BEARS IN MAINE CONTINUE TO BE HARVESTED WITH BAIT AND HOUNDS (TRAINED BEAR DOGS). DUE TO THE LACK OF NATURAL FOODS DURING THE 2020 SEASON, FEWER BEARS WERE HARVESTED LATER IN THE SEASON BY DEER HUNTERS.**



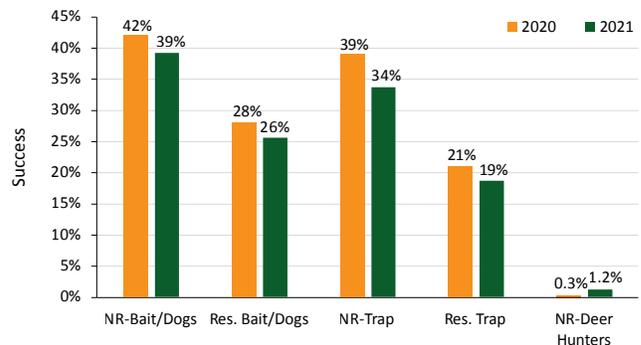
In Maine, most bears (>90%) are harvested over bait or with trained bear dogs. Prior to 2012, approximately 80% of bears were harvested over bait and 10% by hunters using dogs. Since 2013, bait has remained the prominent method of harvest, but a higher proportion of bears (16-25%) have been harvested 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 5). It is important to note that the low number of trappers that harvested a black bear during the 2018 season was due to an emergency rule that limited the types of traps that could be set for bears during the 2018 season and not a change in interest.

Hunters that use bait or trained bear dogs have the most success, with a 30% average success rate since 2008. Success is also higher among nonresidents (Figure 6), who are more likely than residents to hire licensed professional Maine hunting guides (40% of nonresidents use a guide vs. 25% of residents).

**FIGURE 5. HARVEST BY HUNTING 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.**



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





2021

**TABLE 1. NUMBER OF BEARS HARVESTED IN MAINE IN 2021 BY WILDLIFE MANAGEMENT DISTRICT (WMD).**

WMD	METHOD OF TAKE						TOTAL HARVEST	ARCHERY <sup>2</sup>	ASSISTED BY GUIDE	RESIDENT	NONRESIDENT
	HUNTING WITH BAIT	WHILE DEER HUNTING	HUNTING WITH DOGS	SPOT AND STALK	TRAPPING	UNKNOWN <sup>1</sup>					
1	105	0	28	0	4		137	10	126	29	108
2	110	3	41	2	1		157	7	144	23	134
3	212	5	20	2	11		250	19	188	82	170
4	169	2	17	1	4		193	9	120	96	97
5	116	3	51	0	4		174	6	158	27	147
6	237	4	47	7	10		305	15	208	94	211
7	136	0	44	0	18		198	12	144	57	141
8	205	0	109	2	31		347	9	247	140	207
9	106	0	41	2	4		153	6	107	70	85
10	102	0	1	3	10		116	6	80	39	77
11	216	1	82	2	20		321	16	246	94	227
12	91	9	113	2	18		233	20	123	128	108
13	27	3	10	2	7		49	2	19	26	23
14	71	1	38	0	14		124	5	79	62	62
15	33	6	26	2	12		79	1	18	59	20
16	10	5	0	0	4		19	1	0	18	1
17	36	6	10	0	13		65	4	19	50	15
18	178	3	55	0	18		254	9	157	115	139
19	107	0	86	0	5		198	7	177	39	159
20	4	2	3	2	4		15	2	2	13	2
21	1	0	0	0	1		2	0	0	2	0
22	0	0	0	0	0		0	0	0	0	0
23	2	0	0	0	2		4	1	0	4	0
24	0	0	0	0	0		0	0	0	0	0
25	1	0	2	0	0		3	0	0	2	1
26	36	1	1	1	12		51	4	8	44	7
27	36	1	25	2	8		72	5	28	47	25
28	163	2	78	1	4		248	10	174	87	164
29	0	0	1	0	0		1	0	0	1	0
UNREPORTED							11	10	11		
STATEWIDE	2510	57	929	33	239	0	3779	196	2583	1448	2330

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

<sup>2</sup>This does not include 95 bears harvested with a crossbow.



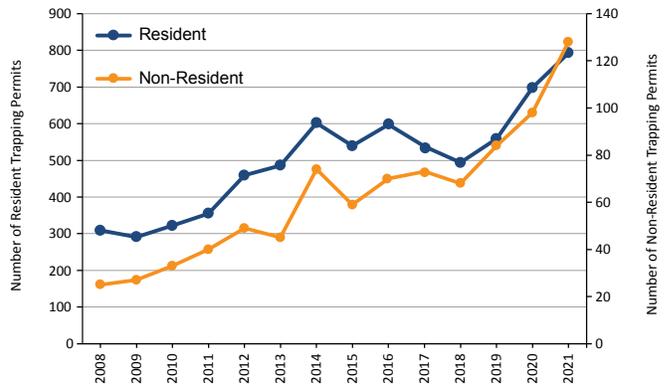
**BEAR TRAPPING**

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. Notably, about 90% of bear trapping permits are purchased by Maine residents.

For two years in a row, trapping permit sales reached a record high, likely in response to the pandemic and increased participation in outdoor activities (Figure 7). Trappers purchased 796 permits in 2020 and 919 in 2021. The prior record was set in 2014 at 676. Trapping interest spiked that year in response to a ballot initiative that, if it had passed, would have eliminated traps, bait, and trained bear dogs as legal harvest methods.

The 2020 and 2021 season harvest of 183 and 239 bears by 796 and 919 trappers eclipsed the previous five years, where an average of 538 trappers harvested anywhere between 87 and 150 bears.

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





### RESIDENT VS. NONRESIDENT HARVEST NUMBERS

Nonresidents harvested most of the bears during the 2021 season (62%), taking 66% of the bears with trained bear dogs and 65% of the bears taken over bait. While the percentage of the harvest by nonresident hunters using spot and stalk methods remains low, it accounted for 21% of the 2021 nonresident harvest.

Among residents, hunting over bait remains popular, with 60% of successful residents taking bears by this means. Although fewer bears are taken during the deer season, in traps, or by spot and stalk methods, Maine residents continue to account for the majority of this harvest (79%).

### THE INFLUENCE OF MAINE GUIDES

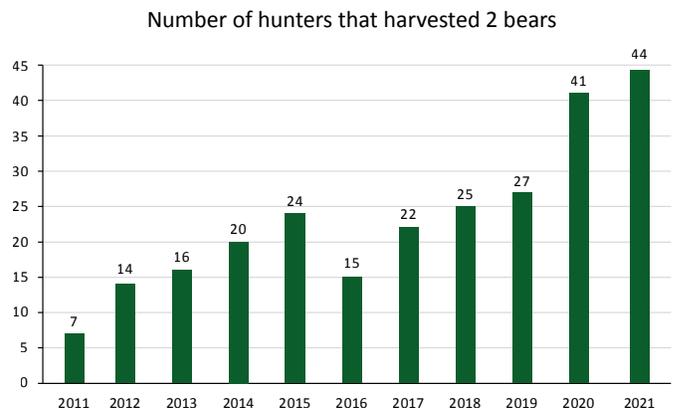
Every year, most bears harvested in Maine are taken by hunters employing a registered professional Maine hunting guide. In 2021, guides helped hunters (84% of whom were non-residents) harvest more than 2,500 bears (68% of the harvest). Hunters employing guides accounted for 83% of bears harvested with trained bear dogs, 70% of those taken over bait, and 20% of the bears taken in traps. 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 in the last five years, from 3% in 2016 to 18% in 2017, 21% in 2018, 12% in 2019 and 2020 and 24% in 2021.

Still, only 29% of Maine residents who harvested a bear in 2021 used a guide. Non-residents' greater use of professional Maine hunting guides could explain their overall higher success rates leading up to deer firearm season (39% compared to 26% for Maine residents).

### GEOGRAPHIC DISTRIBUTION OF THE HARVEST

For the second year in a row, bears were harvested in nearly every county and WMD (14 of 16 counties and 27 of 29 WMDs). Although most bears were harvested from Aroostook County (1,103, accounting for 29% of total harvest), the density of harvest expressed as the number of bears killed per 100 square miles of habitat (forested land) was greatest in WMD 28 at 35 bears/100mi<sup>2</sup>, followed by WMDs 3, 6, and 12 (portions of Aroostook, Oxford, Washington and Hancock counties) at between 25 and 30 bears/100 mi<sup>2</sup>. Fewer bears were taken in southern and central portions of the state (Androscoggin, Cumberland, Kennebec, Knox and Waldo counties), and no bears were taken in Lincoln and Sagadahoc counties or WMDs 22 and 24 (Table 1). The statewide average of 11 bears/100 mi<sup>2</sup> was similar to the statewide average of 13 bears/100 mi<sup>2</sup> in 2020 (a poor food year) and above the statewide average of nine bears/100mi<sup>2</sup> in 2019 (a good food year).

**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 BAG LIMIT INCREASED IN 2011, AN AVERAGE OF 19 HUNTERS HAVE HARVESTED TWO BEARS IN A YEAR.**





### HUNTER PARTICIPATION

Since 1990, hunters interested in harvesting a black bear have had to purchase a bear hunting permit in addition to their hunting license. That first year, nearly 12,000 permits were sold then stabilized to approximately 10,500 permits through 1999 before rising to more than 15,000 permits by 2002. 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 just under 11,000 in 2009 (Figure 9). More recently, in response to the pandemic, numbers have increased. More than 12,000 bear permits were sold in 2020 (the highest number in 17 years) and sales increased again in 2021 to nearly 12,500.

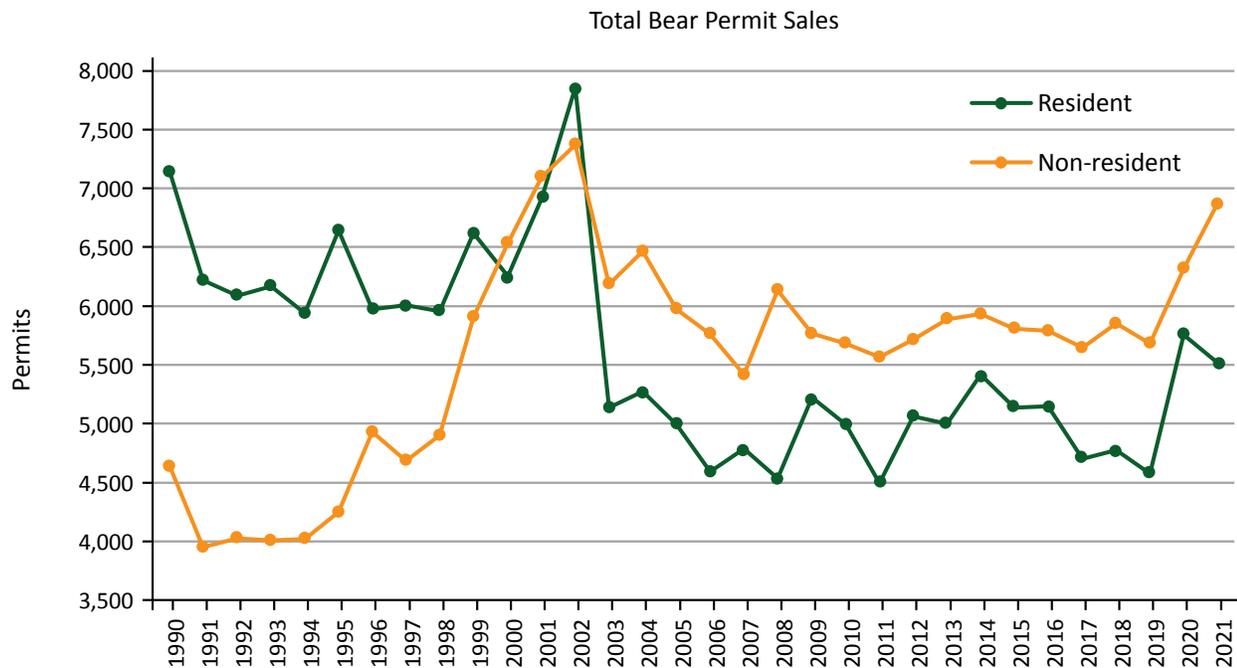
### RESIDENT VS NONRESIDENT PARTICIPATION

Historically, most bear permits (55-60%) were purchased by residents. However, following the closure of the Ontario spring bear hunt in 1999, nonresidents became more interested in hunting Maine black bears; and in 2000, nonresident participation eclipsed that of residents. Since then, nonresidents have accounted for an average of 55% of bear hunting permits.

With the permit fee increase in 2003, resident participation fell more sharply. While not as many nonresidents dropped off, this decline is particularly significant since nonresidents' higher success rates have a greater impact on the final harvest level (Figure 6).

The bump in permit sales in 2020 and 2021 contributing to the near-record harvests of 3,883 and 3,779 bears, respectively (Figure 9). Most notable was the increase in nonresident participation in 2021 which likely explains the higher-than-expected 2021 harvest.

**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.**





#### NEW PERMITS FUNDING BLACK BEAR RESEARCH AND MANAGEMENT

Since 2008, 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, and we are currently using them to:

- Determine the age of harvested black bears from teeth turned in by hunters
- 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 (962 in 2020), sales of resident and nonresident bear trapping permits have been increasing. The sale of these permits has contributed between \$40,000 and \$90,000 annually to bear research and management. 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. Most recently, trapping permit sales reached new highs of 698 resident and 98 nonresidents in 2020 and 793 resident and 128 nonresidents in 2021.

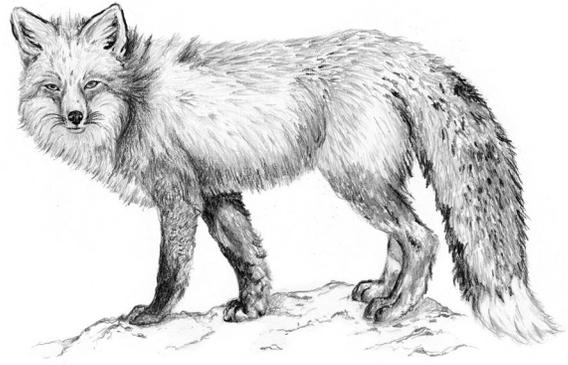
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*This work is supported by the federal Pittman-Robertson program and state revenues from sales of hunting and trapping licenses.*

# FURBEARERS

Shevenell Webb





## Trapping and Furbearer Management

With our abundant lakes, streams, and wetlands, plus southern hardwoods and northern boreal forests, Maine supports some of the most diverse wildlife assemblages in the Northeast. Maine has 16 species of furbearing animals, including semi-aquatic species (beaver, river otter, mink, and muskrat) and terrestrial species (bobcat, coyote, red and gray fox, fisher, marten, raccoon, opossum, striped skunk, short and long-tailed weasel, and red squirrel).

Thanks to modern wildlife management principles, many of these species are more abundant now than they were 100 years ago, allowing for more viewing and harvest opportunities. Game wardens strictly enforce harvest regulations, and wildlife biologists closely monitor the harvest. MDIFW continually reviews and develops science-based regulations, education programs, and capture methods to ensure the harvest is sustainable and that practices are humane.

Healthy furbearer populations are primarily managed and maintained through trapping. Regulated trapping provides many benefits to wildlife and people, including protection and restoration of rare species, population management, and reduction of human-wildlife conflicts.

## Trapping Best Management Practices

Many advancements have been made to improve the safety, effectiveness, and humaneness of trapping. A new report summarizes a long-term study to evaluate trap performance and advance the use of humane traps through development of best management practices for trapping in the United States. Over 600 traps have been tested through the BMP study, which continues to this day. Learn more at [furbearermanagement.com](http://furbearermanagement.com).

To learn more about Maine trapping regulations, please visit [mefishwildlife.com/trappinglaws](http://mefishwildlife.com/trappinglaws).

## Harvest Update

Trapping is the primary method of harvesting furbearers; but red and gray fox, coyote, bobcat, raccoon, opossum, and skunk can also be hunted for a short time each year. Small game, including snowshoe hare, red and gray squirrel, woodchuck, and porcupine, can be hunted as well.

Regardless of harvest method, the pelts of all furbearers except weasels, raccoon, red squirrel, muskrat, skunk, and opossum must be registered and tagged. Tagging pelts gives the Department information on who harvested the animal, with what method, in which town, and during which month and year.

We also collect biological data for some species during the registration process (see page 32). This information is important for monitoring fur harvest intensity, status, and distribution, as well as the demographics of the harvest.

Many factors can influence fur harvests, including changes in trapping regulations, pelt values, wildlife populations, weather conditions, abundance of natural foods, and gas prices. Interest in trapping has remained steady, with more people taking trapper education courses in recent years. Some of the recent interest is related to bear trapping, while other people are drawn in by the challenges and benefits of being outside or the prospect of making their own fur garments and other products.

During the 2021/22 season, the covid pandemic, abundant natural foods, low fur values, and high gas prices all affected trapper effort and harvest.



Bobcat sightings are up, and the bobcat harvest continues to be strong (Table 1). Hunting is the most popular method of pursuing bobcats, with 58% of the annual harvest taken by hunting during the previous three seasons; but it relies on good snow conditions. Most bobcat hunters use dogs, followed by bait, other, calling, and incidental. Over the past 10 years, the number of successful bobcat hunters has doubled, while the number of successful trappers has increased by 15%.

The fisher and marten harvest this past season was comparable to the 2019 season when natural foods (e.g., small mammals and nuts) were abundant. Some species, like mink and foxes, were abundant; but because of low trapper effort, the harvest was well below the 10-year average.

### Trapper Effort

The number of trapping licenses has been fairly stable over the last 20 years. During 2020/21, there were 4,312 trapping licenses (this includes annual and lifetime trapping licenses), representing a 5% increase from the

previous five-year average. Beginning in 2021, trapping license renewals could be purchased online, including Apprentice Trapping, Bear Trapping Permit, and Junior Trapping Licenses. With that change, the Department saw a year-over-year increase in resident and non-resident trapping licenses.

All trappers 16 years and older are required to submit a fall and spring harvest report, even if they did not trap. MDIFW uses this information to monitor trends around targeted species and locations, catch per unit effort, disease, trapping effort in lynx wildlife management districts, and the harvest of species that are not required to be registered and tagged. These reports indicate that coyote and beaver are the most popular species to target. The average species catch per 100 trapnights (1 trap set for 1 night = 1 trapnight) reported on fall harvest reports (2018-2020) has been highest for muskrat (8) and beaver (4), followed by raccoon (3), otter (2), and coyote, fox, mink, fisher, marten, and bobcat (1) (Table 2).

**TABLE 1. FURS REGISTERED FROM THE 2012/13 - 2021/22 TRAPPING AND HUNTING SEASONS IN MAINE.**

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	10-YR AVERAGE
BEAVER	9,327	42,95	3,541	5,666	3,448	5,411	4,187	6,173	5,988	5,325	5,336
BOBCAT	239	136	126	228	207	221	281	352	396	354	254
COYOTE	1,746	1,315	1,036	1,429	963	1,482	1,965	1,905	1,912	1,158	1,507
FISHER	1,346	656	688	295	341	352	659	365	741	470	591
R. FOX	901	541	304	618	437	582	726	457	739	411	622
G. FOX	437	334	535	286	131	264	196	247	275	141	259
MARTEN	4,048	1,042	1,224	395	1,113	519	946	315	1,057	395	1,105
MINK	2,256	1,379	1,173	1,206	485	536	284	348	356	243	827
OTTER	762	408	292	494	322	656	397	678	628	582	522

**TABLE 2. SPECIES CATCH PER 100 TRAP-NIGHTS AS REPORTED ON FALL TRAPPER HARVEST REPORTS.**

SEASON	COYOTE	G. FOX	R. FOX	MINK	FISHER	MARTEN	BEAVER	MUSKRAT	RACCOON	OTTER	BOBCAT
2018	1.59	0.46	0.73	1.21	0.79	1.08	4.48	7.94	2.71	2.08	0.42
2019	1.14	0.58	0.61	1.06	0.75	0.78	4.18	7.42	0.88	1.34	0.65
2020	1.07	0.61	1.41	1.01	0.99	1.60	4.76	8.77	4.38	1.61	0.77
AVG	1.27	0.55	0.92	1.09	0.84	1.15	4.47	8.04	2.66	1.68	0.61

<sup>1</sup>Imports and roadkills were excluded from this summary.

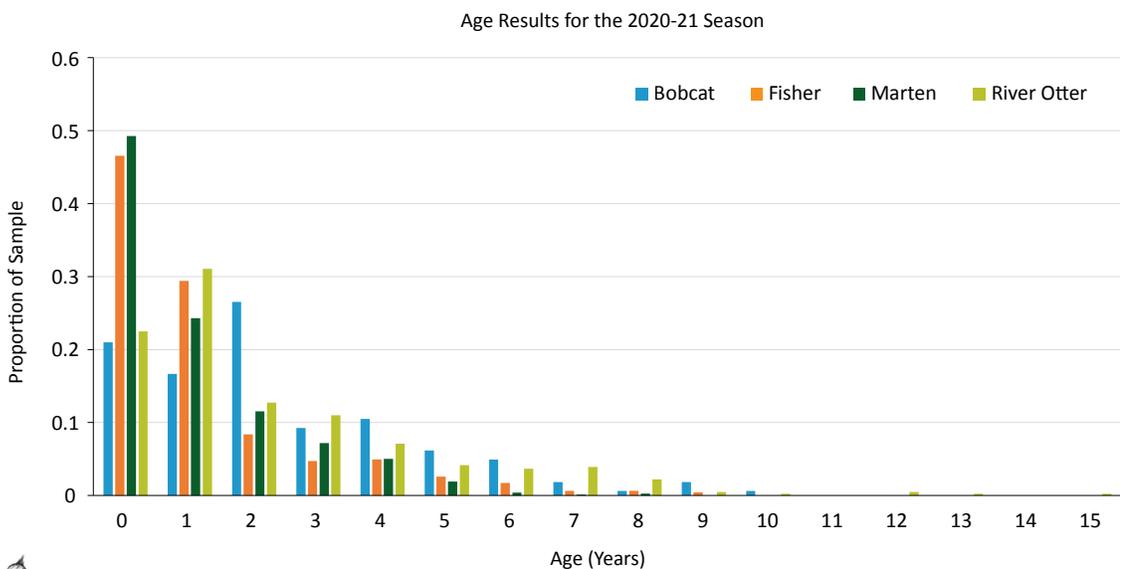
## Biological Data

MDIFW biologists collect biological samples from bobcat, fisher, marten, and river otter (Figures 1-5). By closely monitoring harvest demographics, we are able to improve how we manage these species and ensure that trapping and hunting levels are sustainable. We also use these data when interpreting harvest trends and considering regulation changes.

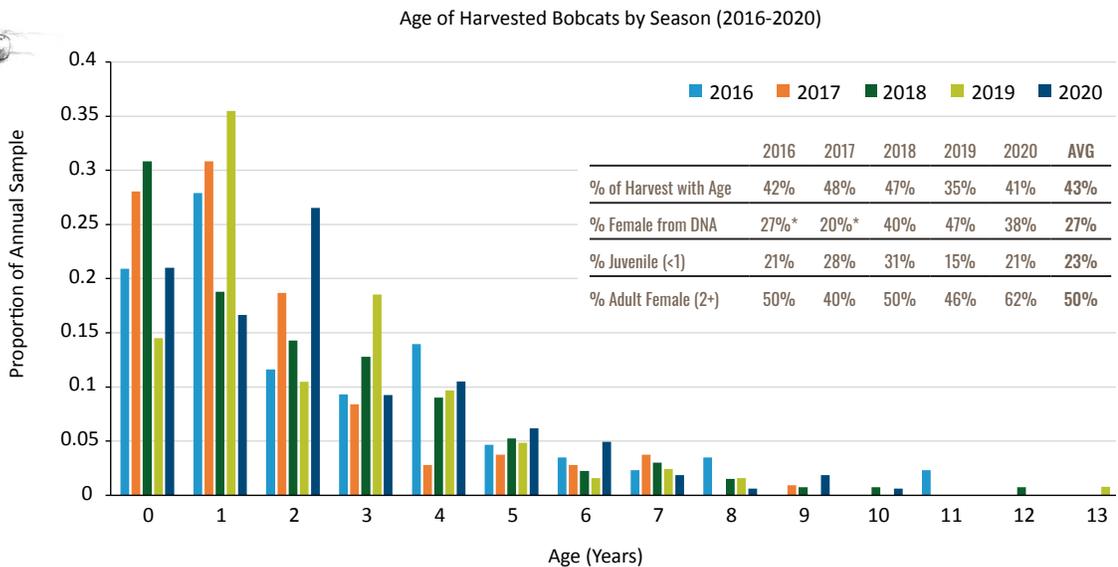
We have learned a lot in the past five years of the study. The harvest has been composed primarily of younger age

classes, mimicking natural mortality trends. On average, 49% of the bobcat, 77% of the fisher, 76% of the marten, and 57% of the otter annual harvest samples were juveniles (<1 years old) or yearlings. The percentage of adult females (2+ years old) in the harvest has been low, representing 24% of the bobcat, 15% of the fisher, 6% of the marten, and 14% of the otter annual harvest samples. The oldest animals in the study were bobcat (13 years old), fisher (11 years old), marten (9 years old), and otter (15 years old).

**FIGURE 1. AGE DISTRIBUTION OF THE SAMPLED BOBCAT, FISHER, MARTEN, AND RIVER OTTER HARVEST DURING THE 2020-21 HUNTING AND TRAPPING SEASON IN MAINE.**

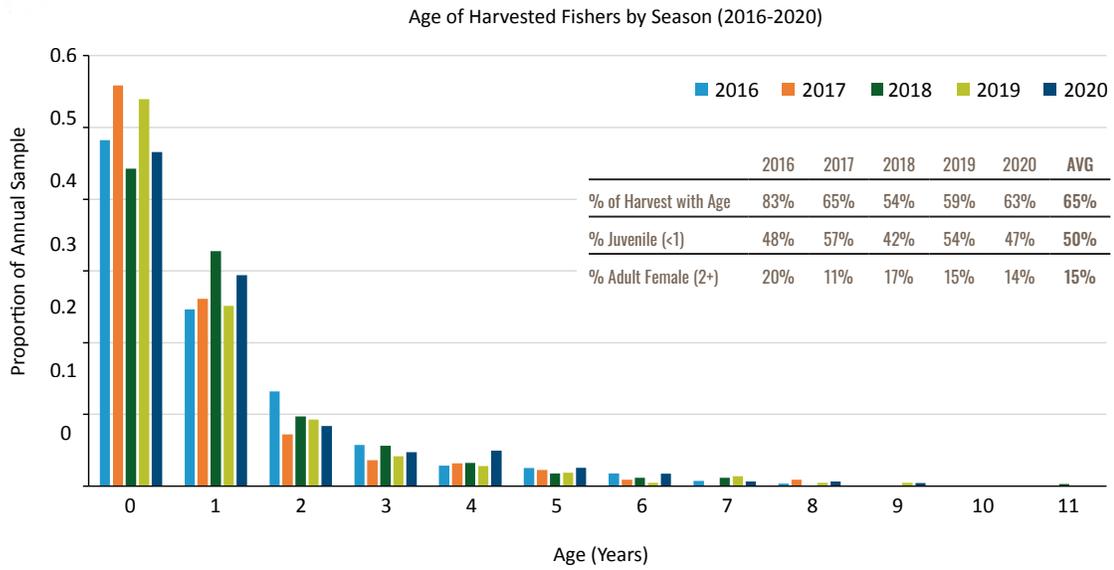


**FIGURE 2. AGE AND SEX OF BOBCATS SAMPLED DURING THE 2016/17 - 2020/21 HUNTING AND TRAPPING SEASONS IN MAINE. NOTE THAT ASTERISKS\* MARK RESULTS BASED ON VERY SMALL SAMPLE SIZE (I.E., LESS THAN 30 BOBCAT TISSUE SAMPLES).**

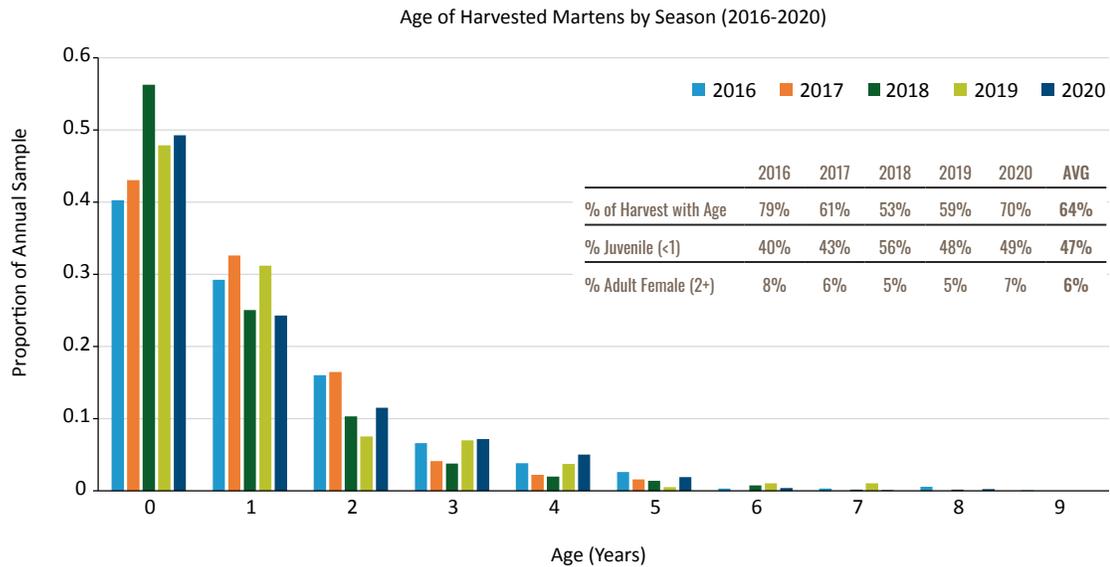




**FIGURE 3. AGE AND SEX OF THE FISHER SAMPLED DURING THE 2016/17 - 2020/21 TRAPPING SEASON IN MAINE.**

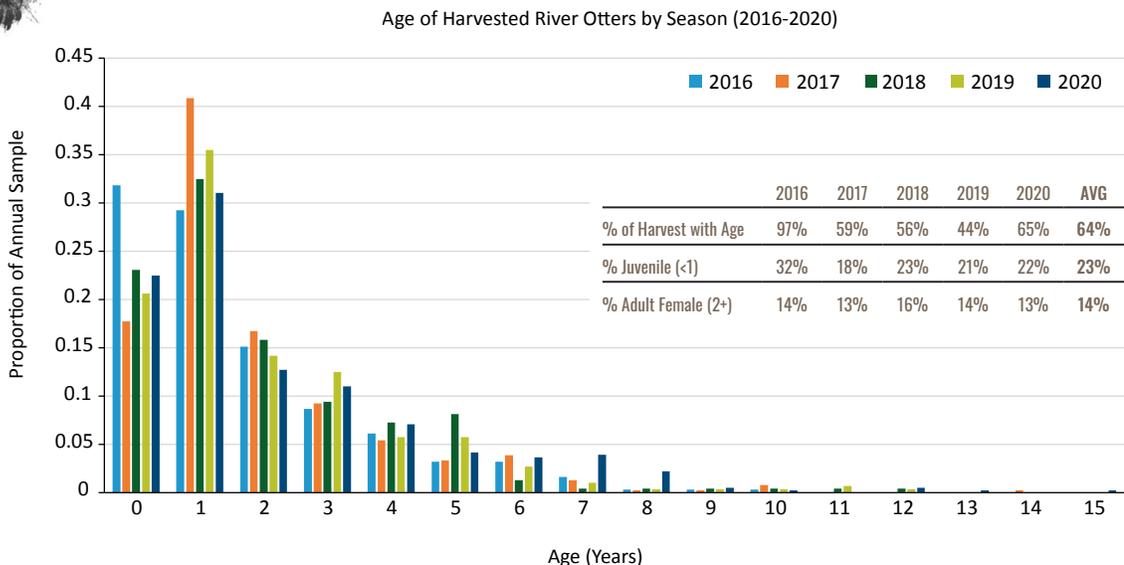


**FIGURE 4. AGE AND SEX OF THE MARTEN SAMPLED DURING THE 2016/17 - 2020/21 TRAPPING SEASON IN MAINE.**





**FIGURE 5. AGE AND SEX OF THE RIVER OTTER SAMPLED DURING THE 2016/17 - 2020/21 TRAPPING SEASON IN MAINE.**



## Other Updates

### FURBEARER PLANNING

As part of its mission to preserve, protect, and enhance Maine’s inland fisheries and wildlife resources, the Maine Department of Inland Fisheries and Wildlife also must plan for the use and preservation of these resources.

In 2019, the Department started a comprehensive Furbearer Planning initiative. This effort is guided by a Steering Committee made up of diverse wildlife stakeholder groups and species working groups with technical expertise and/or interest. These groups are helping the Department develop 10-year management goals and strategies in three areas: 1.) Research and monitoring, 2.) Policy and regulations, and 3.) Outreach and communications.

The plan’s overarching goals are to maintain healthy, abundant furbearer populations, maintain a sustainable harvest, maintain trapping opportunities, increase public understanding of furbearers and furbearer management, minimize human-wildlife conflicts, and conserve other species in the process. Given the wide scope and number of species involved, this initiative spans multiple years. Learn more about the 2020 public survey results and progress of Maine’s Furbearer Management Plan: [maine.gov/ifw/fish-wildlife/wildlife/species-planning/furbearer-management-plan.html](http://maine.gov/ifw/fish-wildlife/wildlife/species-planning/furbearer-management-plan.html).

## Meso-Carnivore Camera Study

Since 2017, the Department has been working with the University of Maine (Dr. Alessio Mortelliti and Dr. Bryn Evans) to develop a protocol for monitoring marten and fisher populations across the state. We used motion-triggered camera traps because they are an effective, non-invasive approach to survey carnivores over large areas and have advantages over traditional methods like snow track surveys. Cameras are not weather-dependent, they provide more certain species identification, and they can be set for long periods of time.

The study focused on the northern two-thirds of Maine across gradients of forest disturbance, latitude, and fur harvest intensities. Marten and fisher occurrences were collected through transects of camera traps optimized for these species. Over a four-year period, the 197 survey stations collected nearly one million images of 27 mammal species.

The study found that the intensity of forest disturbance was an important driver for marten occurrence.

More disturbed forests indicated more ephemeral marten populations with high turnover (i.e., less consistency in annual detections) as compared to less disturbed areas. In contrast, fisher were common almost everywhere (86% of stations) and appeared to be more habitat generalists.

Marten make a great umbrella species, and survey efforts targeting marten can be maximized to include fisher and other species. The Department is using the results from this study to inform a long-term monitoring program that will improve marten and fisher management. Learn more about the publications that resulted from this study: [alessiomortelliti.weebly.com/publications.html](http://alessiomortelliti.weebly.com/publications.html).



## Fisher Rodenticide Study

The Department is collaborating with partners from multiple states on a large study to better understand the health of the fisher population, including the prevalence of anticoagulant rodenticides (AR), in the Northeast. Rodenticides are commonly used to control rodents worldwide, but the effects of these toxins on other species and their persistence in the environment is not well-understood.

AR accumulate in the liver and work by interfering with Vitamin K activation and preventing blood from clotting. A rodent who ingests the toxins typically dies of internal bleeding, hemorrhaging, or anemia within four days to two weeks. First-generation anticoagulants were developed before 1970 and are more toxic when feeding occurs over several consecutive days. Second-generation anticoagulants were developed beginning in the 1970s to control rodents that became resistant to the first-generation rodenticides. These anticoagulants are more toxic because they can kill rodents after one night of feeding, which increases their potential to harm non-target animals. The second-generation compounds also appear to stay in animal tissue for a long period of time. Due to these factors, the Environmental Protection Agency (EPA) has instituted additional restrictions for these compounds, allowing consumers to purchase ready-to-use bait stations that contain a block or paste inside them, but not to purchase pellets. Only three compounds are currently registered for the consumer market to control mice and rats. Although the EPA restricts the more potent second-generation products to agricultural contexts and professionals, they are still widely available to consumers at local hardware stores and online vendors.

The various pathways of AR exposure may be feeding directly on the baits, feeding on rodents who have eaten the baits, or other means (e.g., water sources). A predator who ingests poisoned rodents can build up toxins over time as they eat more of them; and some species, like avian predators, appear particularly sensitive and can die from AR poisoning. Massachusetts has found that raptors have widespread exposure to AR, but just reported its first lethal rodenticide poisoning of two bald eagles in 2021. In addition to avian predators, rodenticide compounds have been detected in Canada lynx, bobcat, red fox, gray fox, river otter, and fisher in the Northeast. Lethal concentrations are not well understood and appear to vary widely within and among species.

During the fall and winter of 2020/21, the Department worked with trappers and staff to collect 110 fisher from 49 Maine towns. Early results indicate 53% of the Maine fisher tested positive for at least one rodenticide compound (Figure 6). Four of the 11 rodenticide compounds tested were detected in Maine fisher livers, with Brodifacoum and Bromadiolone (second-generation anticoagulants with long half-lives) being the most common. Most of the fisher that tested positive had one or two compounds, while four had three compounds and one had trace amounts of four compounds. Twenty-six of the 46 males (57%) and 30 of the 60 females (50%) had at least one compound. Fishers with rodenticides were detected throughout the state, and it appears that fisher living in remote areas are still getting exposed. Some towns had a mix of individuals that tested negative and positive. Still, levels in Maine are lower than New York, where 79% of fisher tested positive for at least one rodenticide, and Vermont, where 90% did. SUNY ESF will be examining age, reproductive tracts, and testes from fisher in relation to rodenticide levels.

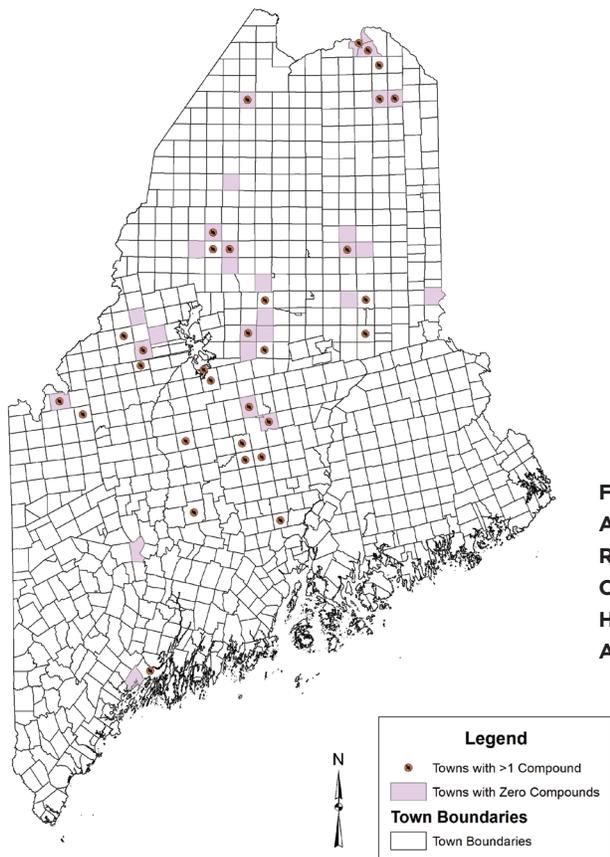
More study is necessary to better understand AR exposure pathways, rates for fisher and other species, and what levels would be harmful to individuals or populations. Given the widespread availability of rodenticides to consumers, increased outreach is needed on integrated pest/rodent management and alternatives to poisons (e.g., snap traps).



### Skunk Adenovirus Study

Skunk adenovirus (SkAdv1) is an emerging respiratory disease that was first discovered in a striped skunk in Ontario in 2014. Since then, its host range has expanded, with several species in northeastern North America infected, including porcupines, gray fox, and raccoon. The virus has also been discovered in captive hedgehog colonies in Japan and New Hampshire. Its source is unclear, with a mixture of cases coming from sick wildlife submitted to wildlife rehabilitation with symptoms and animals who develop symptoms while in a rehabilitation center. There appear to be split outcomes, with some infected animals recovering and others dying. According to Dr. David Needle (UNH Veterinary Diagnostic Lab), who first discovered the virus in the United States, it appears that, of the animals infected and developing the disease, porcupines are the ones that people see most.

It is unknown how the virus impacts wildlife populations, but it may be species- and strain-dependent. Based on preliminary evidence from UNH and collaborators at Cornell and in Canada, it appears fairly transmissible to other species and warrants further study as it is currently emerging in the northern portion of North America’s eastern temperate forests, seemingly focused on Maine, New York, and the surrounding Canadian provinces. The Department will be collaborating with Dr. Needle, Dr. Sarah Childs-Sanford (Cornell University), select wildlife rehabilitation centers, and other partners to collect samples from multiple species to learn more about which species carry the virus and how prevalent the disease is among individuals.



**FIGURE 6. MAP SHOWING MAINE TOWNS WHERE AN INDIVIDUAL FISHER HAD NO ANTICOAGULANT RODENTICIDE COMPOUND (SHADED) OR AT LEAST ONE COMPOUND (SOLID CIRCLES) DETECTED. SOME TOWNS HAD A MIX OF INDIVIDUALS THAT TESTED NEGATIVE AND POSITIVE FOR COMPOUNDS.**



# 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 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 and waterfowl. He is Maine's representative on the Atlantic Flyway Council Technical Section.



# GAME BIRDS

Kelsey Sullivan



# RESIDENT GAME BIRDS

## Wild Turkey Spring Harvest

Maine continues to have a quality wild turkey spring hunting season, with 25% of hunters harvesting at least one turkey and 37% of those successful hunters harvesting a second turkey. The spring 2022 harvest of 7,081 was the highest recorded since the start of spring turkey hunting in Maine in 1986, when just seven of 500 permitted hunters harvested a wild turkey.

Factors contributing to the highly successful 2022 season include an increase in wild turkey hunting participation, good reproduction over the last couple years, and favorable weather conditions during the opening week of the spring hunt.

The table below shows the spring wild turkey harvest each year from 2018 to 2022 by Wildlife Management District (WMD), along with the average harvest over those five years.



**TABLE 1. WILD TURKEY SPRING HARVEST BY WILDLIFE MANAGEMENT DISTRICT 2018 TO 2022 AND FIVE YEAR AVERAGE.**

WMD	2018	2019	2020*	2021	2022	AVERAGE HARVEST
2	4	5	4	3	4	4
3	3	6	9	20	22	12
4	1	1	6	5		3
5	2	6	2	14	9	7
6	48	49	37	90	120	69
7	29	52	24	37	57	40
8	7	14	10	19	35	17
9	6	4	0	9	13	6
10	9	4	0	18	22	11
11	71	75	40	71	125	76
12	91	176	118	164	201	150
13	117	122	35	87	172	107
14	43	55	20	53	66	47
15	643	592	567	605	720	625
16	455	523	457	464	551	490
17	675	603	461	562	681	596
18	118	104	149	92	97	112
19	28	20	54	22	37	32
20	604	705	521	701	719	650
21	608	666	481	651	720	625
22	571	607	526	439	525	534
23	754	765	679	607	749	711
24	174	172	180	185	195	181
25	586	687	558	498	631	592
26	450	456	458	302	406	414
27	70	68	51	97	118	81
28	40	67	58	58	66	58
29	20	8	13	18	20	16
<b>TOTAL</b>	<b>6,230</b>	<b>6,612</b>	<b>6,216</b>	<b>5,891</b>	<b>7,081</b>	<b>6,406</b>

\*Estimated from a post season harvest survey. In 2020, due to COVID, spring harvest registration was waived.

## Wild Turkey Fall Harvest

The fall wild turkey season is open from the Monday closest to September 17 until November 7. Bag limits vary by Wildlife Management District (WMD) and are based on each WMD’s estimated wild turkey density (WMDs with higher estimated turkey densities have higher bag limits). The overall season bag limit per hunter is five wild turkeys.

The fall 2020 wild turkey harvest was the highest we’ve had in the state since the fall season began in 2002, with a total harvest of 3,645 turkeys — 44% more than the 5-year average of 2,515. The higher harvest is partially attributed to the increase in wild turkey hunting participation in 2020, as measured by hunting license and wild turkey permit sales. 2020 was also a very good year for wild turkey reproduction, so there were a lot of wild turkeys on the landscape and available for harvest.

The fall 2018 harvest of 3,503 wild turkeys was also due in part to successful reproduction.



**TABLE 2. WILD TURKEY FALL SEASON HARVEST TOTALS BY WILDLIFE MANAGEMENT DISTRICT FROM 2016 TO 2020.**

WMD	2016 HARVEST	2017 HARVEST	2018 HARVEST	2019 HARVEST	2020 HARVEST	5 YEAR AVERAGE
6	CLOSED	CLOSED	CLOSED	CLOSED	66	66
10	2	8	7	8	19	9
11	46	32	61	30	71	42
12	57	29	107	29	80	50
13	67	10	59	7	30	34
15	307	155	418	196	400	283
16	242	97	371	140	332	211
17	362	146	345	272	363	276
18	62	42	80	48	86	61
19	39	16	35	21	37	32
20	307	212	350	191	384	292
21	194	127	244	154	236	197
22	214	112	301	130	257	196
23	235	154	407	260	369	260
24	99	58	64	57	102	82
25	232	123	340	185	408	233
26	169	81	149	156	292	150
27	CLOSED	42	54	41	57	49*
28	73	68	107	46	116	72
29	21	9	4	4	6	11
<b>TOTAL</b>	<b>2,761</b>	<b>1,521</b>	<b>3,503</b>	<b>1,975</b>	<b>3,711</b>	<b>2,515</b>

\*4 year average



# MIGRATORY GAME BIRDS

## Waterfowl Harvest

The 2020 Maine waterfowl season selection continued with three zones: North, South, and Coastal. The federal framework offered states in the Atlantic Flyway a 60-day general duck season with a six-bird daily bag limit, a 60-day Canada goose season with a two-bird daily bag limit in our North and South Zones, and a 70-day Canada goose season with a three-bird daily bag limit in our Coastal Zone. An early Canada goose season was also open from September 1 to September 25. This season was for the more abundant portion of the Canada goose population breeding in Maine, referred to as resident Canada geese. The regular goose season is timed for when the less abundant geese migrating from the northern breeding grounds in Canada co-mingle

with the resident geese. The early season daily bag limit was 10 in the South and Coastal zones and six in the North zone. The special sea duck season in Maine was 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.

Waterfowl harvest estimates are derived from data collected through the Harvest Information Program (HIP). Led by the federal US Fish and Wildlife Service, the HIP program is an annual hunter survey to monitor waterfowl harvest. All hunters intending to hunt waterfowl must register for HIP each year when they purchase their hunting license. Duck and goose harvest estimates for the 2016 to 2020 hunting seasons, along with the 5-year average, are presented in the table below.



**TABLE 3. WATERFOWL HARVEST IN MAINE BY SPECIES FROM 2016 TO 2020 FIVE YEAR AVERAGE.**

	2016	2017	2018	2019	2020	5 YEAR AVERAGE
Black Duck	2,700	2,900	5,600	2,700	3,500	3,480
Mallard	8,000	9,700	11,800	6,300	10,400	9,240
Mallard X Black Duck Hybrid	100	200	100	100	300	160
Green-Winged Teal	1,900	1,600	1,100	1,900	2,100	1,720
Blue-Winged Teal	200	0	0	200	600	200
Northern Shoveler	0	100	0	100	0	40
Northern Pintail	100	200	400	100	200	200
Wigeon	100	0	200	200	100	120
Wood Duck	5,500	6,500	3,700	4,600	9,800	6,020
Greater Scaup	0	0	100	0	0	20
Lesser Scaup	100	0	0	0	100	40
Ring-Necked Duck	800	200	800	900	1,200	780
Bufflehead	2,500	1,500	2,700	700	2,400	1,960
Common Goldeneye	600	600	700	400	900	640
Hooded Merganser	600	600	600	400	900	620
Other Mergansers	700	500	700	200	900	600
<b>Total Dabbling/Diving Duck Harvest</b>	<b>27,000</b>	<b>32,200</b>	<b>39,400</b>	<b>22,900</b>	<b>40,600</b>	<b>32,420</b>
Canada Goose	11,400	15,200	11,400	7,200	14,300	11,900
Common Eider	1,800	5,700	7,300	1,700	2,200	3,740
Long-Tailed Duck	800	1,700	2,600	1,300	2,400	1,760
Scoter Species	1,100	1,300	800	1,100	2,400	1,340
<b>TOTAL SEA DUCK HARVEST</b>	<b>3,700</b>	<b>8,700</b>	<b>10,700</b>	<b>4,100</b>	<b>7,000</b>	<b>6,840</b>



## American Woodcock

Surveyors in Maine contributed to the USFWS-coordinated American Woodcock Singing Ground Survey (SGS), which is carried out each spring across the woodcock breeding range in Eastern Canada and the central and eastern US. MDIFW and USFWS staff, together with several volunteers, completed 55 routes in Maine in the spring of 2021. The average number of males they heard per route was 3.73, up from the previous year's average of 3.45, but slightly lower than the 10-year average of 3.96. These numbers indicate that the breeding portion of woodcock is stable in Maine, despite having declined in many other parts of the woodcock range. Such declines are attributed in part to loss of young forest habitat important to woodcock.

As with waterfowl, the Harvest Information Program (HIP) provides estimates of woodcock hunter numbers and harvest. Based on data from HIP, approximately 5,500 woodcock hunters harvested an estimated 9,600 woodcock in Maine in 2020.

The recruitment index is a measure of the ratio of immature (young of the year) woodcock per adult female derived from a wing-collection survey. In 2020, Maine hunters provided 770 woodcock wings. The recruitment index of 1.7 immature to one adult female in the 2020 harvest was the same as the long-term average of 1.7 (1963–2019).



2021-2022

RESEARCH + MANAGEMENT REPORT

Non-Game Species Conservation and Management



Download additional sections at [mefishwildlife.com/wildlifereport](https://mefishwildlife.com/wildlifereport)



## 2021-22 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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- » Habitat Conservation & Management
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Conservation & Management
- » Regional Wildlife Management

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Compiled and edited by  
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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.



**Cory Stearns**  
**Wildlife Biologist**  
*Small Mammals*

Cory is the small mammal specialist for MDIFW, overseeing the research, monitoring, and restoration efforts for small mammals. Most of his work is focused on New England cottontails, bats, and northern bog lemmings.

---

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- Ben Holt

### Bat Project

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# 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.

FIGURE 1. CANADA LYNX RANGE



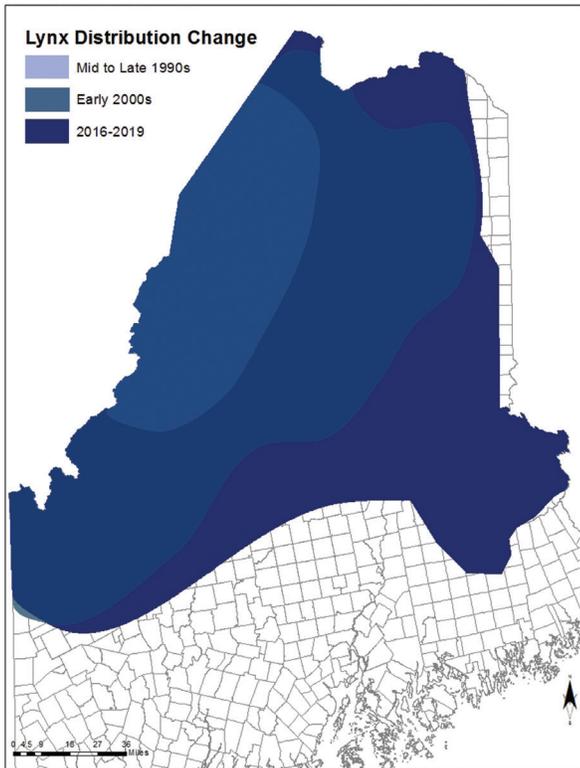
Range map by IUCN Red List



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, lynx abundance 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 again. Lynx survival and productivity follows this same trend, lagging by two to three years. Once lynx become more common, snowshoe hare numbers begin to decrease, and a decrease in lynx numbers follows.

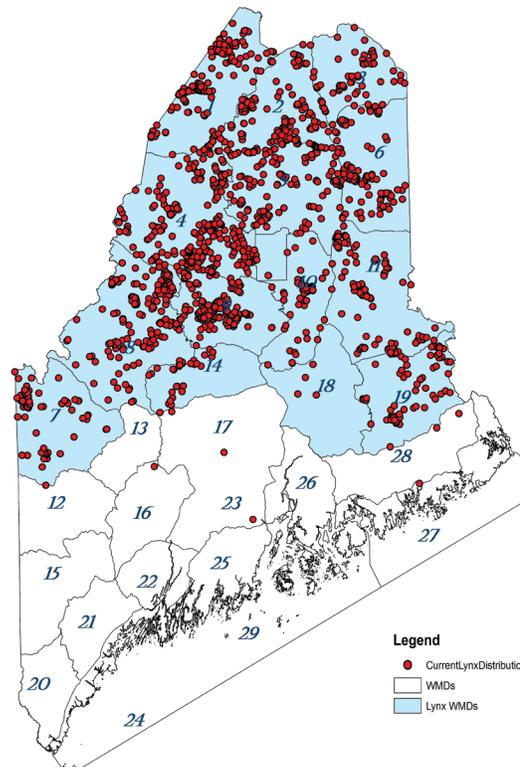
Snowshoe hare numbers also influence lynx reproductive rates, with female lynx producing more kittens when they have a lot to eat. In Canada, although litters as large as eight kittens have been observed, a normal litter is one to five. In Maine, when snowshoe hares are abundant, litters of four to five kittens are common. Age is also a factor — younger females typically give birth to smaller litters and although lynx can reach reproductive maturity as yearlings, very few do even in the core of the range when snowshoe hares are most abundant.

**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, when habitat conditions following the spruce budworm outbreak began to 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 and mostly ambivalent to the presence of people, they will often stay in the area long enough for a viewer to capture a photo or video. Such an opportunity to watch lynx in their natural environment is a truly unique and memorable experience.

**FIGURE 3. CREDIBLE LYNX OBSERVATIONS IN MAINE SINCE 2000**



## Why are Lynx in Maine Thriving?

Nearly 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).

## Is it a lynx or bobcat?

Two closely related wild felids are found in Maine, the bobcat and Canada lynx. Although bobcats and lynx are both small, bobtailed cats, bobcats are more habitat and prey generalists, and do not do well in areas with deep snow. As a result, bobcats are more common in southern portions of the state and are found in a variety of habitats. So, location is your first clue as to whether it is likely a bobcat or a lynx. Next, you can look at certain key features.

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



LYNX TRACKS



Set of lynx tracks in snow. Photo by MDIFW



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

BOBCAT TRACKS



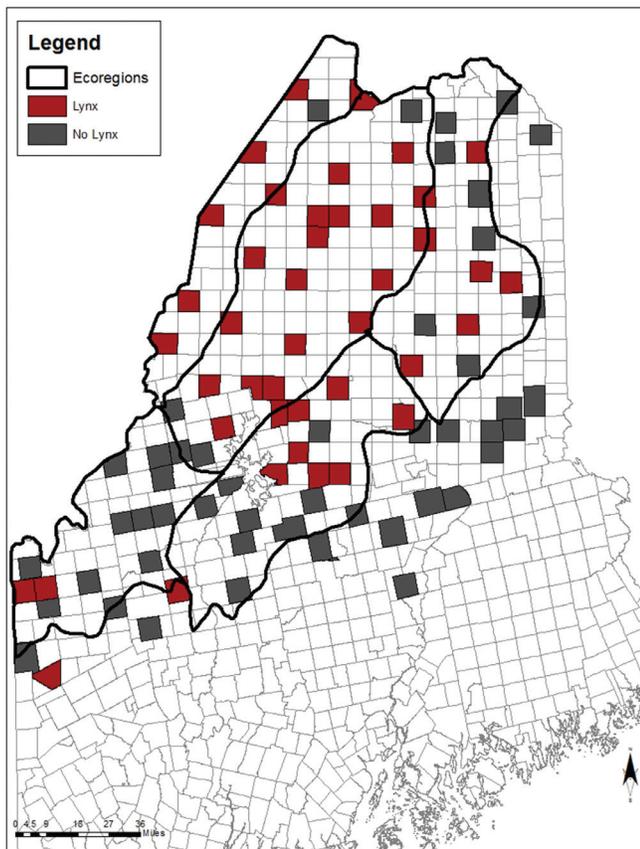
Set of bobcat tracks in crusty snow. Photo by MDIFW

## Lynx Management in Maine

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

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

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



### MAINE'S FIRST LYNX SNOW TRACKING STUDY

In the 1990s, MDIFW began collecting baseline lynx status information 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 an adult male would typically share an area with two to three females. When snowshoe hare were abundant, most females would give birth to litters ranging from one to five kittens. And when snowshoe hare were the most abundant, most litters contained 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**.

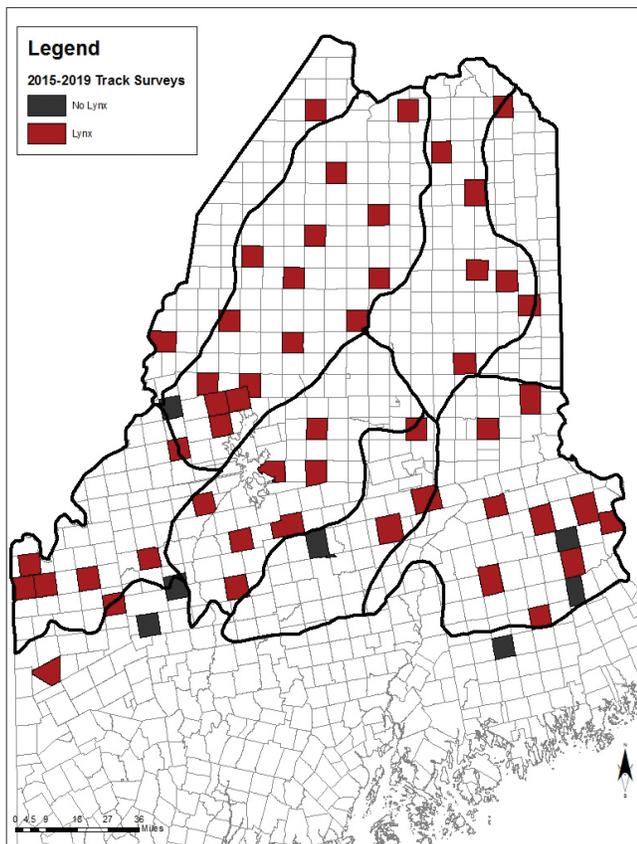
### SNOW TRACKING 2.0

In the winter of 2015, with an increase in reliable lynx and kitten observations 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 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, 40 had been previously surveyed (see Figure 4), with a previous occupancy rate of 46%.

### TELEMETRY 2.0

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



In the fall of 2015, biologists launched a second telemetry study, through which we 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 us 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 GPS collars failed to send sufficient locational information, data from the other 23 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. However, since the start of the pandemic, we have not radiocollared lynx to minimize potential virus exposure. We will likely revisit this decision next year.

### THE LAST YEAR

In 2022, we continued recording credible lynx sightings including observations of family groups throughout the state. We also continued to respond to road mortalities and accidental trapping of lynx. Although lynx are protected from harvest, they are sometimes caught in foothold traps set for other furbearers. When this occurs, most are released from traps unharmed. We document these captures to help address accidental take and further document lynx distribution in the state. We are also working with researchers at the University of Maine to further analyze existing track survey data. This work will help us to direct future efforts to spot changes in lynx occupancy and distribution. Future monitoring efforts will likely involve more winter snow track surveys throughout northern Maine.

### THE FUTURE

In 2000, the 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, the 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, the USFWS must finalize a recovery plan, which is expected by December 1, 2024.

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

# BATS

Cory Stearns

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 serve 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.

All three of Maine's tree bat species (silver-haired, eastern red, and hoary bats) are considered species of special concern. They typically roost in tree foliage, are solitary, and migrate out of state for the winter.

Maine's cave bats include little brown (state endangered), eastern small-footed (state threatened), northern long-eared (state endangered, federally endangered), big brown (special concern), and tricolored bats (special concern, but proposed as state threatened and federally endangered). Bats in this group 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.

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 of infected bats. The fungus grows in dark, moist, cool environments where bats hibernate, and bats or people can easily move the spores from one cave to another. Bats with the disease tend to wake more often from hibernation, which causes them to burn through precious energy reserves and eventually 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%. Unfortunately, WNS has now been confirmed in at least 38 states and eight Canadian provinces. Researchers are studying the disease to determine effective treatment options and better understand why some individuals or species are more resistant than others, but there is a lot left to learn.



## Monitoring

Bats are notoriously difficult to study — they are active at night, they are challenging to catch, and it now takes a lot of effort to locate some species. Luckily, we have specialized acoustic detectors that record high frequency bat calls and computer software that can identify various species' calls.

In 2015, MDIFW began conducting annual bat acoustic surveys using various methodologies. In the summers of 2015-2020, we collected data from stationary survey sites (i.e., where detectors are set in one location for the duration of the survey) and shared it with researchers Jesse de La Cruz and Dr. Mark Ford of Virginia Tech. Using presence/absence data for each species, as well as remotely sensed data, they were able to identify habitat features that influence the presence and detectability of each of our eight species and generate maps of where each species is likely to occur in the state. This work has greatly increased our knowledge of Maine's bat populations, and was used to establish our long-term monitoring program, which we initiated in 2022.

Previously, we surveyed new sites each year as means of establishing baseline information about our bat populations. Now that we have a solid understanding of our bats' relative abundance and distribution, we have transitioned to a long-term monitoring program. Although we will still survey some new sites each year, most will be repeated on a two-year rotation, with half the sites surveyed in even years and half in odd years. This will give us a more statistically robust methodology for tracking trends in our bat populations.



Prior to the 2022 survey season, we used the results of previous surveys to select many sites for inclusion in the long-term monitoring program, prioritizing those where our rarest species (i.e., northern long-eared, eastern small-footed, and tricolored bats) had been detected. To avoid issues with dependency between sites and to spread our effort across the state, we imposed a 1-km minimum distance between sites and a limit of two sites per property. Our conservation partners at Rachel Carson National Wildlife Refuge and Katahdin Woods and Waters National Monument also contributed their bat monitoring data.

**STATIONARY SURVEYS**

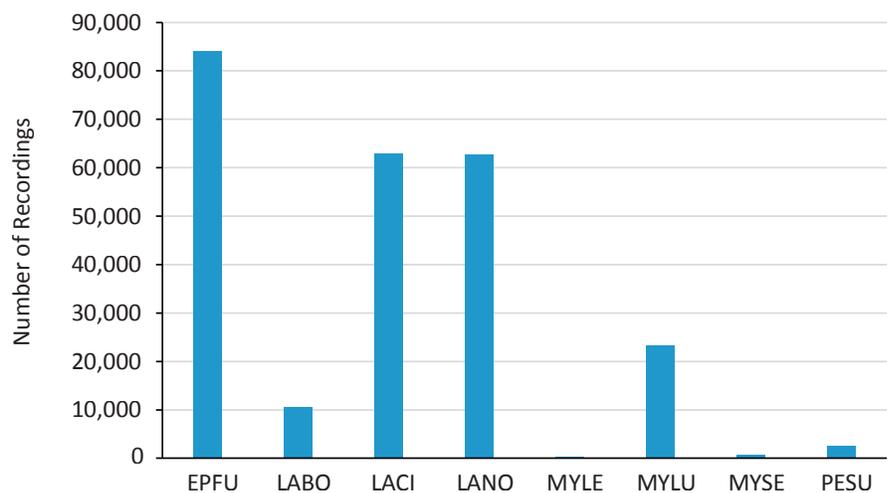
In 2022, MDIFW and our conservation partners surveyed 225 stationary acoustic sites for a total of about 2,700 detector nights, with >248,000 recordings that were identifiable to species. The results of the 2022 surveys were similar to the Virginia Tech’s previous analysis, with big brown, hoary, and silver-haired bats collectively composing about 85% of all recordings. On the other end of the spectrum, our three rarest species (eastern small-footed, northern long-eared, and tricolored) each accounted for ≤1% of recordings. Hoary bats were detected at the most sites (82.7%), followed by little brown and eastern red bats (67.6%), big brown (61.8%), silver-haired (44.0%), eastern small-footed (12.0%), northern long-eared (8.4%), and tricolored bats (7.1%).

Through our summer monitoring efforts to date, interesting trends have emerged regarding Maine’s bat species distribution. Generally, species richness (the number of species present) and the number of bat recordings are both higher in the southern parts of the state, indicating that bats are more abundant there than they are in northern Maine.

As far as specific species go, big brown bats often roost in barns and attics, so it’s not surprising that their summer distribution is similar to Maine’s human distribution. Eastern red bats are present statewide, but uncommon in Aroostook County. Hoary bats are abundant throughout the state, but in 2022 were found more often in northern regions. Silver-haired bats occur most often in coniferous forests, so they are generally more abundant in northern areas. Little brown bats are well-distributed, but in 2022 were found at a higher portion of sites in northern Maine. Northern-long eared bats are rarely documented, but in 2022 were more commonly documented in coastal areas. Eastern small-footed bats are typically found in taluses, cliffs, or other rocky areas, and in the last two years have been found most often in southern and downeast Maine. And finally, tricolored bats have a patchy distribution and occur most often around major waterbodies.

**FIGURE 1. THE NUMBER OF RECORDINGS IDENTIFIED TO SPECIES AT 225 STATIONARY ACOUSTIC SITES IN MAINE DURING SUMMER 2022.**

EPFU= big brown bat, LABO = eastern red bat, LACI = hoary bat; LANO = silver-haired bat; MYLE = eastern small-footed bat; MYLU = little brown bat; MYSE= northern long-eared bat; PESU = tricolored bat





**FIGURE 2. STATIONARY ACOUSTIC SURVEY SET-UP AT MAJOR GREGORY SANBORN (BROWNFIELD BOG) WILDLIFE MANAGEMENT AREA, THE ONLY SURVEY SITE WHERE ALL EIGHT SPECIES WERE CONFIRMED IN 2022.**

**MOBILE SURVEYS**

While stationary acoustic surveys are great at detecting whether or not an area is occupied by a species, the current technology does not tell us how many individuals are present. A better methodology for monitoring bat abundance is the mobile survey. Mobile acoustic surveys involve attaching a microphone to a vehicle, which is driven at a constant 20-mph speed for the length of the survey. Since the detector moves at a rate faster than bats typically fly, each recording is likely from a different bat. This allows us to compare the actual numbers of bats detected during surveys. To supplement our stationary survey effort in 2022, we revisited nine mobile routes (ranging from 27 to 33 miles long) that we had previously surveyed in 2017 and 2018. In 2022, we detected more big brown, eastern red, hoary, and little brown bats per survey route than we did in the previous years. However, silver-haired bat numbers were lower in 2022.

**FIGURE 3. AVERAGE NUMBER OF BAT RECORDINGS PER MOBILE SURVEY ROUTE, OF NINE ROUTES SURVEYED IN BOTH 2017 AND 2022.**

LANO=silver-haired bat; MYLE=eastern small-footed bat; MYLU=little brown bat; MYSE=northern long-eared bat; PESU=tricolored bat

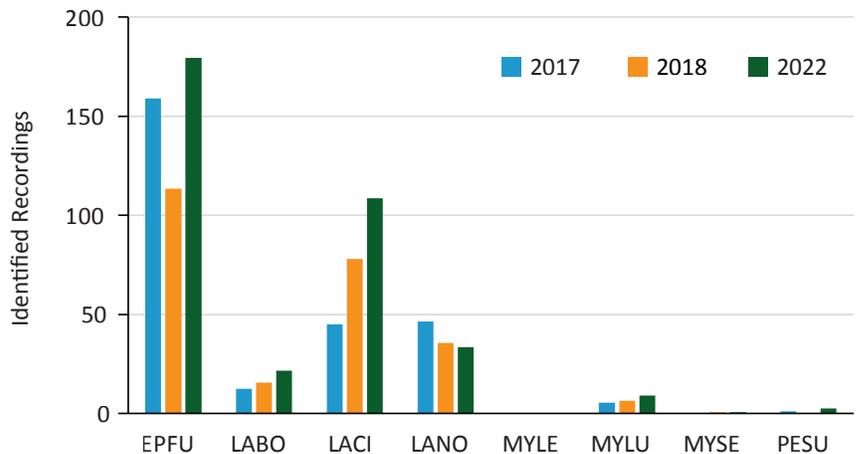




Photo by Ann Froschauer, USFWS.

### 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 hibernate. Research in other states suggests the *Myotis* bats (i.e., little brown, northern long-eared, and eastern small-footed) also hibernate throughout the winter in between the rocks in talus slopes and cliff faces. Since Maine has few caves, gaining a better understanding of our non-traditional alternatives will help our bat conservation efforts. To that end, researchers at MDIFW, Acadia National Park, and the University of Maine partnered on a research project to document whether bats are over-wintering on talus slopes in Maine.

During the winters of 2017/18, 2018/19, and 2019/20, we used acoustic detectors to record bat activity during the core winter period (Dec.-Feb.) on talus slopes in western, central, and coastal Maine. We confirmed bat presence at 25 of 43 survey locations, including detections of big brown (25 sites), eastern small-footed (7 sites), little brown (10 sites), and northern long-eared bats (4 sites). The results suggest that the *Myotis* species are more likely to use larger and more open (i.e., fewer trees) talus slopes for over-wintering. The findings of this study will help us conserve areas with documented winter use and inform future research.

### 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 make wonderful homes for many species (including bats) that 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 [www.batcon.org/resources/getting-involved/bat-houses](http://www.batcon.org/resources/getting-involved/bat-houses).

**Keep them outdoors.** Learn more about how to bat-proof your home here: [www.maine.gov/ifw/fish-wildlife/wildlife/living-with-wildlife](http://www.maine.gov/ifw/fish-wildlife/wildlife/living-with-wildlife).

**Remove with care.** If you already have a colony of bats living in your attic and want to remove them, we recommend you avoid doing so during the maternity season (summer) when young are unable to fly, or in winter when they need to be hibernating.

**Keep your distance.** Never pick up and handle bats. Some bats carry rabies, which is fatal to people and pets if left untreated.

**Remove with care.** If you find a bat in your home, close the interior doors and open the exterior doors and windows to let it fly out on its own. If that doesn't work, 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: [www.maine.gov/ifw/fish-wildlife/wildlife/living-with-wildlife/orphaned-injured-wildlife](http://www.maine.gov/ifw/fish-wildlife/wildlife/living-with-wildlife/orphaned-injured-wildlife).

**Get a test.** If a bat is found in a room with an intoxicated, handicapped, sleeping person, 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 Maine CDC (1-800-821-5821).

**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: [www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/report-bat-colony.html](http://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/report-bat-colony.html).

# NORTHERN BOG LEMMINGS

Cory Stearns

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.

The U.S. Fish and Wildlife Service is currently reviewing the northern bog lemming for potential listing under the federal endangered species act. As part of the review process, in 2021 they conducted a survey effort in Maine (and other states) to collect additional information on the current distribution of the species. MDIFW coordinated with USFWS on survey methodology (which was based on Dr. Olson's methodology developed in Maine) and site selection. The survey effort did document a few new northern bog lemming locations. Due to having few known locations in Maine, further research on their distribution and population status 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

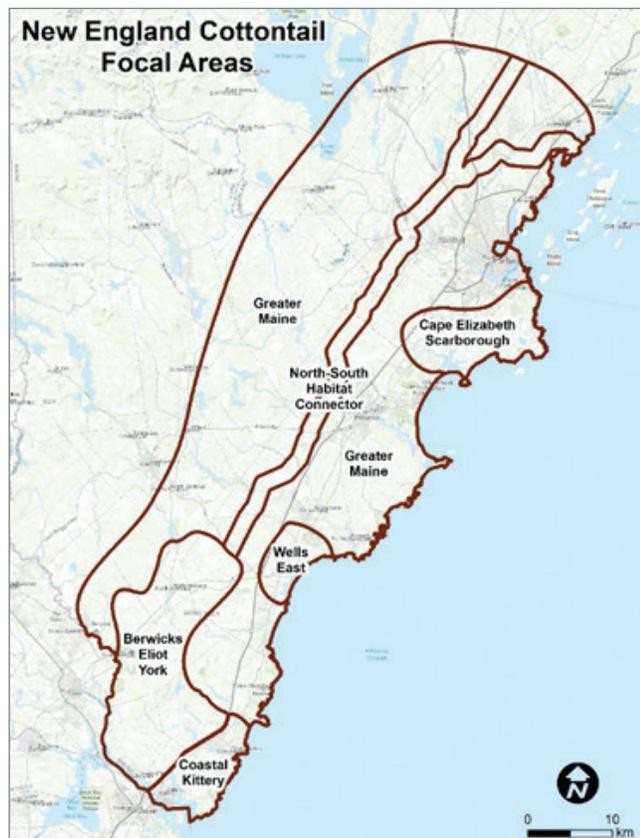
Cory Stearns

## About the Rabbit

The New England cottontail (NEC; *Sylvilagus transitionalis*), or cooney, was once a common rabbit in southern and coastal Maine, ranging from Kittery to Belfast. However, NEC populations declined dramatically as old fields reverted into mature forests and shrubland was developed into residential areas.

In 2004, MDIFW closed the hunting season on NEC; and in 2007, we listed the species as endangered. By 2008, there were no known populations of NEC north of Portland. Today, there are only about 300 individuals in the state, which are only known to occur in 6 towns: Cape Elizabeth, Scarborough, Wells, York, Kittery, and Eliot.

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



The decline of NEC in Maine and in other northeastern states raises concern over the status of other wildlife species that use shrubland and young forest habitats. There are at least 42 Species of Greatest Conservation Need (SGCN) that use similar thicket habitats, including the eastern towhee, American woodcock, and black racer. Dense, shrubby habitat is rare in southern Maine, making up less than three percent of the land base; so most NEC restoration efforts are targeted at creating or maintaining such areas for the benefit of NEC and other wildlife

## 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, Wildlife Management Institute, the National Fish and Wildlife Foundation, and Wells National Estuarine Research Reserve. Much 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 and newly created habitat. Our habitat restoration efforts are led by Maine's NEC Restoration Coordinator Sarah Dudek, who is based at Rachel Carson National Wildlife Refuge. Among other duties, Sarah actively recruits and works with private landowners to manage their lands for cottontails and other wildlife species dependent on shrubland and young forest habitats. If you're a landowner within the NEC focal areas, and you are interested in conducting habitat management for New England cottontails, please contact Sarah at [sarah\\_dudek@fws.gov](mailto:sarah_dudek@fws.gov) or (207) 646-9226.

## Monitoring Efforts

MDIFW participates in a regional program to monitor the trend in the number of habitat patches occupied by NEC throughout their range (including parts of ME, NH, MA, CT, RI, and NY). This helps guide management efforts by telling wildlife managers whether current NEC populations are expanding into new areas or being lost from formerly occupied areas.

To conduct this survey, biologists search patches for fecal pellets, which we then send to laboratories at the University of New Hampshire and University of Rhode Island for

DNA analysis to confirm the species (i.e., New England cottontail, eastern cottontail, or snowshoe hare). Each site in the program is surveyed on a 2-year rotation, with half the sites surveyed in even years and the other half in odd years. Because we always survey the same sites, any change in the number of occupied sites indicates a change in the NEC population.

The program has now been operating for five years; and during that time, we've observed a steady increase in the number of Maine sites occupied by NEC, from 21 sites in 2018 to 30 in 2022 (Table 1). However, the species still appears to be declining at the range-wide level.





**TABLE 1. THE NUMBER OF PATCHES CONSIDERED OCCUPIED BY NEW ENGLAND COTTONTAILS AMONG THE 51 MAINE SITES SURVEYED REGULARLY (JAN.-MARCH EACH YEAR) SINCE THE FIRST YEAR OF THE REGIONAL MONITORING PROGRAM (2018), BY FOCAL AREA.** The 2017 column represents the number occupied sites as of 2017 or the most recent survey (up to 5 years prior). N denotes the number of sites surveyed in the five years before the monitoring program. N denotes the number of sites surveyed as part of the regional monitoring program.

FOCAL AREA	2017	2018	2019	2020	2021	2022
Cape Elizabeth/ Scarborough (N= 27)	10 (n=18)	14	17	18	19	20
Eliot/York/Berwicks (N=9)	3 (n=5)	2	2	1	2	2
Coastal Kittery (N=9)	4 (n=5)	4	4	4	4	3
Wells East (N = 6)	0 (n = 5)	1	1	1	2	5
<b>Total (N=51)</b>	<b>17 (n=33)</b>	<b>21</b>	<b>24</b>	<b>24</b>	<b>27</b>	<b>30</b>

In addition to the regional occupancy surveys, MDIFW also surveys other areas each year in hopes of uncovering new NEC locations. Over the last five years, we have documented a few previously unknown locations each year, increasing our total number of known occupied patches to 41. Most new detections are within 1 km of other known sites, but in 2021 we detected a NEC in western Wells within the North-South corridor focal area — the first detection in that focal area since 2001!

Once NEC are documented at a new site, that site is added to the regional monitoring program. Vacant sites are also added to the program to keep occupancy rates (% of sites that are occupied) at about 50%. This gives us an equal chance of documenting an increase or decrease in the population. There are currently 72 sites within the regional monitoring program.

**Captive Breeding and Translocation**

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

The first captive-bred rabbits released in Maine were released at the Wells National Estuarine Research Reserve in fall 2017. A total of 60 rabbits were released at the Reserve in the falls of 2017-2019, with another four in fall 2021. We monitored success of the releases by conducting fecal pellet collection surveys each February. Melissa Bauer (PhD student at the University of New Hampshire) then conducted a detailed genetic analysis to determine the number of individuals present. The Wells Reserve population has risen from five individuals in 2019 to 17 in 2020, 25 in 2021, and 30 in 2022. Further, NEC dispersing from the Reserve have colonized seven other nearby patches of suitable habitat that were previously vacant.

In March 2022, the Rhode Island Division of Wildlife provided three NEC from the Patience Island colony, and MDIFW live-trapped five individuals from an existing population in Cape Elizabeth. We temporarily held these eight NEC at the Maine Wildlife Park before equipping them with radio collars and releasing them at Scarborough Marsh Wildlife Management Area. As of this writing (12/16/2022), seven of the eight were still alive. In summer 2022, game camera images documented uncollared rabbits, suggesting successful reproduction. In fall 2022, we released an additional seven NEC, including one from the Great Bay NWR pen, four from Roger Williams Zoo, and two from Queens Zoo.

## 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) 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 cottontails, which are nearly indistinguishable to NECs, but are not native to New England.

Around 1900, state wildlife agencies and hunting clubs started introducing tens of thousands of eastern cottontails into the southern New England states. The introduction of non-native animals or plants often threatens native wildlife populations. In this case, the introduced eastern cottontail can use a wider variety of habitats and tends to have higher survival and reproductive rates than our native NEC. Eventually, when the two species occur together, eastern cottontails can displace NEC. For example, Rhode Island has lost almost all of its NEC population and now has primarily eastern cottontails.

In 2017, wildlife biologists verified an eastern cottontail population in Maine for the first time. They were documented 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. Until 2020, EC populations were only known to occur on Badger's Island; but a few other individuals were confirmed after being transported into the state accidentally in potted plants and other landscaping materials and intentionally by well-meaning people that rescued orphaned young in other states. We have also documented a couple road kills of unknown origin. In 2021, eastern cottontail populations were detected in Kittery, South Berwick, and Portland, and one individual was found in Wells. In 2022, we detected more ECs in each of those towns, plus in York. Unfortunately,

the two cottontail species can hybridize, and in 2019 two New England cottontail x eastern cottontail hybrids were detected in Cape Elizabeth. Hybridization appears to be rare, but does pose another threat to the persistence of New England cottontails.

## What you can do to help:

If you're interested in aiding MDIFW's NEC restoration efforts, there are several ways to do so. First, if you're a landowner in one of the towns that currently has NEC, we'd love to talk to you about habitat management options on your property. Please contact Sarah Dudek (contact information is above) for more information. If you're not a landowner, you can support your local towns and land trusts as they conduct management activities. Finally, you can report any cottontail sightings to MDIFW's cottontail reporting webpage: [mefishwildlife.com/rabbits](http://mefishwildlife.com/rabbits). This page was launched in November 2021, but already has received >330 reported sightings. Most sightings are actually from snowshoe hares, but some have certainly been New England cottontails. Reported sightings will be used to direct winter surveys, and as a way to track population expansion of both cottontail species.

MDIFW would like to thank the following volunteers and contractors for participating in the New England cottontail project: Melissa Bauer, Abigail Burke, Sarah Dudek, Madi Harvey, Adrienne Kovach, Helen Manning, Julia Mast, and Jeff Tash.

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.

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2021-2022

RESEARCH + MANAGEMENT REPORT

Reptile, Amphibian, and Invertebrate  
Conservation & Management



Download additional sections at [mefishwildlife.com/wildlifereport](https://mefishwildlife.com/wildlifereport)



# 2021-22 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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- » Regional Wildlife Management

**Compiled and edited by  
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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, provides expertise on issues related to reptiles, amphibians, and invertebrates, and advises more broadly on endangered and nongame species policy. Some of his recent projects include: facilitating updates to the state's endangered and threatened species list; supervising MDIFW's program for protecting high-value vernal pools; co-coordinating state atlas efforts for butterflies, dragonflies, amphibians, and reptiles; and advising landowners and land trusts on best management practices for conserving at-risk species. Phillip is also a Graduate Faculty member at the University of Maine's Department of Wildlife, Fisheries, and Conservation Biology and a Research Scientist in the Colby College Biology Department.



### 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, Blanding's turtles, spotted turtles, and wood turtles, and is coordinating Maine's efforts on these species with those of several working groups across the Northeast. Derek is also studying and developing recommendations on 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 2021-2022:

Dr. Catherine Bevier  
 Kalyn Bickerman-Martens  
 Dr. Steve Burian  
 Dr. Ron Butler  
 Dr. Aram Calhoun  
 John Calhoun  
 Dr. Matthew Chatfield  
 Sequoia Dixon  
 Charlene Donahue  
 Dr. Frank Drummond

Sarah Haggerty  
 Victoria Hughes  
 Dr. Malcolm Hunter  
 Dr. Mike Jones  
 Dr. Michael Kinnison  
 John Klymko  
 Gregory LeClair  
 Derek Moore  
 Ethan Nedeau  
 Trevor Persons

Bryan Pfeiffer  
 Dr. Leif Richardson  
 Karen Robbins  
 Dr. Patrick Roberts  
 Marcia Siebenmann  
 Lisa St. Hilaire  
 Dr. Herb Wilson  
 Mark Ward  
 Dr. Liz Willey  
 Dr. Bruce Young



# 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). Some are of regional and national conservation concern, and about 1/3 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 2022 annual meeting in West Virginia. 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 (PAR-CAs); 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](http://parcplace.org)

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

## Maine Amphibian and Reptile Atlas Project (MARAP)

Derek Yorks and Phillip deMaynadier

**1<sup>ST</sup>, 2<sup>ND</sup>, AND FORTHCOMING 3<sup>RD</sup> BOOK EDITIONS (1992, 1999, 2024)**

In 1986, MDIFW, in cooperation with Maine Audubon and the University of Maine, launched 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 first step culminated in the 1992 publication of the book, *The Amphibians and Reptiles of Maine*, the first edition of which sold out within two years.

By 1998, new data had been compiled and there was increasing demand for updated information on the state’s herpetofauna. 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 adding color photographs.

Still generating data after 37 years, MARAP is Maine's longest-running community science project. With more than 16,000 records currently logged into MDIFW's electronic database (more than six times the number included in the 1998 book!), a new team of editors (M. Hunter, A. Calhoun, T. Persons, P. deMaynadier, and D. Yorks) has embarked on a third edition of *The Amphibians and Reptiles of Maine* for publication with University of Maine Press. The updated work will be written for a diverse audience of scientists, naturalists, and curious members of the public. In so doing, the new book will help advance both of MARAP's longstanding goals: 1) to raise public awareness of and concern for these under-appreciated vertebrate groups, and 2) to improve our scientific knowledge of Maine's herpetofauna.

### CONTINUING DATA COLLECTION

Since the most recent atlas's publication, 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 2022, 1,700+ volunteers had logged over 16,000 records, nearly all of which were carefully vetted and digitally curated by Trevor Persons, a consulting herpetologist. Read on to learn how you can contribute to this ongoing atlas effort.

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

During the 2021-2022 field seasons, MDIFW made additional efforts to advance MARAP by filling distribution gaps, exploring the limits of species distribution within the state, and investigating novel occurrences in need of verification. Our field surveys yielded many new and notable township occurrences, including:

- The first documentation of **Northern dusky salamanders** in Washington County and confirmation that they are distributed throughout easternmost Maine

- Confirmation of **pickerel frog** northwest of Fort Kent in the St. John drainage bordering New Brunswick, where the species range is disjunct from the rest of Maine
- A 25% increase in vouchered townships for **four-toed salamanders**, including a new northernmost record near Baxter State Park
- A western mountain occurrence of **blue-spotted salamander** at >2,300 feet – the highest-documented elevation in Maine and possibly range-wide.

Because of their regional significance, many of these records have been submitted for publication in a scientific journal.

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 reptile and amphibian observations online on MDIFW's Maine Amphibian and Reptiles Atlas Project website: [mefishwildlife.com/atlas](https://mefishwildlife.com/atlas) (Figure 1).
2. Use the popular iNaturalist app. Within the platform, just look for the project, *Maine Amphibian and Reptile Atlas Project*. All Maine amphibian and reptile observations added to iNaturalist are automatically added to this project.

**FIGURE 1. SCREEN CAPTURE OF MARAP DATA ENTRY PORTAL**

*This work is supported by the federal (USFWS) 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 six state-listed species below to: [derek.yorks@maine.gov](mailto:derek.yorks@maine.gov) or (207) 941-4475



*Blanding's turtle (Endangered) photo by Derek Yorks*



*Black racer (Endangered) photo by Derek Yorks*



*Spotted turtle (Threatened) photo by Derek Yorks*



*Wood turtle (Special Concern) photo by Derek Yorks*



*Ribbon snake (Special Concern) photo by Trevor Persons*



*Northern spring salamander (Special Concern) photo by Trevor Persons*

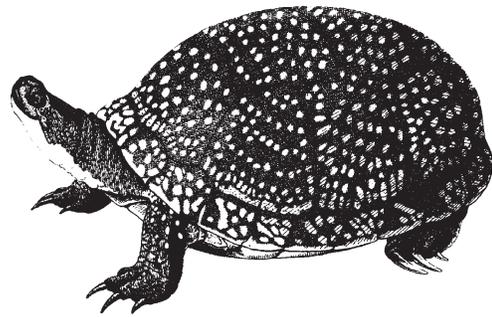
## Blanding's and Spotted Turtles

Derek Yorks

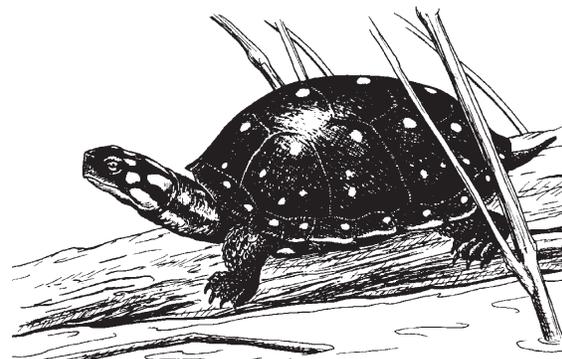
For over 30 years, MDIFW has researched the distribution and status of Blanding's (Endangered) and spotted (Threatened) turtles in Maine. Blanding's turtles are seven to 10 inches long with a yellow throat and light-colored flecking on a helmet-shaped shell. They are found primarily in York County and 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 migratory 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 expand 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 is no match for a car tire.



*Blanding's Turtle drawing by Abigail Rorer*



*Spotted Turtle drawing by Mark McCollough*

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. Population analyses of Blanding's turtles indicate that as little as 2 to 3% additive annual mortality of adults is unsustainable. In other words, losing just a few breeding adult turtles in a population each year to roadkill, or other causes such as illegal collection, can drive local populations to extinction.

### CONSERVATION EFFORTS

MDIFW is currently involved in multiple 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 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 northeastern states have been 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*.

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.



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 in York County 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. Now in its 17th year, this project was one of the first of its kind among northeastern states.

#### 3. Maine's First Turtle Passage System: In southern Maine, where road densities and traffic volumes are significant, road mortality is a serious threat to rare turtles and other wildlife.

One particular stretch of highway – a segment of Route 236 in Eliot – stands out as the state's deadliest known road segment for Blanding's turtles, with seven mortalities documented since 2013. During that same time, other at-risk species mortalities documented at the site include spotted turtle (Threatened) and New England cottontail (Endangered).

In 2019, we constructed a half-mile exclusionary barrier on both sides of the road where it bisects diverse freshwater wetlands. Then in the spring of 2021, we built a large concrete box culvert that is now tied into the barrier fencing.

This effort to reduce Blanding's turtle mortality and permit safe wildlife passage under Route 236 was a cooperative endeavor between MDIFW and Maine MDOT. The Maine Turnpike Authority (MTA) and USFWS provided additional financial support.

Technical challenges have hampered efforts to monitor turtles' use of the culvert, but we consider the project to be an overall success. Road mortality surveys along the fenced segment have documented that just a handful of painted turtles managed to travel beyond the end of the fence and were killed while attempting to cross the roadway.

#### 4. Improving Nesting Habitat for Blanding’s Turtles:

Most modern-day Blanding’s turtle nesting sites are created by human disturbance; and without periodic management, these bare gravel, sand, or soil areas are eventually overcome with vegetation that is too thick to permit successful reproduction.

MDIFW, in partnership with local land trusts, private landowners, and the U.S. Forest Service, is working to monitor (using time-lapse cameras to document nesting females), and in some cases create or enhance nesting habitat at several of Maine’s Blanding’s turtle sites.

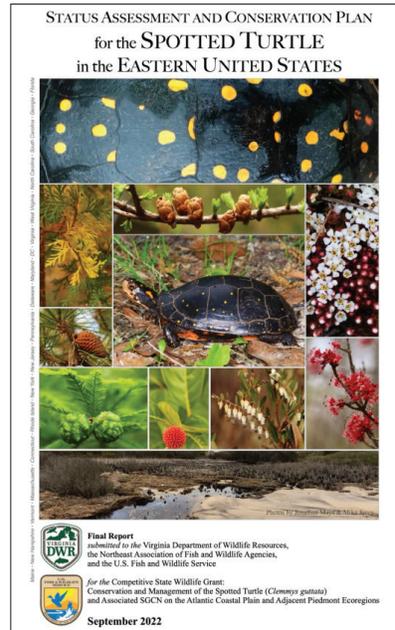
This ongoing habitat-focused management effort will improve long-term viability of Maine’s regionally important Blanding’s turtle populations and reduce the need for nesting females to travel outside core or interior areas of sites. Nesting area management may also enhance nest success and hatchling 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 severe disturbance and human-subsidized predators, such as raccoons and skunks.

#### 5. Spotted Turtle Conservation in the Eastern U.S:

In 2017, MDIFW, along with 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 have since been confirmed in another four counties as far north as central and mid-coast Maine, adding significantly to our knowledge of the species’ distribution rangewide.

Under this grant, MDIFW broadened its spotted turtle population assessments, making a special effort to gather baseline data at sites supporting the 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.

These efforts in Maine, and from other participating states throughout the species’ range, culminated in 2022 with the publication of the **Status Assessment and Conservation Plan for the Spotted Turtle in the Eastern United States (Figure 2).**



**FIGURE 2.**  
**THE NEWLY PUBLISHED SPOTTED TURTLE STATUS ASSESSMENT AND CONSERVATION PLAN.**

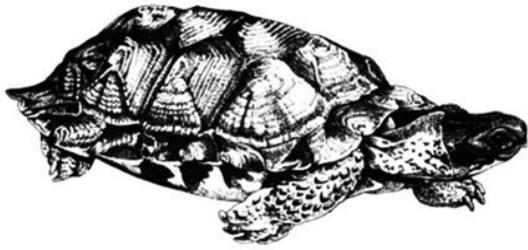
*This work is supported by the federal (USFWS) State Wildlife Grants program, the Maine Department of Transportation, The Nature Conservancy, the Maine Outdoor Heritage Fund, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance.*

## Regional Wood Turtle Conservation

Derek Yorks

The wood turtle, listed as Special Concern, is one of Maine’s rarest and most vulnerable turtles. This medium sized (five to eight inches) species with a distinct sculpted shell and orange coloration on its neck and legs can survive for 60 years or more.

For much of the year, wood turtles are found in slow to moderate moving clear-water streams with predominantly sand or gravel substrates. 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 pools, under riverbanks, or beneath woody debris. No other Maine turtle species makes such extensive use of both aquatic and terrestrial habitats.



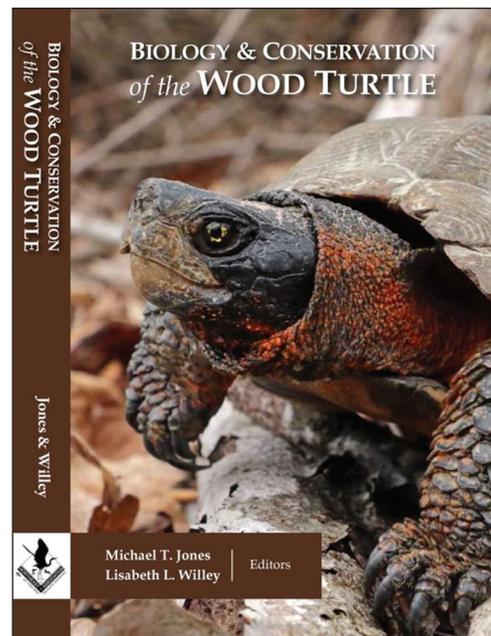
Drawing by Abigail Rorer

Widespread concern about the wood turtle's status prompted the 2009 establishment of the Northeast Wood Turtle Working Group (NEWTWG) through the Northeast Partners for Amphibian and Reptile Conservation (NEPARC). This group, consisting of agency biologists, agency representatives, land managers, and others from 13 states and the District of Columbia, has collaborated on several major initiatives. In 2014, MDIFW and seven other state wildlife agencies active in NEWTWG were awarded a federal Competitive State Wildlife Grant (CSWG) entitled *Conservation Planning and Implementation for the Wood Turtle (*Glyptemys insculpta*) and Associated Riparian Species of Greatest Conservation Need from Maine to Virginia*. This project was active from 2014-2017, during which time MDIFW biologists conducted standardized field surveys and participated in a regional, data-driven, scientific process for delineating the state's best wood turtle populations. The results of this effort included identification of a wood turtle Conservation Area Network (CAN) and publication of a *Conservation Plan for the Wood Turtle in the Northeastern United States*. This study was the most comprehensive to date on the wood turtle in the Northeast, and it helped to establish a conservation baseline for this vulnerable and beautiful denizen of Maine's wild rivers and forests.

In 2021, a second CSWG entitled *Regional Conservation for Wood Turtles and Related Emydine Turtles* was awarded to Maine and many of the same states that participated in the first CSWG. This new grant has enabled northeastern states and their partners to continue gathering baseline data on wood turtle populations and engage in conservation actions outlined in the first CSWG's conservation plan. In Maine, this new effort has primarily focused on gathering baseline data on populations across the state so that they may be identified, tracked, and conserved.

During the spring and fall seasons of 2022, MDIFW staff and seasonal field technicians conducted standardized surveys for wood turtles at sites around the state. Over the course of the 2022 field season, and to a limited extent during 2021, MDIFW conducted 113 standardized surveys at 21 sites including 46 unique 1-km segments (many sites contain more than one survey segment). Biologists made 185 wood turtle captures representing 157 individual animals. Work on this project will continue through 2023 with another season of sampling, conservation planning, and a symposium on the conservation of wood turtles and related Emydine turtles to be held in Pennsylvania in July.

In 2022, a new book, *Biology and Conservation of the Wood Turtle*, was published by the Northeast Association of Fish and Wildlife Agencies (**Figure 3**). This publication is dedicated to the evolution, ecology, biology, spatial ecology, habitat needs, and conservation of the wood turtle. MDIFW biologists and other specialists from 13 state fish and wildlife agencies and non-governmental conservation groups contributed to this impressive body of work. Supported in part through regional State Wildlife Grants, this semi-technical and richly illustrated 235-page publication will be of interest primarily to natural resource professionals and land managers.



**FIGURE 3. RECENTLY PUBLISHED WOOD TURTLE BOOK, INCLUDING CONTRIBUTIONS FROM MAINE.**

# Northern Black Racers

Derek Yorks



Adult northern black racer photo by Derek Yorks

## HABITATS AND STATUS 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, the Northern black racer is listed as a Species of Greatest Conservation Need (SGCN) in all six New England states and is state Endangered in Maine. 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.

## POPULATION MONITORING

In the spring of 2016, MDIFW biologists initiated a multi-year project seeking to confirm and document new or poorly known occurrences, study habitat use, and to establish a monitoring program at sites where black racer populations occur. 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 assessed 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 indicates that even Maine's very best sites support relatively small populations.



Neonate northern black racer. As hatchlings, and for their first year, they have a blotched pattern that will soon fade to the characteristic black of adults. photo by Derek Yorks

The radio-telemetry study, which began in 2016, continued through 2021 and will resume in 2023. During the six years from 2016 to 2021, we used VHF radio transmitters to track a total of 53 racers. We have now conducted telemetry at five sites, tracking anywhere from six to 14 individuals each year. Data gathered on occupancy, abundance, and habitat use of northern black racers will guide future conservation of this rare reptile.

A secondary component of the telemetry work has focused on monitoring racer habitat use prior to the construction of a commercial grid-scale solar development in Sanford. In 2021, we conducted our first season of post-construction monitoring to evaluate the effects of this development on racer habitat use. During this first season, we tracked 12 racers and observed almost no snake use beneath the solar panel arrays. We plan to keep monitoring habitat use at this site in 2023 and beyond.

## NEW POPULATION DISCOVERED IN SOUTHERN OXFORD COUNTY

Also in 2021, we confirmed the existence of a black racer population for the first time in Oxford County, which is likely the northern extent of the species' statewide range. We equipped two racers at this outlying site with radio transmitters in the spring to learn more about their movements and habitat use. Unfortunately, we lost track of both snakes relatively early in the season. MDIFW's work on racers during the 2022 season was limited to a few surveys in a new area of this site, where we were fortunate to document a neonate racer early in the fall. We plan to return to this promising site again in 2023 and track a larger number of individuals.

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



*Common mudpuppy  
photo by Trevor Persons*

## The Introduced Mudpuppy

Phillip deMaynadier

The mudpuppy is Maine's largest salamander and only non-native (exotic) amphibian species. Entirely aquatic in all life stages, this giant salamander (up to 14 inches) 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 has negatively affected Maine's aquatic communities; however, its ecological interactions as both predator and prey are largely unstudied. Anecdotally, anglers have expressed concerns that it 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 SGCN species in Maine, some of which overlap the mudpuppy's potential range. More study is needed to assess the mudpuppy's current range and its ecological effects on 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 and disease risk analysis to assess potential impacts on aquatic ecosystems.**
- 3. Increase public and angler awareness of mudpuppies and potential risks of new waterbody introductions.**

### eDNA SAMPLING

This project will 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. Given the challenge of mudpuppy detection and management, the prospect of combining eDNA sampling with traditional direct observation and trapping methods presents an exciting opportunity to determine and validate species occupancy estimates.



### IMPROVED TRAPPING TECHNIQUE

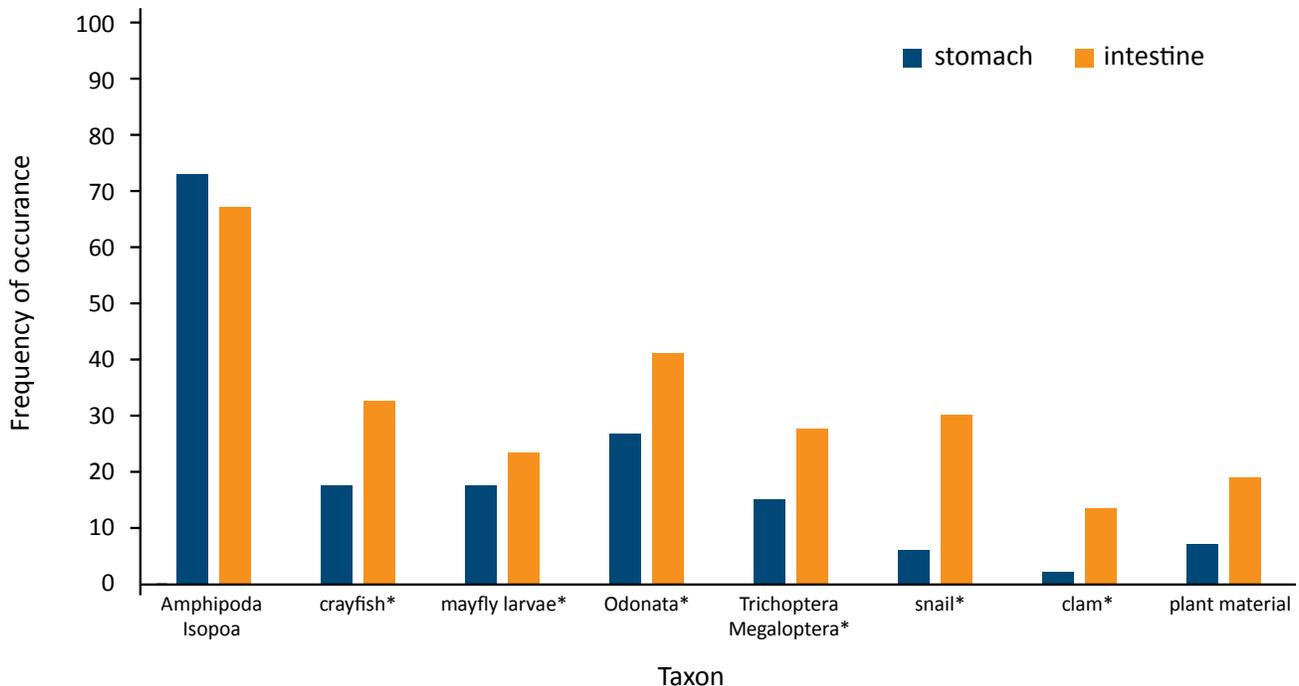
Following a review of previous capture techniques, we developed a methodology for trapping mudpuppies through the ice using modified, baited minnow traps. Using this technique, we captured 356 mudpuppies during the winters of 2017, 2018, and 2019, confirming presence in seven waterbodies: Salmon Lake (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 that 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, capture rates on Long Pond (Belgrade/Mount Vernon) equaled 1.45 animals per trap night (139 animals over 5 days), 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 300 mudpuppies to examine digestive tract contents. As a generalist predator, the mudpuppy consumes a wide range of prey. In Maine, it was found to consume seven major taxa: crayfish (Decapoda), mayflies (Ephemeroptera), amphipods (Amphipoda), damselflies and dragonflies (Odonata), alderflies (Megaloptera), snails (Gastropoda), clams (Bivalvia), as well as plant matter (Figure 4). By far the most frequent food items were amphipods (scuds), found 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 (USFWS) 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 4. FREQUENCY OF OCCURRENCE OF FOOD ITEMS IN STOMACHS (N = 194) AND INTESTINES (N = 281) OF MUDPUPPIES SAMPLED IN 2017 AND 2018. TAXA FOLLOWED BY AN ASTERISK INCLUDE AT LEAST ONE SPECIES OF CONSERVATION CONCERN (SGCN) IN MAINE.**



# 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 significantly declined. Habitat loss, pesticides, intensive agricultural

practices, diseases, and parasites introduced with commercially raised bumble bees, and climate change all may play a role. For the past several years, MDIFW has been collecting data to assess the diversity, distribution, and conservation status of Maine’s bumble bee fauna. Read on to see what we’ve learned, and be sure to check out “Pollinator Habitat” on page 24 for information on how you can help Maine’s bumble bees and other pollinators.

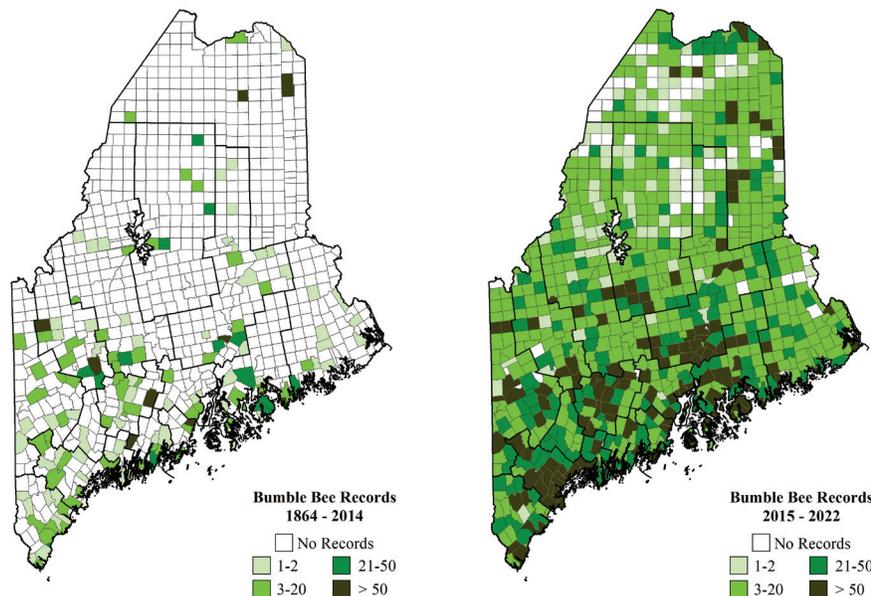


### THE MAINE BUMBLE BEE ATLAS: KEEPING TRACK OF NATIVE POLLINATORS

In 2015, MDIFW and the University of Maine initiated the Maine Bumble Bee Atlas (MBBA). This multi-year statewide survey enlisted the help of volunteer community 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.

During the project’s six seasons, more than 200 volunteers conducted surveys at more than 2,500 sites statewide and contributed more than 27,000 new Maine bumble bee records! Their efforts have greatly increased what we know about Maine’s bumble bees (Figure 5). Since the project ended in 2020, MDIFW has been steadily entering MBBA data into a database that documents what species are found in Maine, where they occur, and what habitats and forage plants they use. The data has already been extremely valuable in helping MDIFW determine which species appear to be rare or declining vs. stable or increasing.

**FIGURE 5. MAINE BUMBLE BEE RECORDS BEFORE AND AFTER THE MAINE BUMBLE BEE ATLAS PROJECT.**





As a result of MBBA, we’ve learned that 15 of the 17 species historically known to occur in Maine (Table 1) are still present – which is positive news, considering that some of these species have disappeared in other parts of their range. One example is the yellow-banded bumble bee, which has experienced rangewide declines but is now rebounding in northern New England. MBBA volunteers found this species every year of the project, in a wide range of habitats spanning more than 350 Maine townships.

While MBBA data indicate that most of Maine’s bumble bee species are still relatively abundant and widely distributed on the landscape, several species stand out as either inherently rare or significantly less common compared to historical records (Table 1). Two species were found at only one or two locations, and two others were not found at all and may now be extirpated from the state. Continue reading to learn more about Maine’s rarest bumble bees.

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

TABLE 1. BUMBLE BEES OF MAINE.

COMMON NAME	SCIENTIFIC NAME	STATE STATUS	SRANK
Rusty Patched Bumble Bee	<i>Bombus affinis</i>	SC	SH
Yellow-banded Bumble Bee	<i>Bombus terricola</i>		S3
Brown-belted Bumble Bee	<i>Bombus griseocollis</i>		S4S5
Red-belted Bumble Bee	<i>Bombus rufocinctus</i>		S3S4
Ashton's Cuckoo Bumble Bee	<i>Bombus ashtoni</i>	PE	S1
Lemon Cuckoo Bumble Bee	<i>Bombus citrinus</i>	SC	S3
Flavid Cuckoo Bumble Bee	<i>Bombus flavidus</i>		S3S4
Indiscriminate Cuckoo Bumble Bee	<i>Bombus insularis</i>	SC	S1
Two-spotted Bumble Bee	<i>Bombus bimaculatus</i>		S5
Common Eastern Bumble Bee	<i>Bombus impatiens</i>		S5
Confusing Bumble Bee	<i>Bombus perplexus</i>		S5
Sanderson's Bumble Bee	<i>Bombus sandersoni</i>		S4S5
Tri-colored Bumble Bee	<i>Bombus ternarius</i>		S5
Half-black Bumble Bee	<i>Bombus vagans</i>		S5
Northern Amber Bumble Bee	<i>Bombus borealis</i>		S4S5
Yellow Bumble Bee	<i>Bombus fervidus</i>	SC	S2
American Bumble Bee	<i>Bombus pensylvanicus</i>		SX

State Status: SC = Special Concern, PE = Proposed Endangered

SRANK is a state conservation status rank assigned to a species using NatureServe ([natureserve.org](http://natureserve.org)) ranking criteria. S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, SX = Presumed Extirpated, SH = Historical/Possibly Extirpated.

ON THE HUNT FOR MAINE’S RAREST BUMBLE BEE SPECIES

Two species that historically occurred in Maine but were not found during the MBBA project are the American bumble bee and rusty patched bumble bee.

The **American bumble bee** is known from just a few records and has not been reported in Maine since 1951. While still relatively common elsewhere, this species appears to have always been very rare in Maine and is now believed to be long extirpated from the state.

Conversely, the **rusty patched bumble bee** once 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 and not since 2009. Unfortunately, the rusty patched bumble bee has experienced a 90% population decline and reduction in range throughout North America, and in March 2017 became the first bumble bee to be protected by the U.S. Endangered Species Act. Beginning in 2019, with funding from the U.S. Fish & Wildlife Service, MDIFW has been conducting targeted annual surveys in the vicinity of the most recent occurrences, as well as in adjacent areas of southern and southwestern Maine. So far, despite four seasons of surveys at more than 200 sites, not a single rusty patched bumble bee has been found.

One of the most exciting MBBA finds came in 2017, when a volunteer collected an **Ashton’s cuckoo bumble bee** in northern Aroostook County. Once widespread across the state, this species is now one of the rarest bumble bees in North America and had not been recorded in Maine since 1996. Except for several observations in Alaska and Canada, where the species is listed as Endangered, our single occurrence is one of the only known recent records in the species’ former range. Because Ashton’s cuckoo bumble bee is an obligate nest parasite of both the rusty patched bumble bee and yellow-banded bumble bee, its decline is likely attributable in part to the rangewide declines experienced by these once common species.



*Rusty patched bumble bee photo by Johanna James-Heinz*



*Ashton's cuckoo bumble bee photo by USGS Bee Inventory and Monitoring Lab*

Due to its extreme rarity, Ashton's cuckoo bumble bee was proposed for listing as Endangered under the Maine Endangered Species Act in 2022. Although three more individuals were found at the same location in 2018 and 2019, surveys conducted in 2022 were unsuccessful. MDIFW will continue

searching in 2023, especially along the New Brunswick border where a few new occurrences were recently documented. If not already too late, one hope is that the rising numbers of yellow-banded bumble bees across Maine and other northern regions might support a gradual recovery of this critically imperiled species.

MBBA surveys also indicated that two other cuckoo bumble bee species are rare in Maine. The **indiscriminate cuckoo bumble bee**, which was previously known from just a handful of records and apparently never common in Maine, was documented at just two locations – also in northern Aroostook County. Historically more common and widespread, the **lemon cuckoo bumble bee** was only found in 17 different townships, most in Aroostook County and a few in western Maine. MDIFW listed both these species as Special Concern in 2022.

Not uncommon in historical collections, the **yellow bumble bee** has become alarmingly rare in Maine over the past decade. Despite six seasons of MBBA followed by targeted MDIFW surveys for rare species, only nine occurrences have been documented statewide since 2015. Known to be experiencing a long-term, steady decline in other parts of its range, particularly in the Northeast, the yellow bumble bee was listed as Special Concern in 2022. If its downward trend continues, it could qualify for state-Threatened status.

MDIFW will continue to look for these extremely rare species in hopes of finding additional populations. You can help by carefully observing the bumble bees you see and documenting any possible sightings with close-up, in-focus photographs. Then submit your photos to iNaturalist ([inaturalist.org](https://www.inaturalist.org)), which MDIFW will monitor for confirmed reports. For more information and tips on how to identify the rusty patched and other rare bumble bee species, please visit the Maine Bumble Bee Atlas website ([mainebumble-beebeatlas.umf.maine.edu](https://mainebumble-beebeatlas.umf.maine.edu)).

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*This work is supported by the federal (USFWS) State Wildlife Grants and Endangered Species Section 6 grants programs, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance from community scientists.*

# Damselflies and Dragonflies

Phillip deMaynadier

Insects in the order Odonata, damselflies and dragonflies are diverse and ecologically important members of Maine's wildlife community. Over 1/3 of North America's Odonate fauna — 160 species — have been documented in Maine. In fact, northeastern North America is considered a regional hotspot for damselfly diversity, hosting several species of global conservation concern.

## TRACKING THE ELUSIVE RINGED BOGHAUNTER DRAGONFLY

Listed as a State Threatened species and a Species of Greatest Conservation Need in Maine's 2015 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.



*Ringed boghaunter basking on a red maple trunk, South Berwick, Maine photo by Mark Ward*

MDIFW biologists discovered Maine's first ringed boghaunter in 1995. Since then, extensive fieldwork (>725 field surveys of >325 wetlands over 26 years) has only yielded 16 confirmed and probable breeding populations, all restricted to York and Oxford Counties. One of the challenges of boghaunter detection is the short (less than one month) spring field season when winged adults are active near their natal wetlands. To help extend field study opportunities, MDIFW is cooperating with the University of Maine's School of Biology and Ecology (Dr. Erin Grey and Christiana Teye) to explore the use of environmental DNA (eDNA) as a novel survey technique. eDNA consists of cellular DNA products shed from organisms into their environment, and has recently emerged as a sensitive and cost-effective alternative to traditional survey methods for cryptic species. Currently, this research is focused on identifying boghaunter genetic markers, which if successful, could help us identify the shed larval skins (exuviae) they

leave behind on aquatic vegetation upon transformation to adults. These exuviae are often more detectable than the far-flying adults and can persist for weeks or months, significantly extending the survey season.

In some cases, boghaunter dragonflies share their habitat with other species of conservation concern, including Blanding's turtles (State Endangered), spotted turtles (State Threatened), and Eastern 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 other vulnerable elements of Maine's biological diversity, identifying, characterizing, and mapping populations of the ringed boghaunter is an important first step toward forging species conservation strategies and partnerships with landowners, land trusts, towns, and others.



*New England bluet photo by Bryan Pfeiffer*

## AN ATLAS OF THE DAMSELFLIES AND DRAGONFLIES OF THE ACADIAN REGION

In 1998, MDIFW received a grant from the Maine Outdoor Heritage Fund to initiate the Maine Damselfly and Dragonfly Survey (MDDS). One of North America's first state-sponsored dragonfly atlas projects, the MDDS engaged trained community scientists to improve the Department's knowledge of statewide Odonata distribution and abundance. In addition to engaging nearly 250 Maine naturalists and raising public awareness of invertebrate conservation, the MDDS helped MDIFW more accurately assess the status of several at-risk species including the ringed boghaunter and boreal snaketail (both State Threatened), and 18 additional species of State Special Concern.

With the field survey component of the MDDS completed, the next phase is to compile and summarize the results by way of: a) a comprehensive database of all Odonate records of Maine and the Maritime Provinces (completed), b) a reference collection of Museum-curated specimens and digitally-archived photo vouchers of all 160+ species, c) a



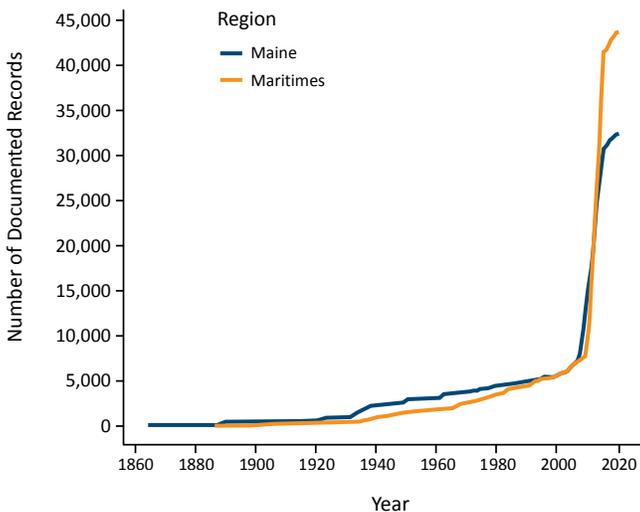


Pink-edged sulphur photo by Bryan Pfeiffer

The volunteer atlas component of the MBS project was launched in 2007 and completed its 10th field season in 2016. More than 25,000 new observations 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 7), 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 7. CUMULATIVE INCREASE IN BUTTERFLY RECORDS IN MAINE AND THE MARITIMES INDICATING THE RECENT DRAMATIC INCREASES ASSOCIATED WITH BOTH COMMUNITY SCIENCE PROJECTS.**

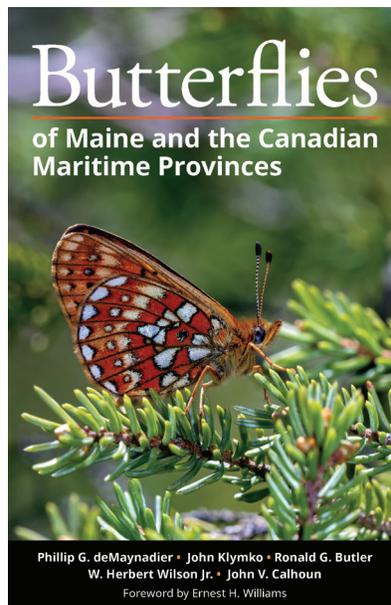


White admiral photo by Bryan Pfeiffer

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](http://mbs.umf.maine.edu)) has attracted more than 50,000 worldwide visits.

**NEW ACADIAN BUTTERFLY PUBLICATION**

In 2016, we began working with the Atlantic Canada Conservation Data Centre (John Klymko) to combine data from their recently completed Maritime Butterfly Atlas with that of the MBS project. A key product of this collaboration is a new book entitled *Butterflies of Maine and the Canadian Maritime Provinces*, available from Cornell University Press in the fall of 2023 (Figure 8). Other atlas and book collaborators include UMaine Farmington (Ron Butler), Colby College (Herb Wilson), and the Florida Museum of Natural History (John Calhoun).



**FIGURE 8. RECENTLY COMPLETED BOOK ON THE BUTTERFLIES OF THE ACADIAN REGION, WITH CONTRIBUTIONS BY MAINE COMMUNITY SCIENTISTS.**

We hope that this contribution will both summarize the state of Acadian region butterfly knowledge for scientists and introduce new members of the public to the fascinating world of butterflies and other invertebrates.

In addition to the publication, other recently completed MBS project deliverables include: a finalized electronic database of over 38,000 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.

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*The work is supported by the federal (USFWS) 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.*

## Flowerflies (Hoverflies)

Phillip deMaynadier

Reports of insect decline are widespread in the scientific and popular press, raising concerns that critical ecosystem functions such as pollination, decomposition, and food web provisioning are at risk of unravelling. Yet we still do not know the status of entire groups of insects, or why they might be declining. One such group that is known to be important for pollination in the Northeast is flower flies, also known as hover flies (order: Diptera; family: Syrphidae). With approximately 900 species in North America, these flies are among the most colorful and conspicuous insects found around flowers. Flower flies occur in a diverse range of moist northeastern habitats, from salt marshes to old-growth forests, and they play important ecological roles during different phases of their life cycle. As adults forage for nectar and pollen they pollinate many plant species including crops such as cranberries. And unlike young bees, who are fed by their mothers or colonies, flower fly larvae forage for themselves and typically serve as decomposers or predators of aphids and related insects.

Until now, MDIFW has not worked on flower flies, due to a lack of awareness of their importance and to limited capacity and expertise. This recently changed when, with assistance from NatureServe, Maine and a few other north-eastern states began developing state flower fly checklists followed by assessments of their rarity and risk status. To support this effort, NatureServe contracted John Klymko from the Atlantic Canada Conservation Data Centre to develop a list of Maine flower flies based on confirmed records gleaned from the literature, museum collections, online community science forums (e.g., iNaturalist, BugGuide), and recent surveys. Upon completion of this contract, Klymko delivered an electronic database of more than 3,500 Maine flower fly records and a checklist of 214 species including completed S-ranks per NatureServe methodology.



*Oblique-banded pond fly photo by Ron Butler*



*Bald-faced hornet fly photo by Ron Butler*

NatureServe is a North American network of scientists and institutions whose mission is to track the status and trends of at-risk species and habitats based on standardized, science-based methodologies. Core to this practice is the assignment of conservation status ranks indicating the threat of extinction or extirpation a species or subspecies faces at the global, national, and subnational (e.g., states and provinces) levels, using G-ranks, N-ranks, and S-ranks, respectively. **NatureServe status ranks** take into consideration factors of rarity, threats, and population trends, and can be defined as follows:

- **X:** Presumed extinct (G-rank) or extirpated (N-rank and S-rank).
- **H:** Possibly extinct — known from only historical occurrences but still hope of rediscovery.
- **1:** Critically imperiled — At very high risk of extinction or extirpation.
- **2:** Imperiled — At high risk of extinction or extirpation.
- **3:** Vulnerable — At moderate risk of extinction or extirpation.
- **4:** Apparently secure — At fairly low risk of extinction or extirpation.
- **5:** Secure — At very low risk of extinction or extirpation.
- **U:** Unrankable — Unrankable due to lack of information about status or trends.
- **NR:** Unranked — Rank not yet assessed.
- **NA:** Not applicable — The species is not a suitable target for conservation activities. Examples include nonnative species, rare colonists, and vagrants.

While we do not have enough records or life history information on most of Maine’s flower flies to develop informed ranks (making them State Unrankable, or SU), eight species were flagged as taxa of potential conservation concern. These included *Chrysogaster inflatifrons* (SH), *Eristalis brousii* (SX), *Sericomyia slossonae* (S1S3), *Volucella evecta* (S1S3), *Volucella facialis* (S1S3), *Parasyrphus tarsatus* (S1), *Platycheirus modestus* (SH), and *Sphaerophoria pyrrhina* (SX). These S-ranks are now available to the public via the NatureServe Explorer online database (**explorer.natureserve.org**). With this new information on a previously under-studied taxon, MDIFW is better prepared to consider adding at-risk flower flies to the state’s SGCN list during the 2025 State Wildlife Action Plan update, thereby leveraging SWG funds for increased survey, research, and conservation of this ecologically important group.

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*The work is supported by the federal (USFWS) State Wildlife Grants program, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, NatureServe, and the Sarah K. de Coizart Perpetual Charitable Trust.*

## Mayflies

Beth Swartz

Mayflies, or “shadflies” as they are often called, are a diverse group of insects with over 170 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.

### MAYFLY CONSERVATION

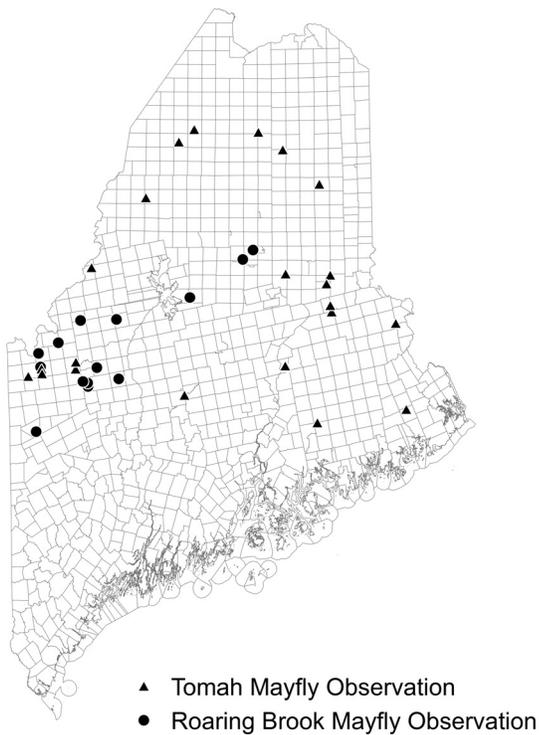
Most, but not all, of Maine’s mayfly species are common and widespread. Of the rarer mayfly species, Maine lists Roaring Brook and tomah mayflies as Threatened, and both are identified as Priority 1 Species of Greatest Conservation Need (SGCN) in Maine’s 2015 Wildlife Action Plan.

The **Roaring Brook mayfly** is among the rarest mayflies 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 170 streams and documented 15 where the mayfly occurs, all in the mountains of north central and western Maine (**Figure 9**).



*Roaring Brook mayfly photo by Don Chandler*

**FIGURE 9. DISTRIBUTION OF ROARING BROOK MAYFLY AND TOMAH MAYFLY IN MAINE.**



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. To learn more about this unique habitat and the Roaring Brook mayfly’s ability to survive its harsh conditions, be sure to read “Montane Headwater Streams” on page 29.

Like the Roaring Brook mayfly, **Brown’s comb minnow mayfly** is also a high-elevation, headwater stream specialist. To date, it has been recorded at just seven streams in Maine — five in Baxter State Park and two in the western mountains. Its only other global records are from similar habitats in Vermont and the White Mountains of New Hampshire, as well as a single record from Quebec. Of the 170 streams that MDIFW surveyed for Roaring Brook mayfly, we only found Brown’s comb minnow mayfly in two. The Roaring Brook and Brown’s comb minnow mayflies may be equally rare, but we can’t be certain yet. Because the minnow mayfly emerges in early spring, it may be under-sampled. For now it is listed as Special Concern, but to adequately assess its status in Maine, we will need to do more targeted survey work.



*Tomah mayfly ©Dwight Kuhn*

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 9**) 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.

To protect Maine’s state-listed mayflies, MDIFW regularly provides management guidelines for development projects and forest harvest activities that may impact their stream habitats. In 2020 and 2021, this included working with several ski resort expansion projects to avoid and minimize their impacts on potential Roaring Brook mayfly streams. The best management practices that we recommended focused on conserving forested riparian buffers, implementing Stream Smart road and trail crossings, and protecting water quality.

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

# Tiger Beetles

Derek Yorks

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. Even their larvae are fierce predators, living in burrows where they lie in wait to ambush invertebrate prey that pass over them.

## KEEPING TRACK OF RARE TIGERS

Most of Maine's tiger beetle species are widespread and common in their respective habitats. However, Maine lists one as Endangered, one as Threatened, and one 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 State Threatened **marginated tiger beetle** and State Special Concern **White Mountain tiger beetle** are identified as Priority 2 SGCN.



*Cobblestone tiger beetle photo by Jonathan Mays*

The cobblestone tiger beetle, first discovered in Maine in 2009, 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.

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 organic sediment build-up. Statewide surveys to document potential new cobblestone tiger beetle populations were conducted in 2010 and more recently in 2019 and 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 the list of remaining unsurveyed sites with suitable habitat is short, and 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 the western foothills.

## UPCOMING TIGER BEETLE STUDY

The newly state-Threatened marginated tiger beetle is a saltmarsh habitat specialist. Within this ecosystem, it primarily inhabits the back dune-marsh ecotone where unvegetated sand lies between the salt marsh's high tide line and the barrier beach's backdune. This species is rare throughout New England; and in Maine, its distribution is very limited and its habitat is increasingly threatened by development and climate change-caused sea level rise. In 2023, MDIFW plans to assess the status of the few known marginated tiger beetle populations. We will also survey for potential new populations in areas of suitable habitat while keeping track of relative abundance and potential habitat threats.

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

# Freshwater Mussels

Beth Swartz

Freshwater mussels are largely sedentary, bottom-dwelling invertebrates found in most of Maine’s lakes, ponds, rivers, and streams. They provide a vital service to aquatic environments by filtering suspended particles such as algae and bacteria from the water – keeping it clean for humans, too. Because they spend their entire lives (decades!) in one place constantly filtering large volumes of water, freshwater mussels are valuable indicators of water quality and aquatic ecosystem health. They are also one of the most imperiled groups of animals in the country. Of the nearly 300 species native to the U.S., more than a third have vanished or are in danger of extinction, and over 75% are listed as Endangered, Threatened, or Special Concern at the state level. These dramatic declines have resulted primarily from habitat loss and degradation caused by pollution, dams, invasive species, riparian development, and channelization and sedimentation of once clean, free-flowing rivers and streams.

Maine is home to 10 species of freshwater mussels (Table 2), three of which are listed as Threatened under the Maine Endangered Species Act: the brook floater, yellow lampmussel, and tidewater mucket. For more than three decades, MDIFW’s conservation actions have helped protect these rare species and their habitat. Examples include surveying for new occurrences, assessing statuses

of known populations, identifying potential threats and conservation needs, helping to remove and relocate mussels from harm’s way during construction projects, and working with partners on new monitoring techniques and regional conservation programs. Read on to learn more about MDIFW’s work with rare mussels in 2021 and 2022.

## ASSESSING BROOK FLOATER STATUS IN THE PISCATAQUIS RIVER

The **brook floater** is found only in clean, relatively undeveloped, undammed rivers and streams with intact forested riparian buffers. Because of its exacting habitat requirements, this species has declined throughout its range and is listed as Endangered or Threatened in nearly every state where it occurs.

In Maine, its stronghold lies in streams and rivers of the Penobscot River watershed, but it also inhabits several other river systems across the state. In 2020, a new brook floater occurrence (one individual) was discovered in the Piscataquis River — a tributary of the Penobscot. In 2021, MDIFW contracted Ethan Nedeau (Biodrawversity, LLC) to assess the status of the brook floater in the river. Ethan was able to find eight animals of various ages at seven sites from Milo to Guilford, indicating that a small population is present in the river. During the survey, he also found a strong population of yellow lampmussels and one tidewater mucket.

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>Utterbackiana implicata</i>	
Creeper	<i>Strophitus undulatus</i>	
Yellow Lampmussel	<i>Lampsilis cariosa</i>	THREATENED
Eastern Lampmussel	<i>Lampsilis radiata</i>	
Tidewater Mucket	<i>Atlanticoncha ochracea</i>	THREATENED



Brook floater photo by Ethan Nedeau

### ASSESSING TIDEWATER MUCKET STATUS IN COLD STREAM POND AND THE LOWER ANDROSCOGGIN RIVER

Like the brook floater, the **tidewater mucket** has declined throughout much of its Atlantic Coast range. Unlike the brook floater, it lives in lakes and ponds as well as rivers and streams. Contrary to its name, this mussel has been found far from tidal waters in Maine but never outside the Penobscot, Kennebec, and St. George River watersheds. One of the oldest Maine tidewater mucket records is from Cold Stream Pond in Enfield, where it was first reported in 1947. Subsequent surveys by The Nature Conservancy in 1984 and MDIFW in 1995, 1996, and 2006 failed to reconfirm the species' presence in the pond. Undeterred, MDIFW sent Ethan Nedeau back to Cold Stream Pond in 2022. Within 45 minutes, he located several live muckets – marking the first time the species had been found in the pond in 75 years!

Another old record — an empty shell found in 1995 where the mouth of the Androscoggin River meets Merrymeeting Bay — has long been a mystery to MDIFW. While tidewater muckets had previously been documented about 14 miles upriver in the Kennebec, live animals had never been found downstream, nor had the species ever been reported from the Androscoggin or any of its tributaries. Consequently, it was thought the shell had probably drifted downstream from the Kennebec River. In 2022, MDIFW contracted Ethan Nedeau to survey the greater Merrymeeting Bay area, including the lower Androscoggin River, lower Kennebec River, and the Muddy River, a tributary of the lower Kennebec. He visited 13 sites and found live muckets at every location! This discovery of an Androscoggin River population was the first time the species had been found outside the three previously known watersheds. What we do not know yet is if the mucket occurs further up the Androscoggin or if it is restricted to the area below the first dam in Brunswick.

### RECOVERY AND RELOCATIONS

To keep Maine's freshwater mussel fauna intact, it's important that we minimize impacts on listed species during projects that alter aquatic habitat or directly affect the bottom substrate. MDIFW frequently provides recommendations and coordinates pre-project surveys and relocations when listed species might be present, including for bridge repairs and replacements, dam removals, impoundment drawdowns, dredge projects, shoreline stabilization, boat launch construction, and underwater pipeline crossings. For example, MDIFW worked with Maine Dept.

of Transportation in 2021 to survey the Penobscot River where the Rte. 2 bridge in Old Town is scheduled for replacement. Within the project footprint, biologists found 86 yellow lampmussels, five tidewater muckets, and one brook floater. We moved them all, along with some more common mussel species, a short distance upriver where they would be safe from construction activities.



*Tidewater mucket photo by Ethan Nedeau*



*Yellow lampmussel photo by Ethan Nedeau*

### OUTREACH AND PARTNERSHIPS

Because Maine hosts some of the best remaining brook floater, yellow lampmussel, and tidewater mucket populations and habitats, we play a key role in their rangewide conservation. Throughout 2021 and 2022, MDIFW provided technical support and expertise to a variety of state and regional rare freshwater mussel conservation efforts. In partnership with Maine DOT and the University of Maine, we collected DNA samples from all ten of our mussel species to support development of eDNA markers for detecting species presence from water samples. We also collected DNA samples from two different **yellow lampmussel** populations, which we provided to the U.S. Fish & Wildlife Service for its research on this rare mussel's genetic diversity across its range. New yellow lampmussel initiatives included MDIFW serving on a technical Working Group to develop a rangewide assessment and conservation program, and cooperating with the University of Maine to investigate methods for assessing habitat and identifying potential survey and restoration locations.

MDIFW also worked with Ethan Nedeau to develop a brochure/poster that highlights **Maine's freshwater mussel fauna**, the Department's conservation efforts, and how you can help. This is available for download at [mefishwildlife.com/mussels](https://mefishwildlife.com/mussels) and a printed version will be published by spring 2023. We also developed similar outreach panels for two watersheds where listed mussels occur. These will be placed at public access sites to teach visitors about Maine's freshwater mussels and how they can support their conservation.

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*This work is supported by the federal (USFWS) State Wildlife Grants program, 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 services that these wild pollinators provide to natural communities and human societies is immeasurable. Without them, many wildflowers, shrubs, and trees, as well as fruits and vegetables, would not get pollinated, including important Maine crops like apples and blueberries.

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

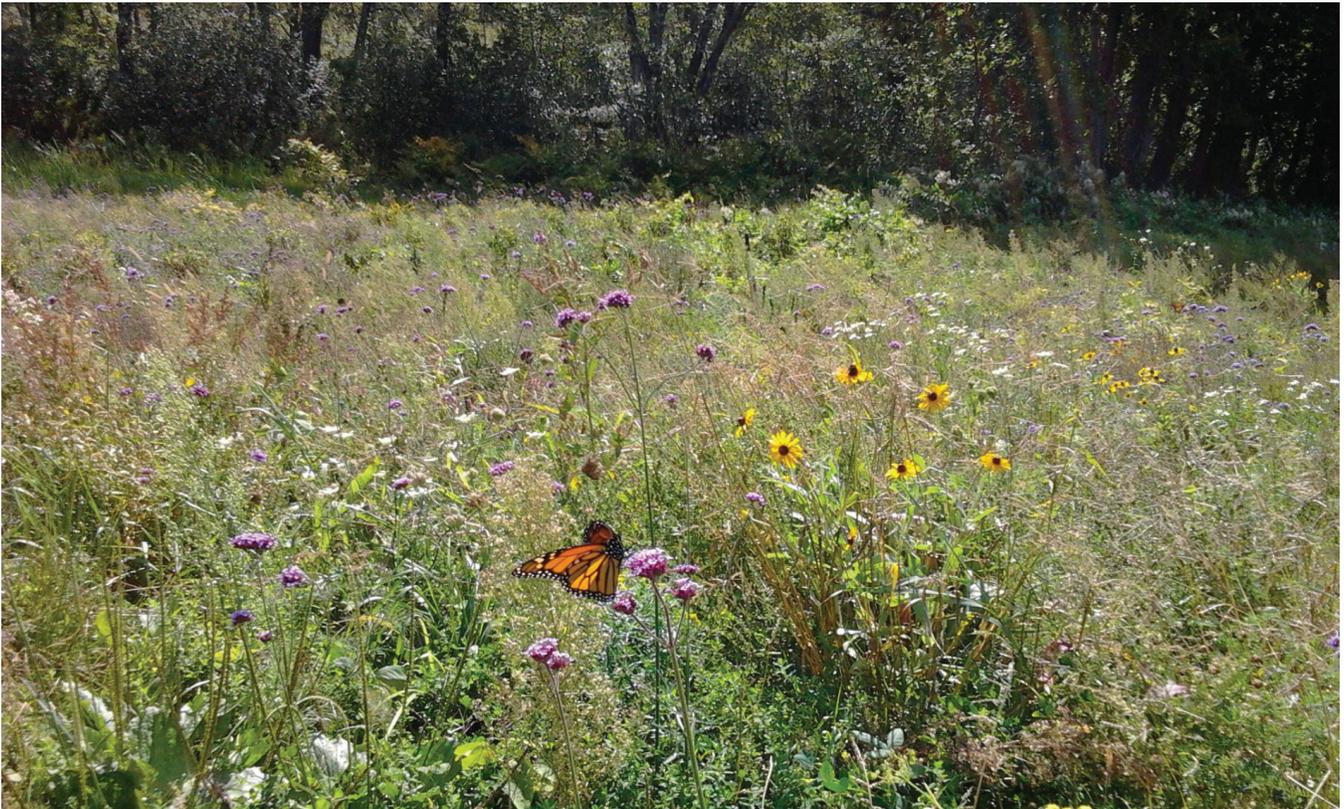


photo by Kelly Boland



*Monarch butterfly photo by Bryan Pfeiffer*

### HOW YOU CAN HELP

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

**Invite Summer Monarchs** – Providing summer habitat for monarch butterflies is as simple as allowing native milkweeds, the sole host plants for their caterpillars and a valuable nectar source, to grow and flourish. Many other beneficial insects in Maine also feed at milkweed flowers.

**Create a Bumble Bee Haven** – Bumble bees are habitat generalists, but they require an abundance and diversity of flowering plants that offer food from early spring to late fall. You can help by including an assortment of preferred pollinator flowers among your plantings during every part of the growing season.

**Embrace Your Wild Side** – Some of the best habitats for pollinators are “weedy” unmowed 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 early spring, waiting two to three weeks between mowings will allow clovers, violets, creeping groundcovers, 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 provide high quality nectar and pollen include bee balm, butterfly-weed, sunflower, coneflower, thyme, mint, rhododendron, blueberry, and rose, but there are many more from which to choose. Use native species as often as possible and remember to include host plants for caterpillars.

**Minimize Reliance on Pesticides** – Be selective when using herbicides. Controlling flowering plants that pollinators feed on reduces their food resources. Always follow label directions carefully when using insecticides. Because insecticides are designed to control insects, improper use may harm bees and other insect pollinators. Even products approved for use by organic growers or homemade mixtures can be toxic to pollinators. Avoid treating plants that are actively flowering with any pesticide, natural or synthetic, since they may be visited by beneficial pollinators. Integrated pest management techniques can help you minimize the need for control. The Maine IPM council’s GotPests website, [www.gotpests.org](http://www.gotpests.org), can help.

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



*Blue-spotted salamander photo by Jonathan Mays*



*Vernal pool photo by Phillip deMaynadier*

### DEFINING AND PROTECTING SIGNIFICANT VERNAL POOLS

In 2006, MDIFW and the Maine Department of Environmental Protection (MDEP) developed a definition of Significant Vernal Pools — a 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 4,430 vernal pools to date, and approximately 20-25% of them meet 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 Northeastern 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 duskywing (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 other rare plants.



*Pitch pine woodlands photo by Phillip deMaynadier*



*Sleepy duskywing photo by Bryan Pfeiffer*

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](http://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 MOOSE

Across Maine's forest-dominated landscape, marshes and shrub swamps serve as focal points for a wide diversity of 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 many invertebrate groups, perhaps most conspicuously dragonflies and damselflies, as well as waterfowl, wading birds, beaver, muskrat, and moose.



*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 and other priority wildlife species.



*Shrub swamp photo by Phillip deMaynadier*

## Montane Headwater Streams

Beth Swartz & Phillip deMaynadier

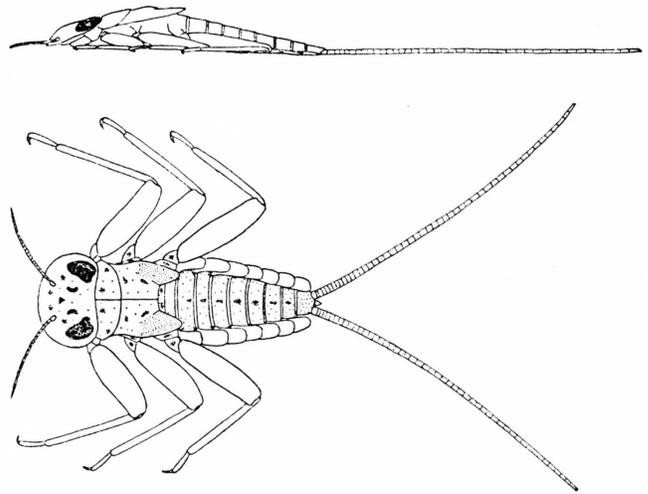
**“To protect your rivers, protect your mountains.”**  
— *Emperor Yu of China, 1600 B.C.E.*

A montane headwater stream often begins its journey as an underground trickle. Fed by groundwater and swelled by melting snow and seasonal rains, it tumbles down steep mountain slopes in a cascade of steps and pools, gradually widening as it descends to lower elevations where it will join with other headwaters. Some too small to show up on a map, Maine’s high-elevation headwater streams are the birthplaces of our state’s rich network of streams, rivers, lakes, ponds, and productive wetlands.

Scoured by ice in winter and flash floods in spring and fall, and often nearly bone dry in summer, montane streams are highly dynamic ecosystems where life can be difficult for an aquatic organism. But these harsh conditions provide refuge for a unique community of animals well-adapted to survive in such a habitat. Some species of aquatic insects have evolved to thrive in montane headwater streams, benefiting from the absence of fish and other large predators. The dense, over-hanging forest canopy keeps water temperatures cool, slows evaporation, and contributes an annual pulse of decomposing leaves and woody material upon which many insect larvae feed. Mayflies, stoneflies, caddisflies, dragonflies, and damselflies are just some of the insect taxa whose aquatic larval stage often depends on headwater stream habitat.

One of over 170 species of mayflies in Maine, the state-Threatened Roaring Brook mayfly is a high-elevation, headwater stream specialist. It requires the cold, highly oxygenated water of fast-flowing, heavily shaded mountain streams. With its body flattened dorsally, the Roaring Brook mayfly nymph is perfectly adapted for a life spent clinging to the underside of rocks and boulders, undaunted by a rushing torrent above and sheltered in cool pockets of water below when summer flows slow.

Also well-adapted to inhabit mountain streams are some



*The flattened body shape of the Roaring Brook mayfly nymph allows it to cling to rocks in swiftly flowing headwater streams.*

*Artwork from The Ecology of Running Waters, Hynes, H. B. N. 1970. University of Toronto Press.*

of Maine’s amphibians, including the northern spring salamander, northern dusky salamander, and two-lined salamander. The spring salamander, a species of Special Concern, is Maine’s largest native salamander (measuring up to 8” in length) and replaces fish as the top predator in some headwater settings. Like the Roaring Brook mayfly, it is dependent on cold, highly oxygenated, forested streams found at higher elevations. Its robust body and vertically flattened, keel-like tail permit it to swim effortlessly in swift water. And its streamlined shape is perfect for hiding and hunting among submerged rocks and boulders or in underground crevices beneath the streambed.

Montane headwater streams are among the most sensitive



*Northern spring salamander photo by Phillip deMaynadier*

aquatic ecosystems to disturbance and fragmentation. Their small size, shallow depth, and close connection to the surrounding forest make them especially vulnerable to impacts from human activities, such as poorly planned road crossings, transmission line rights-of-way, housing and recreational developments, and some riparian forestry practices. Despite their ecological value to downstream watersheds and importance to some of Maine's rarest species, small headwater streams are often underappreciated and overlooked in conservation efforts.

To protect state-listed species like the Roaring Brook mayfly and northern spring salamander, MDIFW has developed management recommendations for development and forestry activities taking place near high-elevation headwater stream habitats. These best management practices focus on protecting water quality, conserving forested riparian buffers, and implementing *Stream Smart* road and trail crossings.



Headwater stream photo by Phillip deMaynadier

## New RAI Group Reports and Publications (2020-2022)

Much of the RAI Group's non-field-oriented work unfolds through meetings, zoom calls, email exchanges, and webinars. Nonetheless, Department biologists occasionally find time to put pen to paper (or finger to keyboard) to formally document some of their hard-won field findings. These scientific musings can take many forms, from internal technical reports, to peer-reviewed journal articles and book chapters. Frequently, these products emerge from collaborative projects undertaken with outside experts and conservation partners. The following is a list of scientific reports and publications that came to fruition during the period of 2020-2022. All are available from MDIFW upon request.

### Technical Reports

Bevier, C., P. deMaynadier, and D. Moore. 2022. **Assessing Potential Ecological Impacts of Introduced Mudpuppies (*Necturus maculosus*) to Maine Waters.** Technical report to the Maine Department of Inland Fisheries and Wildlife, Augusta, ME.

Butler, R.G., H. Mealy, E. Kelly, A. St. Pierre, L. Wadleigh, and P.G. deMaynadier. 2020. **Status, Distribution, and Conservation Planning for Endemic Damselflies of the Northeast: Maine.** Technical report submitted to the Maine Department of Inland Fisheries and Wildlife, Bangor, ME.

deMaynadier, P., B. Swartz, and D. Yorks. 2022. **Herpetofauna and Invertebrate Species of Greatest Conservation Need (SGCN): Research, Status Investigations, and Conservation.** Annual report submitted to U.S. Fish and Wildlife Service for performance under State Wildlife Grant T-6-R-4.

DuClos, B., P. deMaynadier, F. Drummond. 2021. **Roadside rights-of-way as pollinator habitat: a literature review.** Final Report to the Maine Department of Transportation. Augusta, ME.

Hunt, P., V. Brown, R. Butler, P. deMaynadier, L. Harper, L. Saucier, R. Somes, and E. White. 2020. **A Conservation Plan for the Endemic Damselflies of the Northeast.** Technical report submitted to the Sarah K. de Coizart Perpetual Charitable Trust. 20 pp.



Sterrett, S.C., A.H. Roy, P. Hazelton, B. Swartz, E. Nedeau, J. Carmignani, and A. Skorupa. 2022. **Standard Operating Protocol for Mark and Recapture Monitoring of Brook Floater in Streams**. U.S. Department of Interior, Fish and Wildlife Service, Cooperator Science Series FWS/CSS-142-2022, Washington, D. C.

Ward, M. and B. Swartz. 2020. **Surveys for the Rusty Patched Bumble Bee (*Bombus affinis*) in Lincoln and Sagadahoc Counties, Maine**. Technical report to the Maine Department of Inland Fisheries and Wildlife, Augusta, ME.

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Ward, M. and B. Swartz. 2022. **Surveys for the Rusty Patched Bumble Bee (*Bombus affinis*) in Maine**. Technical report to the Maine Department of Inland Fisheries and Wildlife, Augusta, ME.

Ward, M. and P. deMaynadier. 2023. **Hessel's Hairstreak (*Callophrys hesseli*) in Maine: 2022 Survey Results**. Technical report to the Maine Department of Inland Fisheries and Wildlife, Augusta, ME.

Ward, M. and P. deMaynadier. 2021. **Survey Results for the Ringed Boghaunter (*Williamsonia lintneri*) in Southern Maine**. Technical report to the Maine Department of Inland Fisheries and Wildlife, Augusta, ME.

Ward, M. and P. deMaynadier. 2022. **Survey Results for the Ringed Boghaunter (*Williamsonia lintneri*) in Southern Maine**. Technical report to the Maine Department of Inland Fisheries and Wildlife, Augusta, ME.

## Scientific Publications

deMaynadier, P.G. In Press (2023). **Reflections on the Common Green Darner Dragonfly**. In Calhoun, A., M.L. Hunter, Jr., and K. Redford (editors). *Our Maine: Exploring its Natural Heritage*. Down East Books.

deMaynadier, P.G., J. Klymko, R. Butler, H. Wilson, and J. Calhoun. In Press (2023). **Butterflies of Maine and the Canadian Maritime Provinces**. Cornell University Press, Ithaca, NY.

Hopkins, J.B., C.A. Frederick, D. Yorks, E. Pollock, and M.W.H. Chatfield. 2022. **Forensic Application of Stable Isotopes to Distinguish between Wild and Captive Turtles**. *Biology* 2022, 11, 1728.

Jones, M.T., L.L. Willey, J. Crowley, T.S.B. Akre, P. deMaynadier, D.T. Yorks, J.W. Tamplin, B. Zarate, et. al. 2021. **Distribution**. Chapter 4 in M.T. Jones and L.L. Willey (eds.), **Biology and Conservation of the Wood Turtle**. Northeast Assoc. of Fish and Wildlife Agencies. 235 pp.

Jones, M.T., H.P. Roberts, K.D. Gipe, J.D. Kleopfer, P. deMaynadier, L.L. Willey, et. al. 2021. **Restoration and Management**. Chapter 9 in M.T. Jones and L.L. Willey (eds.), **Biology and Conservation of the Wood Turtle**. Northeast Assoc. of Fish and Wildlife Agencies. 235 pp.

Lubelczyk, C.B., S.P. Elias, P.G. deMaynadier, P. M. Brunelle, L.B. Smith, and R.P. Smith, Jr. 2020. **Importation of Dragonfly Nymphs (Odonata: Anisoptera) to Control Mosquito Larvae (Diptera: Culicidae) in Southern Maine**. *Northeastern Naturalist* 27(2): 330-343.

Michell, K., T. Persons, P. deMaynadier, and D. Yorks. 2021. **The Status and Conservation of Timber Rattlesnakes in Maine**. Chapter in Martin, W.H., et.al. (eds). *The Timber Rattlesnake: Life History, Distribution, Status and a Conservation Action Plan*. Partners in Amphibian & Reptile Conservation Technical Publication RCP-1.

Persons, T.B., P.G. deMaynadier, and D.T. Yorks. 2021. ***Lithobates septentrionalis* (Mink Frog)**. *Elevation*. *Herpetological Review* 52(3): 614.

Persons, T.B., P.G. deMaynadier, and D.T. Yorks. 2021. ***Gyrinophilus porphyriticus* (Spring Salamander)**. **Geographic distribution**. *Herpetological Review* 52(1):73-74.

Roberts, H.P., M.T. Jones, L.L. Willey, S.B. Akre, P.R. Sievert, P. deMaynadier, K.D. Gipe, G. Johnson, J. Kleopfer, M. Marchand, J. Megyesy, S. Parren, E. Thompson, C. Urban, D. Yorks, et.al. 2021. **Large-Scale Collaboration Reveals Landscape-Level Effects of Land-Use on Turtle Demography**. *Global Ecology and Conservation* 30 (2021).

Ward, M., P. deMaynadier, and R. Butler. 2020. **First Maine state records for two dragonfly species: Banded Pennant (*Celithemis fasciata*) and Mocha Emerald (*Somatochlora linearis*)**. *ARGIA* 32(4): 21-22.

Willey, L., M.T. Jones, P.R. Sievert, T.S.B. Akre, M. Marchand, P. deMaynadier, D. Yorks, J. Mays, et.al. 2022. **Distribution models combined with standardized surveys reveal habitat loss in a threatened turtle species**. *Biological Conservation* 266 (2022).





2021-2022

RESEARCH + MANAGEMENT REPORT

Regional Wildlife Management

Download additional sections at [mefishwildlife.com/wildlifereport](https://mefishwildlife.com/wildlifereport)



## 2021-22 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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- » Beginning with Habitat
- » Land Acquisition & Water Access Programs
- » Habitat Conservation & Management
- » Bird Conservation & Management
- » Game Species Conservation & Management
- » Non-Game Species Conservation & Management
- » Reptile, Amphibian, and Invertebrate Conservation & Management

Compiled and edited by  
Lauren McPherson

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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.



# REGIONAL WILDLIFE MANAGEMENT

Ryan Robicheau

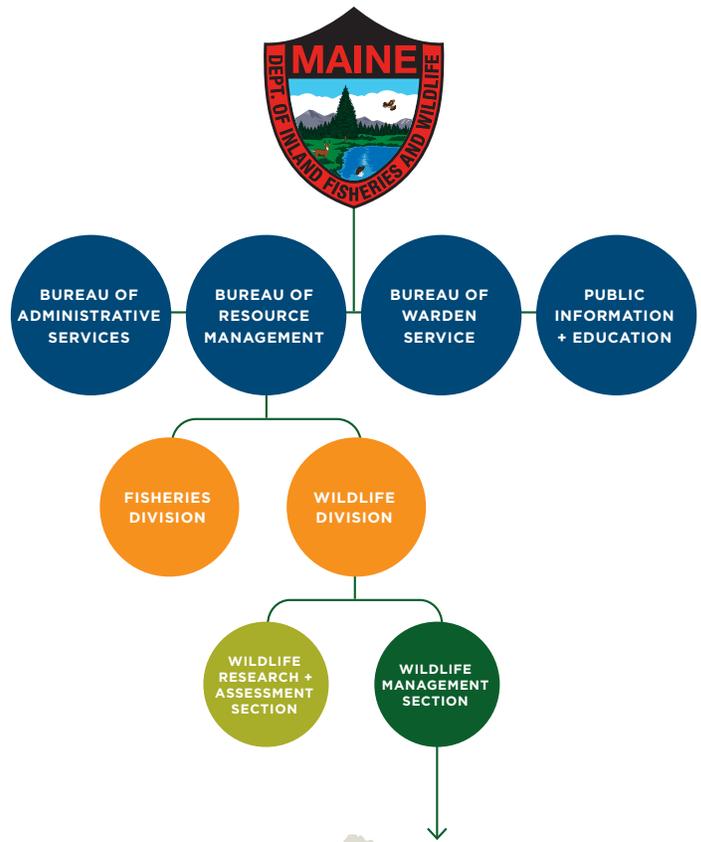
*Wildlife Management Section Supervisor*

The following pages highlight work activities of the Wildlife Management Section over the past year, covering a wide array of topics that the dedicated men and women within the Section have been engaged in. These range from contaminant sampling in wildlife species to timber harvesting for habitat management.

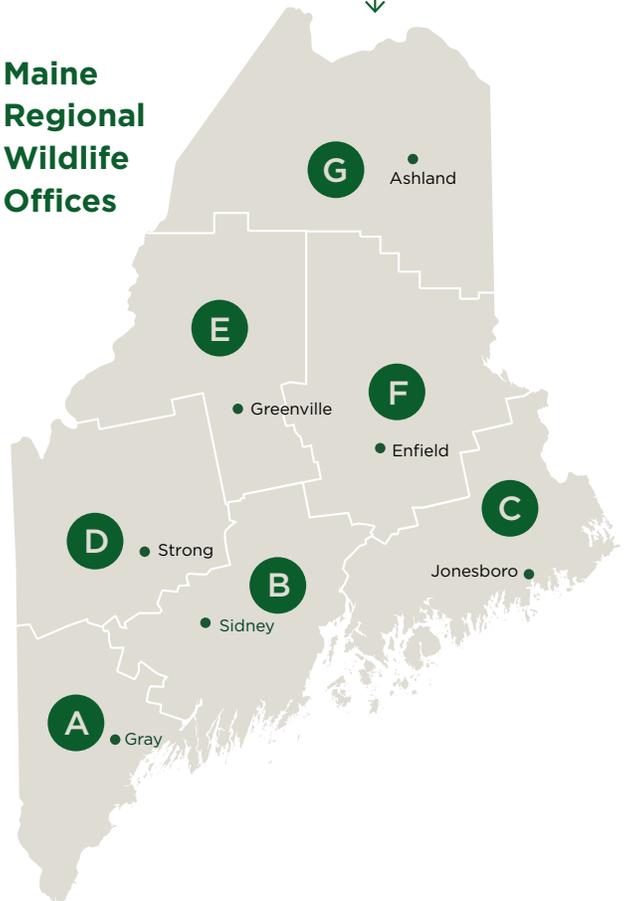
The Section is composed of two or three wildlife biologists in each of our seven geographic districts throughout the state; our Lands Management Program; a wildlife biologist assigned to the Maine Department of Agriculture, Conservation and Forestry; and a wildlife biologist who provides technical assistance to private landowners. Combined, our staff provide a suite of services to other sections of the Department, other state agencies, the public, and conservation partners.

The Wildlife Management Section engages in all Wildlife Division efforts, including:

- Biological data collection for game species
- Non-game wildlife surveys
- Species management and planning
- Environmental review of development projects
- Administration/coordination of the nuisance wildlife policy
- Administration/coordination with wildlife rehabilitators
- Technical assistance to landowners
- Management of Department-owned Wildlife Management Areas
- Oversight of conservation easements held by the Department



## Maine Regional Wildlife Offices



Priorities identified in recent Department planning efforts have refined the Section's efforts to achieve Department goals. We have enhanced our capabilities to provide technical assistance to private landowners, we are engaging with conservation partners to address climate change (including increased saltmarsh and coastal ecosystem restoration/conservation efforts), and we have renewed our efforts to acquire deer habitat land in northern, eastern and western Maine.

As part of the Beginning with Habitat program, the Wildlife Management Section increased its capacity to engage with landowners interested in managing their land and its habitats in a specific way. For example, one landowner's objective might be to benefit Species of Greatest Conservation need identified in the State Wildlife Action Plan, or to promote biological diversity, while another may want to focus on creating and maintaining high quality habitat for popular game species.

Throughout last year, the Department coordinated with stakeholders from Virginia to Maine in a region-wide effort to conserve and restore coastal saltmarsh habitats. Legacy agricultural practices in marshes, tidal restrictions created by transportation infrastructure, and climate change have all heightened the focus on these valuable ecosystems and the important wildlife habitats they provide. Our goal in this effort was to prioritize Maine marshes for restoration and conservation funding. As a result, numerous restoration projects have been implemented, with the Department engaged in projects at the Scarborough Marsh Wildlife Management Area, R. Waldo Tyler Management Area, and two marshes at the Kennebec River Estuary Wildlife Management Area. Conservation partners have also taken the lead on marshes scattered across the coast of Maine.



In 2021, The 130th Maine State Legislature passed an "Act to Preserve Deer Habitat" (H.P. 288 – L.D. 404), creating a new effort to conserve and manage deer habitat in northern, eastern, and western Maine. Per this legislative directive, the Department has prioritized and actively pursued conservation of areas important to deer in places where winter shelter is critical to survival. The legislation created staff capacity to focus on these important habitats and enhanced conservation funding opportunities through the Land for Maine's Future program. It also increased our capabilities to acquire and manage lands through the Deer Management Fund, which is supported by harvested deer registrations. Lands acquired under this effort will be incorporated into the Wildlife Management Area system, with a focus on management for deer habitat and public access.

The ensuing report provides a view into the diverse nature of the Wildlife Management Section's work this past year. As you'll see, much of this involves engagement with other Department staff and conservation partners to balance the biological and social aspects of protecting, conserving, and enhancing Maine's wildlife resources.



# REGION A GRAY

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## Scarborough Marsh Wildlife Management Area

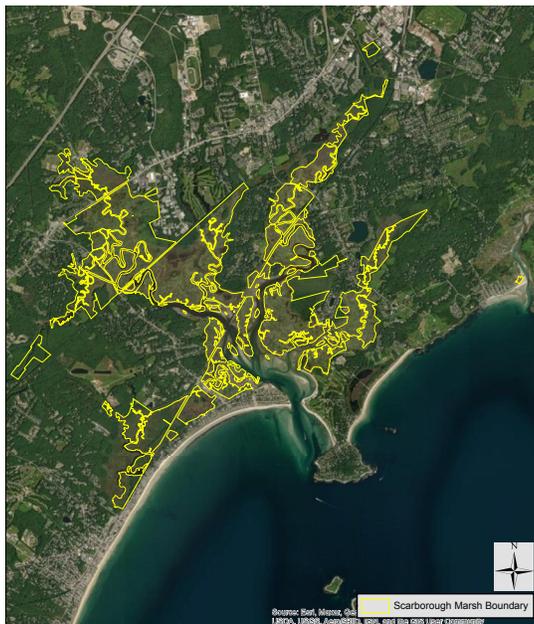
**A time to celebrate 50 years, plovers, terns, New England cottontail, and more**

Sean Campbell

Scarborough Marsh Wildlife Management Area (SWMA) is a wildlife oasis in the middle of one of Maine’s most populated coastal areas. Situated to the south of Portland and to the north of Biddeford, Saco, and Old Orchard Beach, this WMA is an essential breeding, resting, and foraging area for waterfowl, shorebirds, wading birds, numerous marine species, and other diverse wildlife species. Spanning more than 3,000 acres, it is the largest marsh system in the state and consists of high and low marsh communities, regularly and irregularly flooded salt marsh, salt creeks, coastal fresh marsh, tidal flats, and upland habitats. The marsh is fed by three major tributaries: the Scarborough, Nonesuch, and Libby rivers.

The Department began to acquire land for the Scarborough Marsh WMA in 1959. Being primarily wetland, the main management objective was to protect and improve the area for resident and migratory waterbirds. The WMA provides critical habitat for a broad array of waterfowl, saltmarsh and nelson’s sparrow, egrets, and herons. And many shorebird species depend on its rich ecosystem for food, nesting habitat, and a place to rest during migration. The WMA is used by the state-endangered piping plover (*Charadrius melodus*), least tern (*Sterna antillarum*), New England cottontail (*Sylvilagus transitionalis*), and Least Bittern (*Ixobrychus exilis*). It is also heavily utilized by the public. The Department manages for appropriate public access and recreation, including consumptive activities (hunting, trapping, and fishing) and non-consumptive uses (canoeing, kayaking, hiking, birding, and wildlife viewing). The marsh also sustains local businesses in the realms of clamming, aquaculture, guide services, restaurants, and tourism; and it provides ecological services ranging from protection against coastal storms to carbon sequestration.

New England Cottontail (NEC) is the only rabbit native to Maine and is listed as state-endangered with an estimated state population around 300 individuals. NEC are an obligate early successional species that have suffered dramatic population declines since the 1960, primarily due to habitat loss and fragmentation. Currently, NEC only occur in six Maine towns and one WMA: SWMA. In March 2022, as part of the range-wide and state recovery strategy, MDIFW staff released eight rabbits into the Gervais parcel in an effort to re-establish a population. Prior to the release, NEC had not been documented in SWMA since 2010.



Scarborough Marsh Wildlife Management Area

The released rabbits were fitted with radio telemetry collars, and we are currently monitoring their survival and trail camera pictures have confirmed a successful breeding season. The 46-acre Gervais parcel where the rabbits were released was acquired in 2009, and MDIFW has managed it, along with surrounding uplands, for early successional habitat through forest management practices, native shrub plantings, invasive species control, prescribed fire, and mowing. We will conduct tracking and pellet surveys in the winter of 2022 to estimate abundance and breeding success. We anticipate releasing additional rabbits at Scarborough Marsh in fall 2022 and in 2023. Partners assisting in this project have included USFWS, breeding programs at Rodger Williams Park Zoo, Queens Zoo, Great Bay National Wildlife Refuge, and Patience Island, and volunteer citizen scientists who have contributed countless hours of work.



*New England Cottontail*



The three-acre Higgins Beach Unit of Scarborough Marsh is a disjunct parcel from the rest of the marsh. However small and separate, this essential coastal dune habitat plays a critical role in the recovery of Maine's piping plovers and least terns. It hosts over 70 least tern nests and a growing number of nesting piping plovers, numbered at six pairs in 2022. Since MDIFW owns this area, we have been able to increase seasonal management efforts, such as dog restrictions on the beach, increased educational signage, and symbolic and electric fence enclosures. A group of over 40 volunteers has been working to protect the nests and encourage the birds to settle and nest earlier in the year. Partnering with Maine Audubon staff to help monitor and manage for plover and terns across the state, our staff documented the earliest plover nest to hatch this year in Maine on May 24th at the Higgins Beach Unit.



This year, MDIFW celebrated 50 years of partnership with Maine Audubon at the Scarborough Marsh WMA. In 1972, Maine Audubon converted an old clam shack on the edge of the marsh into the Scarborough Marsh Audubon Center. Since its beginnings, the center has grown to serve the local community and visitors alike. Audubon Center Director Linda Woodard, who has worked tirelessly on the marsh for over 35 years, has grown the programs to engage over 10,000 people annually, including over 1,500 school children. The center serves as a focal point to engage the public on the importance of the marsh through naturalist guided tours, exhibits, a nature store, a nature trail, and canoe and kayak rentals.

Looking into the future, management actions on SWMA will continue to focus on providing optimal habitat for migratory waterfowl, shorebirds, fish, NEC, and a diversity of other species while balancing the increased demand for public access and use of these resources. Some of the challenges this management area faces stem from historical uses of the marsh, like ditching and plugging for agriculture, saltmarsh hay production, and mosquito control, large berms for railroads and roads that intersect the marsh, water control structures, and undersized culverts that restrict natural flows of water. Climate change and sea level rise bring new challenges that will impact our ability to manage the marsh for wildlife species. And phragmites and other invasive species also threaten the natural ecosystem and ability to provide optimal habitat. Targeted management actions in the past have addressed some of these issues; and as we move forward, we will continue collaborating with other entities to develop a comprehensive understanding of these natural and man-made processes across the entire marsh. All of this will help guide our management actions to sustain SWMA's ecological services and promote its resilience to sea level rise.



## REGION B SIDNEY

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### Investigating PFAS in Maine Wildlife

Kendall Marden

As Regional Wildlife Biologists, we expect to deal with a wide variety of projects. Some are routine and seasonal, while others are novel but ephemeral. This past year, we embarked on a large project in central Maine that will continue to gain statewide significance. Growing awareness of — and broad concerns about — PFAS in the environment prompted this new area of investigation.

PFAS is an acronym for per- and polyfluoroalkyl substances — a group of thousands of manmade chemicals. The six that have been studied most are associated with health issues including increased cholesterol, decreased birth weights, reduced immune response from vaccines, and increased risk of kidney and testicular cancer. They have been used in a variety of household products, clothing, and other manufactured goods, largely for their water and grease resistant properties. PFAS are also found in certain types of firefighting foam.

These chemicals often end up in food, water, and elsewhere in the environment, where they are consumed by humans and animals. While much is still unknown, the body of information linking PFAS to negative health issues is growing, and many State of Maine agencies are working diligently to better understand their prevalence and impacts. Given the crossover of many issues, those agencies have been communicating and assisting one another regularly.

MDIFW's responsibility lies in managing wildlife and fish, including human/wildlife interfaces. While Maine CDC has the lead role on consumption advisories for both salt and freshwater fisheries, they along with other agencies will be helpful in assisting MDIFW in understanding more about PFAS compounds in wildlife. Given the breadth and depth of the issue, our focus will be the distribution and quantity of PFAS in wildlife to inform if and where we should issue an advisory on wild game consumption to protect public health.

Areas of greatest concern for environmental contamination in Maine stem from the past spreading of sludge on agricultural areas as a fertilizer. Locations that may have repeated applications of firefighting foam are also a potential concern. Our focus on testing wildlife so far has been in the greater Fairfield area, which has been identified as a hot spot for past sludge spreading. This investigation will likely be ongoing for some time, though we are working diligently to learn as much as we can in a timely fashion.

In the fall of 2021, we tested eight deer from a small area with highly contaminated soils to see if PFAS was present in the deer. Our findings prompted a consumption advisory on deer for a large area out of an abundance of caution. We have since started a much larger research project aimed at investigating deer and wild turkey in the Fairfield area. Beginning in the spring of 2022, MDIFW worked with nearly 60 private landowners and USDA-Wildlife Services to collect and test 71 turkeys, and 60 deer for PFAS. Our goal is to better understand if PFAS is present in animals in an area, and to what level it exists. This will allow us to determine if advisories are needed, and in what area they would apply.

Understanding PFAS distribution in wildlife will be more difficult than working with plants and domestic animals that are stationary or fenced in. Wildlife is more mobile, and there are still lots of questions about how animals consume and excrete PFAS, and how quickly levels rise or drop in the muscle tissue when exposure changes. New information on PFAS distribution and levels in soil and water will help direct our research in wildlife.

This is a complicated issue that will continue to develop, likely for years. As we work to comprehend the situation, we expect to have positive information to share, along with possible advisories. For more information on PFAS in Maine see [maine.gov/dep/spills/topics/pfas/](https://maine.gov/dep/spills/topics/pfas/) or [mefishwildlife.com/deerconsumptionadvisory](https://mefishwildlife.com/deerconsumptionadvisory).



## REGION C JONESBORO

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## Offshore surveys in Region “Sea”

Christine West

Over the last year, the biologists in Region C have visited conservation easements, checked on deer wintering areas, attended meetings and trainings, presented at public speaking events with local partners, worked with local school groups, handled nuisance wildlife calls and emails, participated in duck banding and satellite tagging, surveyed for American woodcock, ruffed grouse, nightjars, marsh birds, breeding birds, peregrine falcons, amphibians and reptiles, captured and fitted a satellite transmitter on a great blue heron, collected white-tailed deer bio data, and deployed bat detectors throughout the region. All of these are the regular duties and responsibilities of a regional wildlife biologist.

Aside from its expansive blueberry barrens, Region C is mostly known for its continuous undeveloped coastline dotted with uninhabited islands, exposed ledges, and 15-to-20-foot tides. This coastal ecosystem provides regional staff with many opportunities to get out on the ocean and explore Maine’s state-owned islands.

The Coast of Maine Wildlife Management Area (WMA) includes islands and ledges owned or managed by MDIFW, varying widely in size, shape, and habitat. Even though the WMA comprises over 300 islands and spans the whole coastline, most of the islands are located within Region C.

Guests, volunteers, and other MDIFW staff members have embarked with Region C this year on boat trips to survey birds or check on island conservation easements. Nate Webb, MDIFW wildlife division director, and Ryan Mola, stewardship director at Downeast Coastal Conservancy, came aboard the Region “Sea” to do a conservation easement site visit at Huckins Island in Cobscook Bay.



Region C biologists have also been deploying bat detection units on some of the region’s state-owned offshore islands to determine bat species presence and abundance. The data we gather will give us critical information on how bats are using the offshore island ecosystem in down east Maine.

Finally, the Maine Bird Atlas, a large citizen science project, is in its final year of surveys. During the breeding season, we know that many colonial waterbirds utilize Region C islands as nesting colonies; but the wintering bird populations on some of these offshore islands and ledges are not as well known. One component of the Maine Bird Atlas has been wintering bird surveys; and so the Region C crew was tasked over the last few winters with surveying by boat for wintering birds near offshore islands and exposed ledges along the region’s coast.

Prior to each survey season, project coordinators establish targeted priority blocks. Last winter, Region C biologists tagged along with Marine Patrol officers on their large vessel out of Jonesport to safely explore and tally birds further offshore. The winter of 2022/2023 will be the last of the wintering bird atlas surveys, and the Region “Sea” crew will be ready to set sail and put in more hours navigating the coast of Maine.



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### Conserving Former Farmland and Fast Flying Falcons

Sarah Boyden

#### Giving New Life to a Historical Homestead on Hancock Pond

The Fahi Pond Wildlife Management Area includes three properties within the town of Embden. The Hancock Pond Parcel is located at the northwest corner of the Fahi WMA, covering 428 acres of early successional hardwood forest and including a hand-carry boat launch on Hancock Pond. In the 1800s, the Hancock Pond parcel was home to a farming community known for their cider orchards. Stone foundations and deep dug wells that were once part of the old homesteads can be found throughout the property, along with a few remanent apple trees hiding in the dense regenerating forest. Wild grapes drape the trees surrounding the stone structures, and small patches of irises and lilies are found throughout the property. It doesn’t take much to imagine the farms of the 1800s in full production, with sheep, cows, horses, vegetable gardens, and humble flower beds surrounding the stone foundations. The view from Hancock Pond sweeps across the western mountains to some of highest peaks in Maine, including the distant Bigelow Range, Mount Abraham, and Sugarloaf Mountain.

In modern times, the farming landscape of Western Maine has shrunk to a small fraction of what it once was. Farming benefits many different wildlife by creating food and open habitat in an otherwise forested landscape. When the farms of the area were abandoned sometime in the early 1900s, fields grew up in dense patches of early successional, quick-growing forests. As those forests matured, the faster-growing tree species were replaced by longer-lived, mature species of maple, beech, and ash, along with pockets of hemlock, balsam fir, and spruce. Recently, forest managers have harvested the mature forest of Hancock Pond,

resetting the growth cycle and promoting the faster-growing, early successional tree species common during the post-farming era when fields began reverting to forest.

Early successional forests provide habitat and food for a variety of wildlife species. The dense young forest at Hancock Pond is preferred ground for ruffed grouse, whose drumming can be heard throughout the property, along with the early spring peenting and strutting display of American woodcock. Areas of disturbance created during forestry harvest often grow in with dense thickets of berries and other fruiting shrubs and trees, including raspberries, blackberries, blueberries, and cherries. These species provide important food sources, but most will not persist as the forest ages; instead, they will be replaced by mature, longer-lived trees.



As land managers, we can mimic the wildlife benefits of early successional forests by introducing diversified wildlife habitats onto the landscape. At the Hancock Pond parcel, we have begun to implement small projects that increase food availability, nesting habitat, cover, and forage. As a nod to the farmers who worked the property in the 1800s, we planted a small orchard of dwarf apple trees that will provide an abundant food source for many wildlife species including deer, bear, turkey, and grouse. In the early spring, apple flower blossoms will provide an early source of pollen for a variety of pollinator species. Importantly, these apple trees will not be treated or sprayed with pesticide chemicals. Although the resulting apples will likely be full of holes and not aesthetically pleasing, there will be no ill effects to pollinators. Plus, worms and insects attracted to the apples (what most consider apple tree pests) will provide additional food sources for birds and small mammals.

We selected dwarf apple trees for a couple of reasons. First, they produce fruit much sooner than standard apple trees, which take several years to mature from bare root stock. Second, they are easy to maintain. With their lower branches, pruning is much easier for land managers. Those low branches also make fruit more accessible for deer and bear. Already, even though they're just in the sapling stage, wildlife gravitates to the cleared area surrounding the trees. Grouse and turkey can often be found taking dust baths in the dirt around the trees and snowshoe hare are found along the edges of the orchard clearing, sampling the newly emerging vegetation. Bare soil surrounding the trees will be planted with a low-growing clover mix that will not compete with the apple trees' nutritional requirements but will provide cover for small mammals and browse for turkey, deer, and bear.

## Protecting the Peregrine Falcon

Peregrine falcons, like many other bird species, faced drastic population declines in the recent past due to the effects of DDT, and in the 1960s they were considered extirpated from Maine. Thanks to intensive work including the banning of DDT in the early 1970s and a peregrine falcon reintroduction effort in the 1980s and '90s, Department biologists and other conservation partners recently documented 27 successful breeding pairs and 41 total pairs of the species throughout the state over the course of one year.



Peregrines are listed as endangered under the Maine Endangered Species Act. Given their status, regional biologists often work with private landowners to minimize impacts to nesting peregrines on their properties. Recently, driving past a former paper mill in central Maine, I noticed white guano streaking at the top of the old smokestack — the telltale sign of a peregrine falcon perch point. Peregrines are known for finding high spots to hunt from, often targeting the abundant pigeon populations found at both active and inactive mills.

With a small amount of survey effort, we located the peregrine nest on a windowsill in an old part of the mill and helped coordinate with the Department species specialist and the mill owner to ensure the nest would not be disturbed. In these situations, if necessary, we will create alternative nesting platforms or boxes to encourage the birds to nest in a location that won't interrupt the private landowner. If relocating a nest isn't an option, we monitor the nest and advise the landowner once the nestlings have fledged, allowing the owners to coexist with nesting peregrines. In most cases, the landowners are happy to accommodate, and are often excited to watch the pair raise their young.

Peregrines are dramatic avian hunters, reaching speeds over 200 mph to capture their bird prey. Given their affinity for urban environments, we occasionally hear observations like the one from ticket holders waiting in line at a local concert who watched a peregrine dive bomb a pigeon in the middle of the parking lot. It wasn't the show they came for, but not something they will soon forget.



# REGION E GREENVILLE

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## Caught on Camera: The Use of Cameras to Help Manage Wildlife

Scott McLellan



The Maine Department of Inland Fisheries and Wildlife (MDIFW) is tasked with monitoring and managing all of Maine’s fish and wildlife species. Biologists are trained to explore and determine the most efficient and cost-effective methods of monitoring wildlife populations – specifically, whether a population exists in certain areas, and if so, whether it is increasing, decreasing, or stable.

One method of gathering population-specific information is through the deployment of game cameras. Not every wildlife species is easily detected using cameras, but some such as moose are. In 2021, MDIFW began a partnership with the USGS Vermont Cooperative Fish and Wildlife Research Unit to monitor moose. This was part of a larger Northeastern U.S. effort to research and understand regional moose populations, driven by a 30% decline of moose populations in northern New England over the past 20 years. Part of this plan involves using game cameras across the core moose range in northern Maine. We have chosen areas that we have long-term population data from and continue to collect data from annually using methods such as aerial flights.

While moose are the primary focus of this study, the camera protocol is designed to collect information from a wide variety of mammals from American marten to fisher to snowshoe hare. Currently, we monitor 80 game cameras in areas north of Moosehead Lake. Every three months, we visit the cameras via snowmobile, ATV, or on foot to perform required maintenance (battery and SD changes, for example). These cameras are situated on natural game trails, edge habitats, or funnel areas that would attract free

ranging wildlife, and are placed significant distances apart from each other so that they don’t photograph the same animals. Additionally, each camera site has a marked stake for recording snow depth (in 2-cm. increments) during fall, winter, and spring, a vial with an attractant (skunk essence), and a turkey feather. The purpose of the skunk essence and feather are to draw certain species closer to the camera for a better photograph.

This project will give us excellent insights into a multitude of mammalian wildlife species in a remote part of the state that is otherwise difficult to get information from. We expect to yield management-related information from species such as fisher, snowshoe hare, white-tailed deer, American marten, and, of course, moose. We may not gather quite as much information on smaller species such as long and short-tailed weasel that are fast and don’t stay near camera sites for long.

Biologists will continue to explore and learn what these cameras can reveal. Based on past experiences using cameras to study white-tailed deer and other species, we expect to gain specific information on moose survival, recruitment (survival of young to a specific age class), density, sex ratios, population trends, and more. Upon review and analysis of the data by a team of researchers and managers across the northeastern U.S., final results will be pooled and tallied. We will compare these with other data that we collect during the two-year survey period using different (off-camera) scientific methods, as a measure of double-checking results.

## Roach River Wildlife Management Area

Scott McLellan

Roach River Wildlife Management Area (WMA) is one of two such conservation areas in the greater Moosehead Lake region. MDIFW acquired Roach River WMA in 1990 to protect and promote vital fish and wildlife habitat amidst growing pressure from developers. Roach River resides north of Greenville and to the east of Moosehead Lake, adjacent to Kokadjo. This river is the most important Moosehead Lake tributary in terms of spawning and nursery areas for landlocked salmon and brook trout, so the acquisition three decades ago was a critical conservation move.

The WMA spans 6.3 miles, connecting First Roach Pond to Moosehead Lake's Spencer Bay, and is one of only two major inlets to Maine's largest body of water. MDIFW's ownership includes both the water and a 250-foot strip of woods (from the high-water mark) along each side of the river, plus an additional 250 feet of easement along the 6.3-mile river. Exceptions to this continuous ownership include a few small leases with permanent structures on the east end. The 250-foot strip of mature, softwood-dominated woods on each side of the river provides important habitat for a medley of wildlife including American marten, river otters, mink, white-tailed deer, fisher, reptiles/amphibians, songbirds, waterfowl, and birds of prey. This riparian zone functions as a permanent home for some, nesting habitat for others, a travel corridor for certain species, and a foraging and resting point for many.

Recreational activities such as fishing, hunting (except baiting for black bears), trapping, birdwatching, and canoeing/kayaking are permitted and encouraged.

For those seeking angling opportunities, the river offers seven major access points (three along the Roach River North Road off the Spencer Bay Road, two along the Hardwood Valley Road south of the river, and two in Kokadjo near the river's origin). All access points except one (the one at the dam along Lily Bay Road) require a five to 15-minute walk to reach the river's edge, and their parking are not obviously marked as such. The trails are generally easy to follow, with flagging tape occasionally tied to tree limbs to help guide anglers. Additionally, there are brown boxes with informational cards at many of the trail heads for anglers to record their time spent and results. Fisheries biologists then use these data to make informed management decisions.

Many of the 69 WMAs across the state require some level of wood harvesting to promote or maintain a particular habitat type, which in turn helps out a focal species. For example, if the primary goal of the WMA is to provide quality ruffed grouse habitat, we will plan to harvest within hardwood-dominated stands on a frequent basis. At the Roach River WMA though, since the wood is so close to the river, there is no harvesting (both for legal and conservation purposes). Instead, the goal is to maintain a wooded buffer along the river to protect it from the sun and keep water temperatures cooler, preserving and sustaining the fishery there and in Moosehead Lake.



*Angler box at Roach River*



*Roach River Wildlife Management Area*



## REGION F ENFIELD

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### Monitoring Maine's Waterfowl

Connor White



*Duck Banding*

The great state of Maine is home to 34 species of waterfowl for at least part of their annual migration, staging, or breeding cycles. These waterfowl can be classified into four generic types: dabbling ducks, diving ducks, sea ducks, and geese. In the 1980s, North America's overall waterfowl population began to decline, prompting the Maine Department of Inland Fisheries and Wildlife to prioritize management efforts to conserve these species. Waterfowl biologists, hunters, and enthusiasts across the continent have long advocated for the preservation and management of waterfowl habitat to ensure healthy populations for future generations. To date, of Maine's 100,000+ acres of Wildlife Management Area (WMA) land, roughly half serves as important waterfowl habitat. An added benefit to conserving waterfowl habitat is that it is also utilized by declining invertebrate species, bats, loons, wading birds, amphibians, deer, moose, and a variety of Maine's species of conservation concern.

Maine's regional biologists install and monitor duck boxes on WMAs to provide nesting opportunity for cavity nesters such as wood duck, goldeneye, and hooded merganser. In the spring, we visit the duck boxes, count eggs, and band nesting adult females. During the early summer, we perform brood surveys to measure nesting success. This involves paddling waterbodies searching for hen waterfowl with their ducklings. During the late summer and again in winter, we capture flocks of waterfowl, apply leg bands and GPS transmitters to monitor movement and mortality, and collect bio-samples for disease surveillance. Biologists will also perform winter waterfowl surveys along the coast of Maine via watercraft and airplane to collect data. In late winter, we visit duck boxes across the WMAs to document nesting attempts vs successful hatching. We also manage water levels using pre-existing dams, and in certain situations we introduce beavers to WMAs to promote interspersation within the waterway.

Overall, to confidently monitor waterfowl populations, biologists perform egg counts and brood surveys, apply GPS transmitters and leg bands, conduct winter bird counts, and sample for diseases to measure recruitment, movement, and survival rates. Waterfowl are migratory species that don't adhere to state or country borders, so our agency cooperates with other states and provinces within the Atlantic Flyway to assess their population trends. By comparing hunter harvest data with brood and band return data across the Flyway, we can monitor population trends at the species level. Estimates generated from this data allow biologists to determine whether waterfowl species are increasing, decreasing, or stable.



By knowing the trend and movement of a species, we can adjust bag limits and hunting seasons accordingly. For example, through our management efforts, we have noted a gradual decline in mallard populations across the Flyway, while hooded merganser populations have been increasing. To meet management objectives for these species, The Flyway has increased the bag limit for hooded mergansers and decreased the mallard daily bag limit. As populations continue to change across the Flyway, harvest limits for certain species will change, too. As biologists, we will keep striving to collect the most accurate and valuable data, so that any resultant management or regulation changes will ensure healthy waterfowl populations for future generations.

Many of our regional WMAs offer ample waterfowl viewing and hunting, along with other outdoor recreation. We encourage you to take a paddle on the Sawtelle Deadwater, go birding on Pond Farm, or float down the Mattawamkeag River. Our WMAs may be managed for wildlife, but they are open for all to enjoy!



*Duck Banding*



## REGION G ASHLAND

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### Pollard Flats Expansion

Amanda DeMusz

The Pollard Flats WMA in Masardis was one of Aroostook County’s smaller WMAs until 2021, when it doubled in size from 223 to 505 acres with the purchase of an abutting property. This purchase served many functions, adding valuable habitat protections as well as guaranteed public access to the WMA.

The original parcel only had official public access via the Aroostook River on the WMA’s eastern boundary. Access via land was limited due to a private access road. With purchase of the additional acreage, the Department now owns the road access to the original parcel, plus additional acreage of mixed habitats to the west. There are now two land access points off the Garfield Road, providing sportsmen and non-consumptive users access to enjoy this WMA’s bounty of flora and fauna.

Within the Pollard Flats WMA, a diverse mosaic of grassland, upland, and wetland resources provide habitat for a wide range of species. The original parcel contained mostly grassland and wetland habitat types, both of which are valuable and declining in Maine. The new acreage increased the WMA’s grassland resources and significantly increased its wetland resources, while adding a valuable upland interface to the property.



*Moose walking across field*

Grassland habitat has been the focus of management on much of the original parcel. We have used a combination of mechanical rotational mowing and prescribed fire to maintain the grassland and ensure habitat for species such as bobolink and American Kestrel. In the summer of 2021, the newly acquired fields were mechanically mowed to remove shrubs that had grown in and to begin restoration of the grassland. We will add this new acreage to our rotational management on the WMA to create additional resources for grassland birds.

Wetland habitat has been the second focus of management on the original parcel. In the past, we applied wetland restoration activities to bring back the quality of the wetland on the WMA. The new parcel was purchased with a focus on wetland habitat and with funding from Maine Natural Resources Conservation Program (MNRCP). It has a variety of wetland and aquatic resources including forested, scrub-shrub and emergent wetlands, perennial streams, ephemeral drainages, and a series of beaver dams that have added to a diverse open wetland area. Each of these wetland types provides valuable ecological functions and habitat for a variety of species from invertebrates to salamanders and even moose.

Access point improvements are underway and will provide the public with safe access to the many resources available in this lightly visited property. In the spring and summer, you can enjoy the colors of the grasslands and plethora of avian species singing away the day. In the fall, the uplands and grassland edges offer opportunities for grouse, woodcock, and waterfowl hunting, as well as beaver and muskrat trapping. And in the winter, strap on some snowshoes or backcountry skis and enjoy the variety of animal tracks in the snow. Any time of year, Pollard Flats has a lot to offer the outdoor enthusiast, and we are very excited about the opportunities this recent expansion provides for you to enjoy its bounty.





# BIOLOGIST ASSIGNED TO BUREAU OF PARKS & LANDS

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## State Parks Provide Habitat for a Rare Rabbit

Sarah Spencer

Maine’s State Parks and Historic Sites provide space for recreation and education all across Maine, from camping with friends and family to paddling, fishing, hiking, picnicking, or relaxing on the beach. These special places are also home to some of Maine’s rare, threatened, and endangered species.

One role of the MDIFW biologist assigned to Bureau of Parks & Lands is to work with these sites’ managers to conserve and protect wildlife. This means something different for each species and site: at some sites, it’s necessary to keep trails closed during sensitive times of year. At others, we enhance habitat by altering characteristics of vegetation or providing artificial structures for nesting and protection. One such species that needs the latter level of help is the New England cottontail – Maine’s only native rabbit.

The New England cottontail’s range once included New England and New York, extending from midcoast Maine south to Connecticut and westward into eastern New York; but it is now restricted to six towns in York and Cumberland County. They are an entirely different species than the snowshoe hare, which is well-adapted to Maine’s deep snow and long winters (and is a hare, not a rabbit). It is also not to be confused with the eastern cottontail, a nonnative rabbit that competes with the New England cottontail for habitat and is nearly indistinguishable without having them in hand or having DNA analysis.

In 2007, Maine listed New England cottontail as an endangered species; and in 2006, the U.S. Fish & Wildlife Service listed it as a candidate species for federal protection under the Endangered Species Act. In 2015, that designation was dropped because of the conservation actions being implemented across the New England cottontail’s range by state and federal agencies, partner organizations, and individuals, all doing their part to protect the species.

Such actions have helped keep New England cottontails from becoming even more imperiled; and at three State Parks in Cumberland County, this endangered species is thriving. Crescent Beach, Two Lights, and Kettle Cove State Parks have the habitat characteristics New England Cottontails need to thrive; and Park staff, volunteers, and biologists are all working together to enhance it even more.

New England cottontails need shrublands and young forests to thrive. We refer to these areas as early successional habitats, meaning they are the first stages of vegetation to grow back after an area is cleared. If you look at an overgrown field or an extremely dense young forest that would be challenging for you to walk through, that’s exactly the kind of area this species thrives in. With time, the dense shrubs and trees grow into older trees with sparse vegetation underneath, and at that point the habitat is no longer preferred by these rabbits.

Have you seen a rabbit lately?  
Keep an eye out and help us  
protect Maine's only native rabbit.  
Report your rabbit sighting at  
[mefishwildlife.com/rabbits](https://mefishwildlife.com/rabbits)

Habitat enhancements at Crescent Beach, Two Lights, and Kettle Cove include several projects aiming to keep targeted areas from becoming older forest. Park staff mow fields and young shrublands annually or every other year to keep them relatively short and young, providing quality food resources for rabbits adjacent to established shrublands, while also benefiting native pollinators and songbirds. During the summer, we mow strips of grass just a few feet away from shrublands. The mown areas encourage growth of non-woody vegetation for rabbits to eat, and the adjacent shrubby patches provide cover from predators. A decade ago, we installed artificial burrows in dense shrub areas, giving rabbits a place to hide from predators year-round and raise their young in the spring and summer.

In shrublands, cherry, aspen, and maples are typically the first trees to become established, so when they reach 3-4 inches in diameter, biologists girdle them. Girdling removes the parts of the tree that move water (xylem) and nutrients (phloem), collectively called the cambium. We can use several tools for this, including a hand saw, draw knife, or hatchet. We recently added an electric chainsaw to our toolbox, which helps us girdle more trees in less time. When we do this in winter, the tree doesn't have the ability to move water into the branches to produce leaves in the spring, so the part of the tree above the ground dies, keeping it from shading out the shrubs underneath. Trees like aspens will then use the sugars and nutrients in their roots to send up shoots from the root system, providing a food source for rabbits the following winter. Similarly, maples will sprout new shoots from the stump. At State Parks we do this on a relatively small scale, girdling individual trees in small areas to keep a steady supply of short, young woody stems to feed New England cottontails.

## REPORT A SIGHTING

If you see a rabbit that might be a New England cottontail or an Eastern cottontail, please take note of the following:

- Date
- Time
- Location
- Town
- What habitat the rabbit was in (shrubs, forest, backyard, etc.)
- Characteristics of what led you to believe it was a cottontail (please do not report known snowshoe hares) – find what to look for below!
- If you can grab a photo, even better!



In addition to the mowing and girdling, we added two more management actions to the list in winter 2021/22. The first was clearing of shrubby growth along the edges of hiking trails and other key areas to encourage growth of summer food adjacent to protection from predators, and the second was to remove small groups of non-native invasive shrubs from old fields and replace them with shrubs native to the ecosystem, which provide higher quality habitat for New England cottontail, birds, and invertebrates. State Park staff have established a dedicated group of volunteers who got started on some of the shrub clearing during the winter, and we are all looking forward to engaging more volunteers with these projects in the future.

If you find yourself in one of these special State Parks and see a rabbit, take a moment to appreciate this endangered species and all the efforts underway to keep them around for generations to come. Remember to always keep your distance and keep pets on a leash to prevent any unwanted interactions. After your walk, be sure to report your rabbit sighting at [mefishwildlife.com/rabbits](https://mefishwildlife.com/rabbits). To learn more about how you can help, visit [www.newenglandcottontail.org](https://www.newenglandcottontail.org).



# LANDS MANAGEMENT PROGRAM

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## Habitat Management at Frye Mountain Wildlife Management Area: Compartment F

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).

The Frye Mountain WMA is no stranger to these projects. It has seen a variety of operations over the decades to maintain and enhance the forest and field habitats for many different wildlife species. For the past two years, Compartment J has been the focus of a timber harvest operation that is slated to finish this coming winter. The next area scheduled for treatment is Compartment F, situated in the southwestern corner of the 5,000-acre WMA. Located entirely in the town of Montville, this 472-acre compartment can be accessed by road from the south using Morrill Rd. or from the north using High Bridge Rd. High Bridge Rd. can be accessed by Walker Ridge Rd. if coming from Rte. 220, or Frye Mt. Rd. if coming from Rte. 137.

To help facilitate operations, we will be improving High Bridge Rd. to make trucking easier, reduce road degradation, and reduce sedimentation of nearby water resources. We will also be building two new roads so that we can more economically harvest the area, more easily perform field mowing, invasive plant control, apple tree pruning, and other management activities, and give the public better access to this mostly isolated compartment. This road work is slated to begin in fall 2022 so that timber harvesting can begin in winter 2022/23.



Figure 1. Compartment F is outlined in pink. Leaf off imagery clearly shows the network of maintained fields and matrix of hardwood, softwood, and mixed wood forests.

In 2020, MDIFW developed a Forest & Wildlife Management Operations Report, also known as a harvest prescription, for Compartment F. The Lands Program staff cruised and inventoried the entire compartment and have set wildlife habitat management goals and objectives based on current forest types, soils, and habitat features. We planned and developed these goals and objectives in coordination with wildlife biologists from MDIFW and Maine Natural Areas Program (MNAP). The proposed operations in the report are subject to competitive bidding through Maine's Division of Procurement Services to ensure equal work opportunities for qualified businesses.

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

Like much of Maine, Compartment F was once heavily cleared for agricultural use. Many stone walls, cellar holes, and barbed wire fences buried deep into the trunks of trees tell us that the landscape was mostly not forested. While farm abandonment would have happened slowly since the end of the Civil War, much of the forest in Compartment F originated when the farms located there were sold to the Federal Government during the Great Depression. Tree cores and the natural mortality of mature balsam fir and intolerant hardwoods corroborate this. With these clues, we can age much of the forest to be between 80 and 110 years old. Because of this land use history, Compartment F lacks vertical or horizontal structural diversity and has stands of intolerant hardwoods and fir that are in the process of collapsing.

To remedy this, we plan to regenerate portions of the compartment to a younger age class through single tree selection and small and large group selection treatments. In doing so, we will remove the short-lived, pioneer tree species such as paper birch, aspen, and balsam fir. This will establish a new generation of trees, increase structural habitat diversity, and improve tree species diversity. Thinning treatments will remove trees of low vigor to give healthier residual trees more space and resources to grow.

Cavity trees, standing snags, rare trees, and other “wildlife” trees will be left regardless of silvicultural treatment to aid in nesting, roosting, and hibernation. 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. Cumulatively, these management techniques will aid the forest in its natural progression and create a more natural forest ecosystem to benefit as many wildlife species as possible.

Upland areas will be managed for hard mast (nut) production, prioritizing northern red oak and mast-producing American beech for their value as wildlife food sources. 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 for roosting.

In general, we will manage the mid-slope areas, which are composed of northern hardwoods, with single-tree and small-group selection methods to promote long-lived, shade-tolerant northern hardwoods species. These include sugar maple, 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.

We will primarily manage the lowland areas to maintain and improve the mixed and softwood cover already growing there. Thinning and single-tree selection to remove intolerant hardwoods, fir, red maple, and overtopped or otherwise low-quality trees will release and encourage the regeneration of longer-lived softwood species like hemlock, red spruce, and cedar. These more mature softwood-heavy stands in low lying areas near water resources make for excellent deer wintering areas due to their protection from the elements, with overlapping crowns of hemlock preventing deep snow accumulations and offering refuge from wind and cold nights. Sprouts from red maple and other hardwood stumps also provide a winter food source.



Figure 2. The current over-mature condition of the field edges at Compartment F.

We will use even-aged treatments like overstory removals and clear cuts in select locations to create and maintain young hardwood forest habitat adjacent to fields, alder flats, and wetlands for the benefit of Ruffed Grouse and American Woodcock. Compartment F features several boomer-ang-shaped fields that in some cases are only separated by several feet of trees and woody vegetation. The original intent of these fields was to maximize the amount of “edge” habitat that grouse like to use for nesting, foraging, and cover; but the wooded strips between the fields are aging out of ideal grouse habitat and becoming mature forest. The centerpiece of the Compartment F prescription is a 30-acre overstory removal that encompasses the wooded strips and forested edges of nine fields to bring them back to a younger age structure with trees that are small and dense for cover but has enough light on the edges to promote soft mast-producing shrubs for food and additional cover.



Figure 3. Ideal field edge conditions, as seen at the Ruffingham Meadow WMA.

As we plan and implement habitat management across Compartment F, we will also need to manage invasive plant species so that desirable native species and herbaceous plant communities can establish themselves, develop, and regenerate. 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 non-native honeysuckle, multiflora rose, Japanese barberry, Asiatic bittersweet, and others have been found in abundance on the Frye Mountain WMA; Compartment F is no exception. 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. This is important because timber harvests can exacerbate problems with invasive plants by inadvertently releasing them from overstory competition instead of the native plants and trees that we want to grow.

## Long-Term Ecological Benefits of Deer Wintering Areas (DWAs) and Northern Conifer Forest Management

Daniel Hill

Northern, Eastern, and Western Maine's whitetail deer are at their northern range limit due to the severity of winters in those parts of the state. Maine Department of Inland Fisheries and Wildlife (MDIFW) is responsible for improving Deer Wintering Area (DWA) habitat conditions throughout these areas to help deer survive the significant snow depths, cold temperatures, and long-term resource restriction. To that end, MDIFW is working with landowners and local conservation organizations to acquire, manage, and assist with managing DWAs. This is one strategy we are using to meet our whitetail deer management objectives. Maine's whitetail deer require a more mature spruce-fir softwood-dominated forest with a minor hardwood component to help protect them from the harsh elements from December through April or even May, depending on the

year and location. The mature softwood provides cover from snow accumulations and severe winds, while the hardwood provides a source of winter food within proximity of shelter. Deer in these areas are considered migratory, traveling as far as 75 miles to find these habitats with the components that will help them survive until the spring. The more acres of quality wintering habitat, the more deer that will utilize them, and the more successful Maine's deer populations will be at surviving the winter long-term.

DWAs also provide seasonal and year-round benefits to a suite of other wildlife species. A lot of times, they border riparian, lowland wetland, or forested wetland ecosystems, and provide connectivity and habitat for other mammals, birds, reptiles, amphibians, invertebrates, and more. Some such wildlife species include fisher, snowshoe hare, American beaver, merlin, American three toed and black-backed woodpeckers, rusty blackbird, pine grosbeak, spruce grouse, Northern saw-whet owl, and great blue heron.

Vernal pools are integral components of a forested ecosystem and are found throughout Maine's northern conifer forests. Just some of the species that utilize vernal pools within DWAs include reptiles and amphibians like wood frog, green frog, blue-spotted salamander, spotted salamander, common garter snake, and painted turtle, as well as invertebrates like freshwater mussels such as creeper, Mayflies such as the Tomah mayfly, dragonflies such as pygmy snaketail, and butterflies such as the Clayton's copper. Some of the species listed above are common, while others are threatened, endangered, or species of special concern in Maine. Long-term vernal pool management will improve water quality and the diversity of flora and fauna species associated with these habitats.



*A softwood dominated Northern conifer stand in winter Photo by Daniel H. Hill.*

The northern conifer or Acadian forest type is found in northern Maine, eastern Canada, and higher elevations in northern New York, Vermont, and New Hampshire (Braun 1950). It lies in a transition zone between the boreal forest and the eastern temperate forest and is characterized by spruce species and balsam fir with components of eastern white pine, northern white cedar, eastern hemlock, and hardwoods including red maple, aspen, and birch. The northern conifer forest was historically called the spruce-fir forest, as its primary timber species were balsam fir and red, black, and white spruce. (Source and Credit to: Northern Conifer Management by Granstrom et. al.)

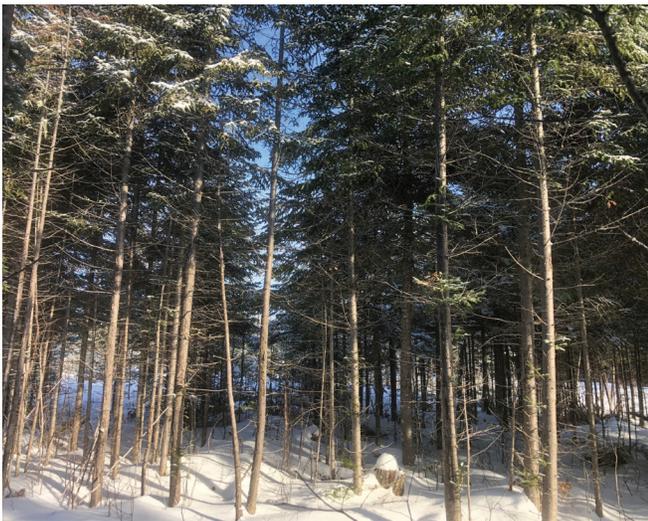
Silvicultural techniques associated with DWA management include a suite of activities to improve the overall forest health and strength of trees after management activities. One technique that can be used to assist with the development of a more mature Northern conifer forest is precommercial thinning (or PCT). PCT is commonly utilized to intervene with forest development at a softwood stand's younger stage to enhance its species makeup and overall hardiness. A forester and biologist set a species priority list based on the site's conditions, including promotion of the strongest individual trees and tree species for the stand's

future development. This list will include longer-lived quality softwood species (red spruce, Eastern hemlock, and Northern white cedar) to promote a softwood dominated habitat. The tree types and species that will be removed first are hardwoods (red maple, sugar maple, paper birch, yellow birch, and ash) and lower-quality softwoods that will not benefit the stand as it matures. Individual hardwoods that are removed tend to resprout, providing a reachable food source for deer as the stand develops. In a DWA, the goal of PCT is to assist with stand development and transition younger softwood stands to a more mature condition in a shorter amount of time, while also providing a food source for the deer within proximity of developing shelter.

#### Works Cited

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A young softwood dominated Northern conifer stand in winter.  
Photo by Daniel H. Hill





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