WILDLIFE

RESEARCH & MANAGEMENT

REPORT 2018

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

ALL IN FOR THE MAINE OUTDOORS

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

COMPILED AND EDITED BY DIANA HARPER

MAINE DEPARTMENT OF INLAND FISHERIES & WILDLIFE

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WILDLIFE RESEARCH & MANAGEMENT REPORT 2018

ALL IN FOR THE MAINE OUTDOORS

When MDIFW adopted our new tagline in 2017, it meant many different things to us.

First, it represented solidarity. Our agency is widely diverse, composed of wildlife biologists, educators, and game wardens, and funded largely by Maine's sportsman community. While our interests may seem broad, we're united by something we all care deeply about: preserving, protecting, and enhancing the Maine outdoors.

"All in" also describes the way we go about our jobs, both here in the Wildlife division and across the agency. Whether it's a biologist surveying bald eagle nests along the coastline from a small, fixed-wing aircraft, a game warden responding to a lost or injured person in harsh wilderness conditions, or an educator at Maine Wildlife Park sparking a child's love for animals, we're all strongly motivated by the importance and impact of our work.

Over the past year, we've been going all in on public awareness and educational efforts, aiming to build a larger community of those who support and appreciate Maine wildlife, and to ensure that the link between wildlife conservation and responsible hunting, fishing, and outdoor recreation is not lost on current or future generations.

And we're seeing some exciting results. The beneficiaries of our work are just as diverse as we are, ranging from aspiring hunters and fishermen to wildlife watchers, citizen scientists, weekend recreationists and more. In 2018, 17,000 of them engaged with our campaign to sign up as a Keeper of the Maine Outdoors (and get on our email list). This group, which is still growing, has responded enthusiastically to our communications with them, including opportunities to get involved in citizen science projects and sporting events throughout the state.

By reading this report and educating yourself on Maine's wildlife management programs, you're showing that you are a part of it, too. It's my honor to invite you to join us in saying, "we're all in."

Sincerely,

Judy Camuso
Commissioner, MDIFW

MAINE'S 2015-2025 WILDLIFE ACTION PLAN

A plan to coordinate voluntary conservation efforts

Amanda Shearin

MDIFW and our conservation partners across the state are now almost three years into the implementation of Maine's 2015-2025 Wildlife Action Plan. This plan, which identifies 600-plus possible conservation actions, is our primary tool for conserving Maine's 378 most vulnerable fish and wildlife species (referred to in the plan as Species of Greatest Conservation Need, or SGCN) before they decline to a point where endangered or threatened species listings are necessary.

The plan is strictly non-regulatory, relying instead on partnerships and voluntary efforts. And the conservation actions within it are adaptive and comprehensive enough that almost any person or group can find one relevant to their interests, location, and/or mission. Options include research and monitoring of species and their habitats, habitat management, outreach, education, and more.

Along with our partners, we have organized many of these actions into citizen science projects, which you'll read more about throughout this report. Projects currently underway include monitoring of Maine's mammal, bird, amphibian, invertebrate, and reptile species.

Maine's 2015-2025 Wildlife Action Plan has already influenced numerous planning, conservation, and management efforts across the state. For example, over the past year MDIFW has been identifying wetland habitats in our Wildlife Management Areas crucial to the conservation of several declining reptile, amphibian, and invertebrate species. And conservation groups and landowners have been including updated SGCN and habitat information in grant proposals and land management plans.

We've also been working on outreach. In late 2017, we conducted a phone survey to gauge public awareness of Maine's declining fish and wildlife species, and we're now using information from that survey to inform SGCN outreach and education strategies.

You can read the plan and find an action or project that works for you at maine.gov/ifw/fish-wildlife/wildlife/wildlife-action-plan.html.

MDIFW staff and conservation partners surveying Blanding's turtle habitat. Blanding's turtles are a priority species in Maine's 2015-2025 Wildlife Action Plan.

Photo by Derek Yorks

In 2019, we'll continue working with conservation partners on the development of a new collaborative webtool. This tool, called the 'Maine State Wildlife Action Plan Conservation Action Tracker,' or 'SWAP CAT', will document our collective conservation accomplishments across the state and allow partners to voluntarily document their activities, search for other organizations performing similar work, and identify conservation needs and gaps. If your organization would like to become involved in reviewing and testing the SWAP CAT as it is developed, please reach out to me at **amanda.f.shearin@maine.gov.**

FUNDING WILDLIFE CONSERVATION

There is a saying that "sportsmen are the original conservationists," and it still rings true today. We receive most of our funding from hunting or fishing license and equipment purchases and other voluntary contributions, which are then matched up to 3x by various grants and federal allocations.

Federal State Wildlife Grants (SWGs)

MDIFW receives some federal funding to manage at-risk animals designated Species of Greatest Conservation Need (SGCN) in the State Wildlife Action Plan. These funds support vulnerable species before further setbacks lead to protection via the Endangered Species Act (ESA); but the certainty and scale of SWG funds fall far short of the need. SWGs are appropriated in each year's federal budget and distributed based on a state's area and human population. Like 12 other rural or small states, Maine receives a minimum 1% share. In FY 2018, that was $506,000, or just $1,340 per species for the year.

Partnerships, regional collaborations, and other dollar-stretching strategies

To maximize effectiveness of SWG dollars, we forge partnerships and regional collaboration with other states, and place emphasis on strategies that benefit multiple SGCN or help us to secure other grants. You'll read about several such projects throughout this report.

Voluntary Contributions

Here's where you can help!

1. Buy a hunting or fishing license (some people do this even if they don't hunt or fish). This is our core funding mechanism. License revenues directly support MDIFW and fund the 25% state matching dollars required for federal Pittman-Robertson Act* and Dingell Johnson Act* funds.
2. Buy sporting equipment. Most staff salaries, administrative costs, and operations of MDIFW's Bureau of Resource Management are funded by federal aid cost-share programs based upon excise taxes on sporting equipment.
3. Upgrade your license plate. A $20 upgrade to your vehicle registration, the loon/conservation and sportsman/support wildlife license plates both support the Maine Endangered and Non-game Wildlife Fund, as well as the state parks (conservation plate) and fisheries, landowner relations, and public boat launches (sportsman plate).
4. Contribute to (or ask your tax preparer about) the Chickadee Checkoff. The suggested donation is $5-25, and it goes directly to the Maine Endangered and Non-game Wildlife Fund.
5. Donate online. You can contribute to the nongame and endangered species fund via the MDIFW online store.

The Pittman-Robertson (PR) Act, adopted in 1937, generates funds earmarked for management of mammals and birds. Maine's allocation in Fiscal Year (FY) 2018 exceeded $8.0 million.

The Dingell-Johnson (DJ) Act of 1950 initiated similar support for fisheries, and Maine's share this year exceeded $3.5 million.

ENDANGERED AND THREATENED SPECIES CONSERVATION IN MAINE

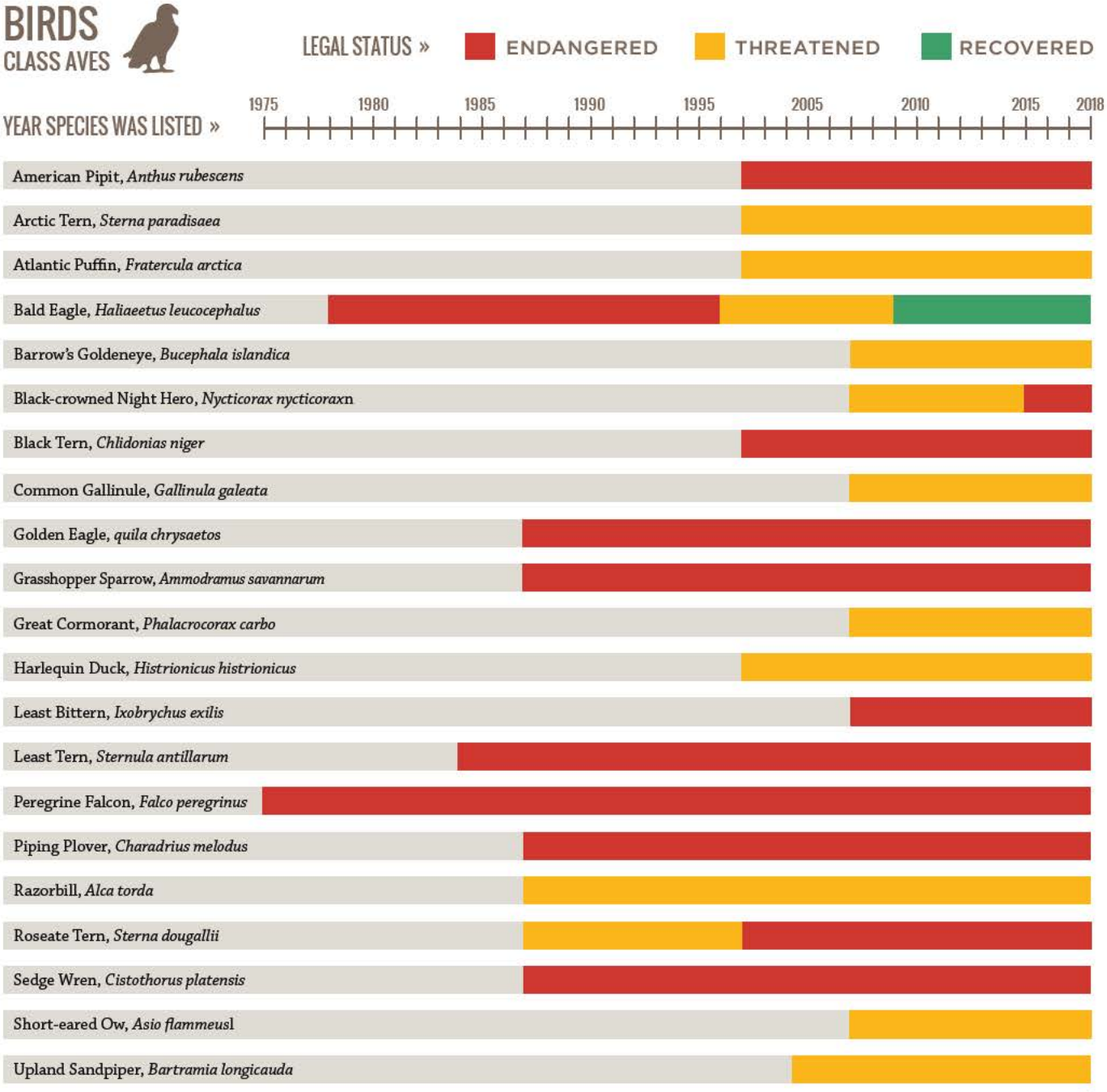
Maine's List of Endangered and Threatened Species Managed by MDIFW

Charlie Todd

HOW DOES A SPECIES GET ON THE ENDANGERED/THREATENED LIST?

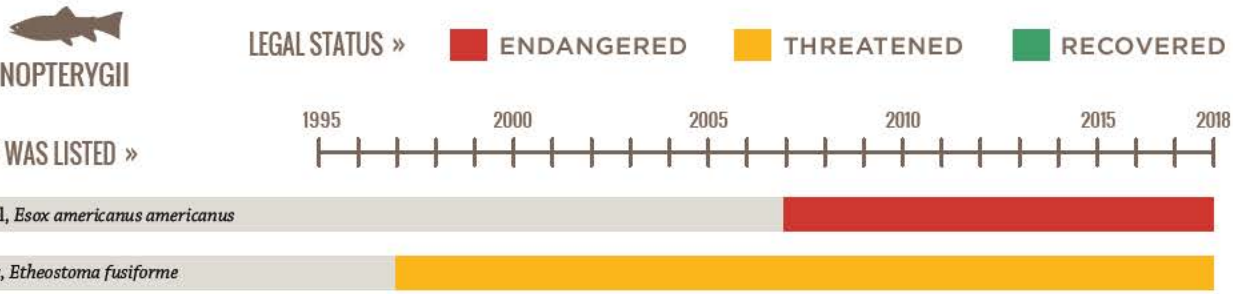
In order for any bird, terrestrial animal, or freshwater fish species to be listed as endangered or threatened (E/T) in Maine, the listing has to be proposed by MDIFW, then reviewed and adopted by the Maine Legislature. The current E/T list under MDIFW jurisdiction includes the following 51 species (**Figure 1**).

FIGURE 1. FISH & WILDLIFE LISTED AS ENDANGERED OR THREATENED UNDER MAINE'S ENDANGERED SPECIES ACT (2015).

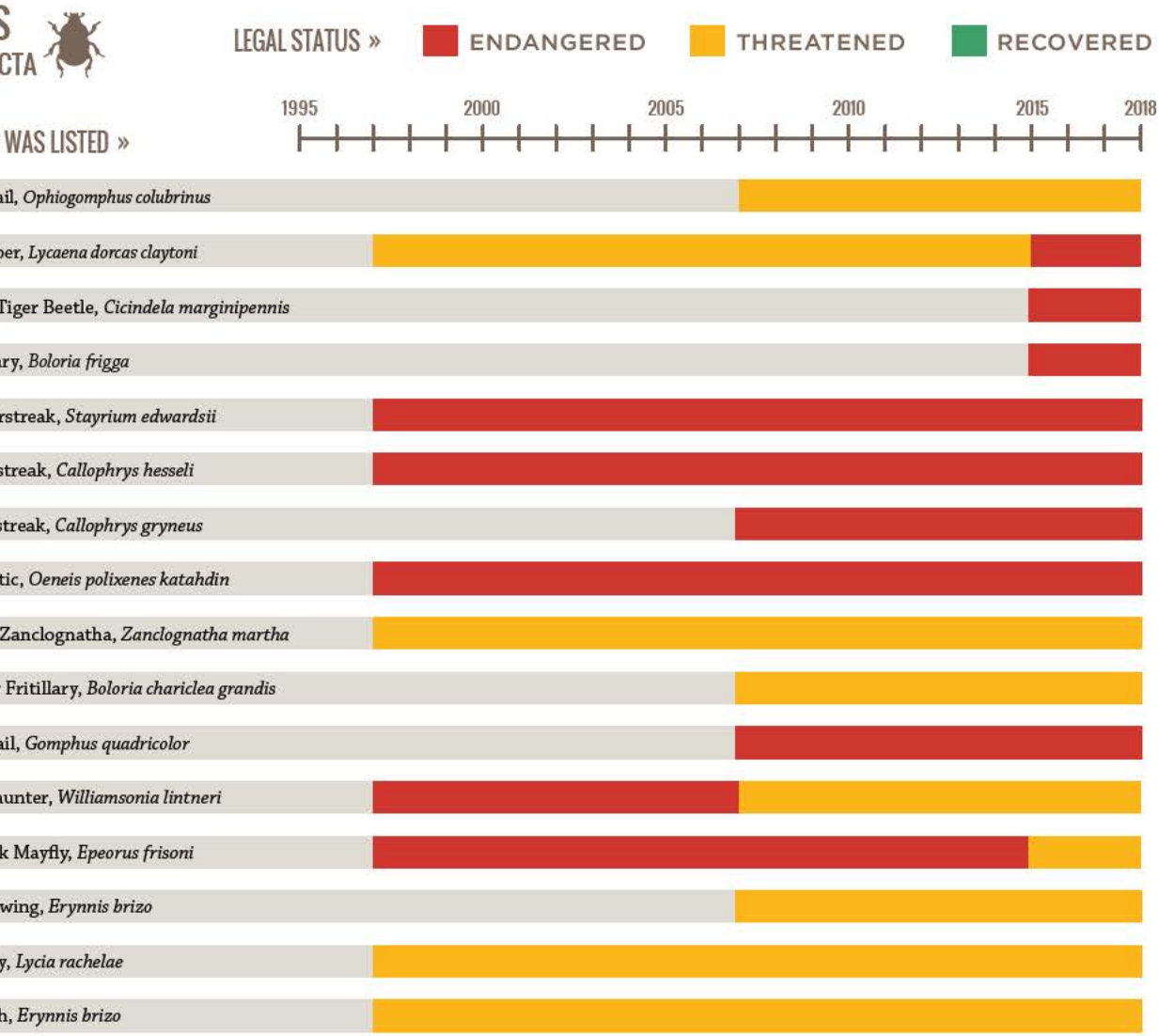


Regulations require MDIFW to review this list at least once every eight years for the purpose of adding, deleting, or changing the status of listed species as needed. All proposed changes are reviewed in advance by the Department and peer scientists, and weighed in on by citizens during public hearings. After these steps, we draft a bill for state legislators to consider the following year.

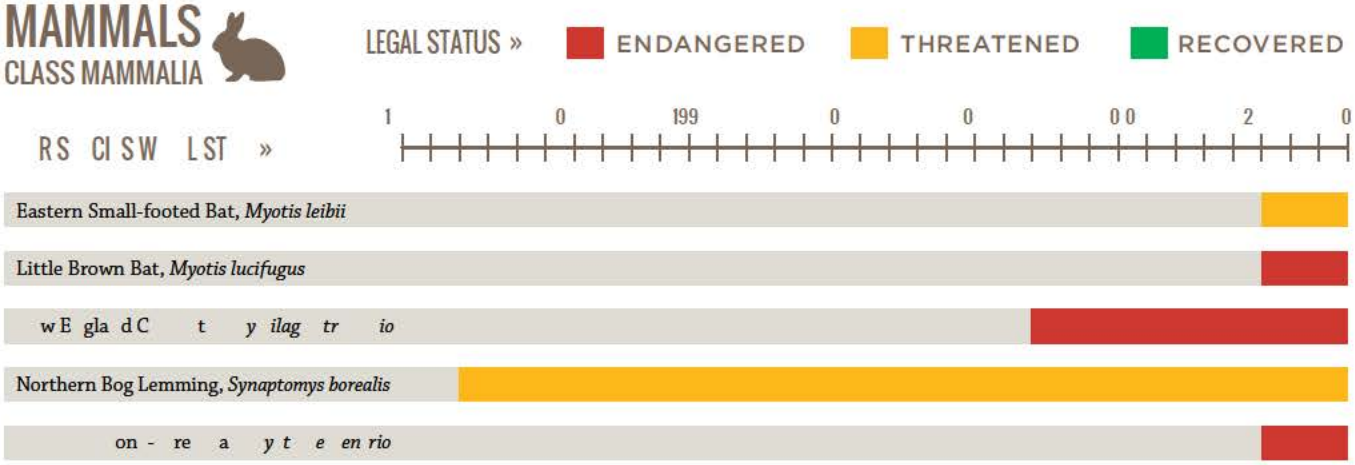
FISH
CLASS ACTINOPTERYGII



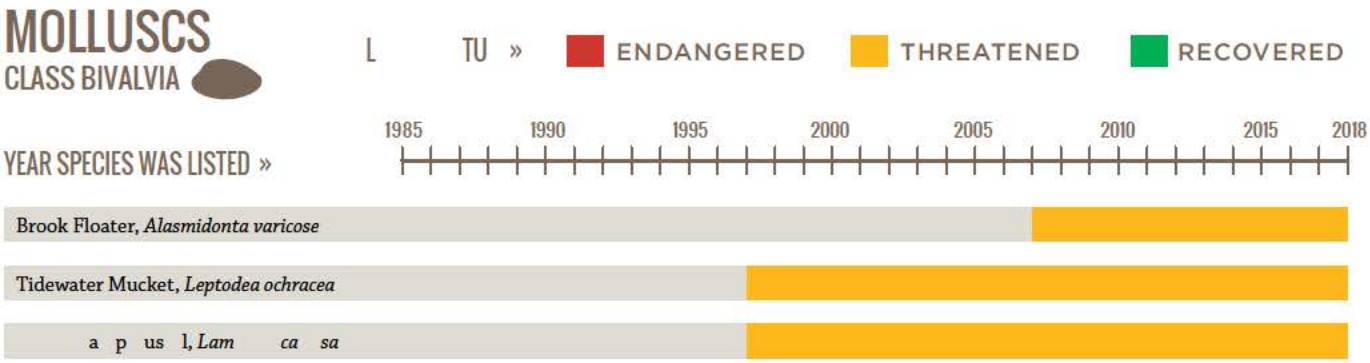
INSECTS
CLASS INSECTA



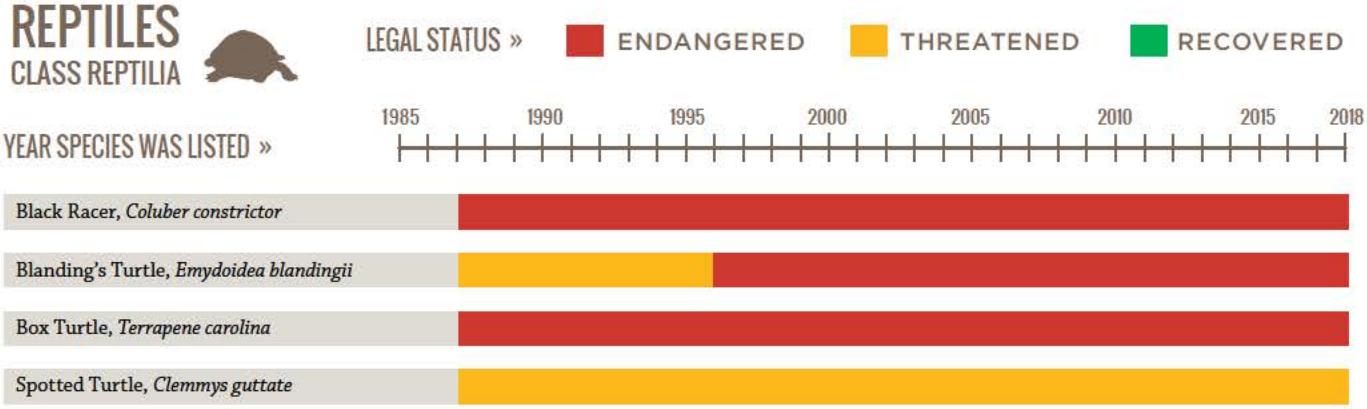
MAMMALS
CLASS MAMMALIA



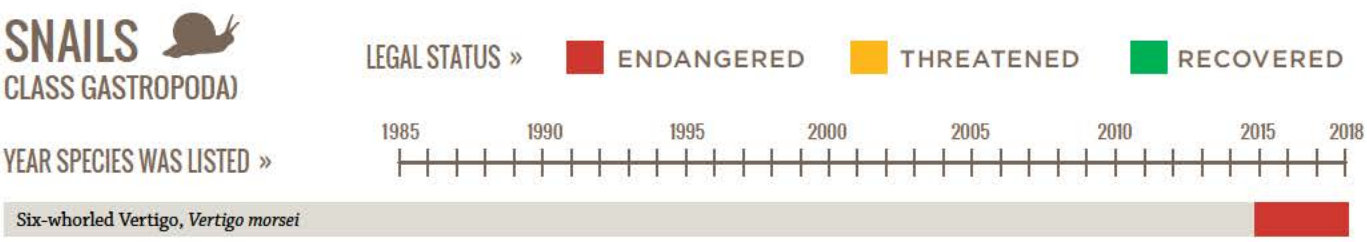
MOLLUSCS
CLASS BIVALVIA



REPTILES
CLASS REPTILIA



SNAILS
CLASS GASTROPODA)



Charlie Todd

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

Endangered/Threatened Species not Managed by MDIFW

Some species are managed by different state agencies. These include:

Department of Marine Resources
- Marine fish
- Turtles & invertebrates that occur in coastal water

Maine Natural Areas Program (Department of Agriculture, Conservation and Forestry)
- Plants

The U.S. Fish and Wildlife Service and the National Marine Fisheries Service
- Animals and plants recognized under the federal Endangered Species Act (currently 23)

Nationally Endangered Species

Twenty-three Maine species are recognized under the Federal Endangered Species Act, meaning that they are endangered or threatened over "all or a significant portion of a species range." In these cases, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service take the lead on species management, in cooperation with state agencies. MDIFW has had a cooperative management agreement under federal ESA since 1976.

Recent Maine Endangered/Threatened Species Highlights

- No species have been extirpated (lost from Maine) after being listed under the Maine Endangered Species Act.
- **Blanding's turtles, spotted turtles, and New England cottontail** each have regional conservation strategies that coordinate MDIFW actions with those of other states and resource agencies.
- A similar regional coalition is now focused on the **wood turtle** and the **brook floater**, a rare freshwater mussel, across its entire range in states and provinces along the Atlantic seaboard. A decision is pending on its federal ESA status.
- Intensified monitoring and radiotelemetry studies have advanced insights the **black racer**, Maine's rarest snake.
- A new population of the **juniper hairstreak butterfly** was documented by MDIFW in 2018, in a Southern Maine rocky outcrop with Eastern Red Cedar. This raised the number of known Maine sites for this distinctive emerald green butterfly to just three.
- Thanks to a cooperative agreement drafted by MDIFW and funded by the U.S. Fish and Wildlife Service – Maine Field Office, **little brown bats, northern long-eared bats**, and **eastern small-footed bats** at Maine's largest cave bat hibernaculum recently benefited from installation of a disturbance-limiting "bat gate."
- Reintroductions of captive-bred **New England cottontail** began this year, while habitat restoration efforts continue with cooperating landowners in southern Maine.
- Two new breeding locations for **grasshopper sparrows** were documented in southern Maine during 2017–2018. The species had nested at only four localities in the previous 30 years.
- The abundance of **piping plovers** reached a record 69 pairs nesting on Maine beaches in 2018. Management agreements formalize stewardship at all publicly-owned (municipal or state) beaches and one private ownership.

No species have been lost from Maine after being listed under the Maine Endangered Species Act.

- **Peregrine falcons** nested in at least four new locations in the last two years. A fifth pair benefited from a gravel nest tray installed by the Maine Department of Transportation. After at least three years of breeding failure, this Penobscot County location yielded eight young peregrines during 2017 - 2018, a new two-year record!
- MDIFW staff have tallied four observations of **golden eagles** so far in the 2018 breeding season. The state's last nesting effort was in 1997. Maine is the only eastern state where golden eagles can be seen throughout the year.
- MDIFW staff processed hundreds of requests for environmental review of projects in 2017 - 2018, providing science-based recommendations designed to balance economic opportunities with conservation of habitat for the state's rarest and most vulnerable wildlife.

Monitoring a Recovered Species

When MDIFW removed bald eagles from Maine's E/T list in 2009, we committed to monitor the breeding population at least once every five years moving forward. Preliminary results from our 2018 survey identified 734 nesting pairs across the state, an increase of 102 since the last survey in 2013 **(Figure 2)**. We observed single adults at another 55 nests, as well as 87 former nesting territories that appeared to be unoccupied. The effort is always a "minimum count," but this year's preliminary total may have missed as many as 40 pairs. Eagles spend less time near nests if not tending eggs or nestlings, and severe snowstorms in early March handicapped aerial surveys.

Rates of population growth over the past five years in 10 Maine counties exceed the 16% statewide average. York, Oxford, Sagadahoc, Aroostook, Piscataquis, Franklin, Kennebec, Lincoln, Cumberland, and Androscoggin (in decreasing order) exhibited proportionally more expansion since 2013. The primary growth of the bald eagle population nesting in Maine continues to shift westward and northward from the traditional Downeast stronghold **(Figure 3)**. In 2018, eagles occupied a record 90% of all traditional territories ever documented in Maine.

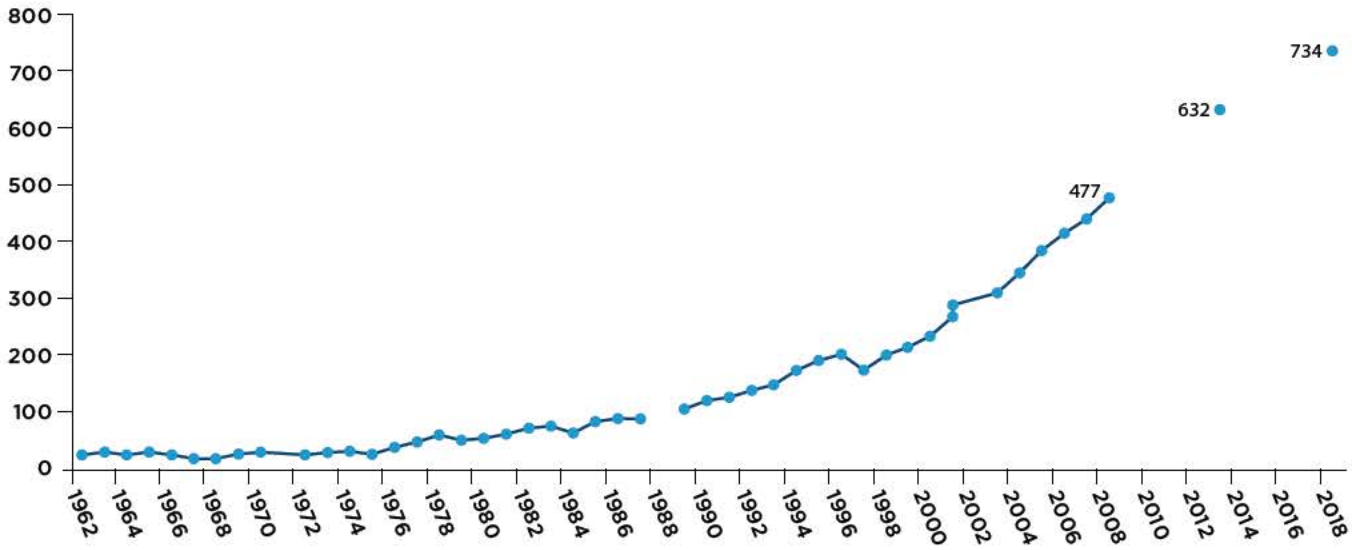
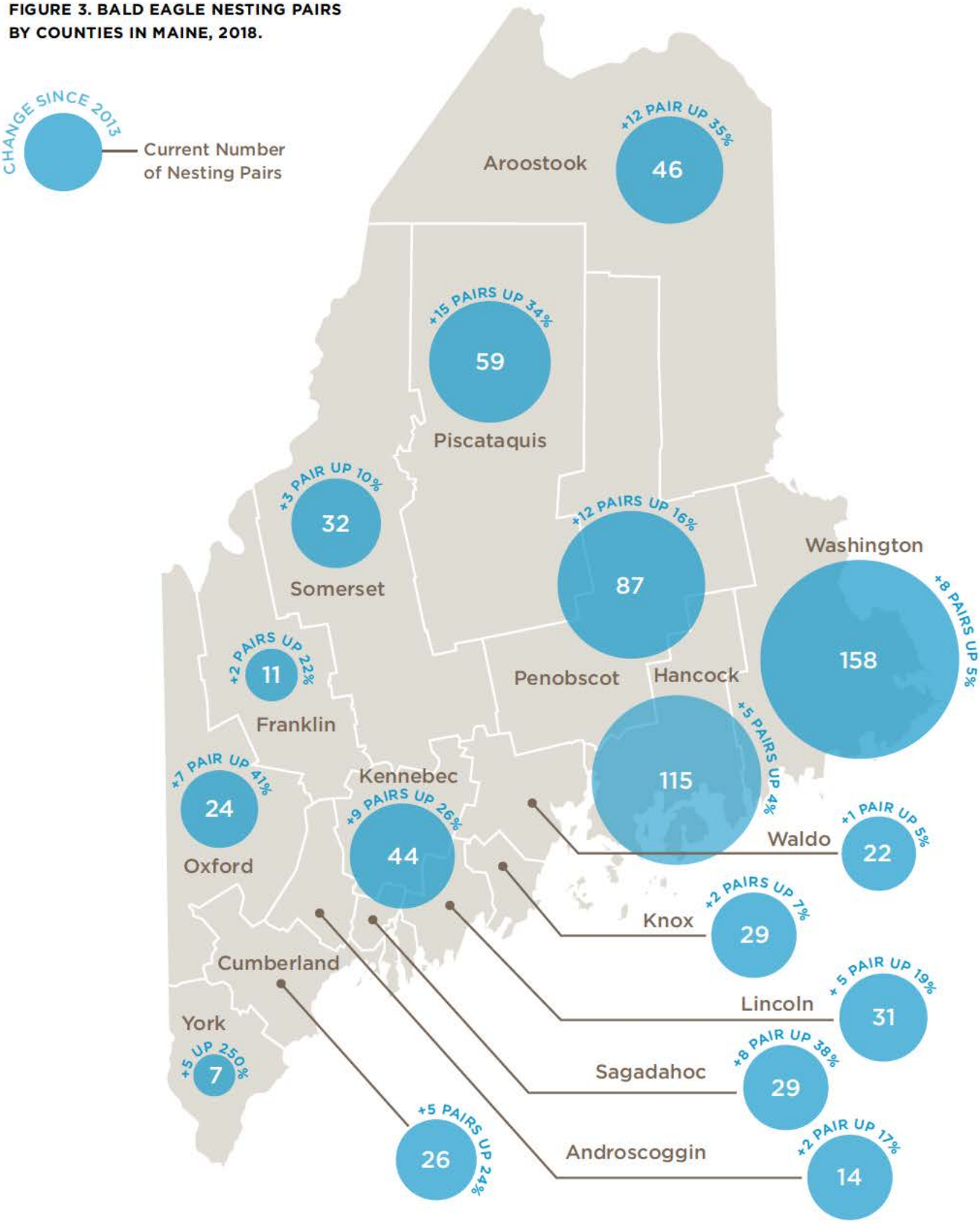


FIGURE 2. STATEWIDE ABUNDANCE (NESTING PAIRS) OF BALD EAGLES BREEDING IN MAINE, 1962-2018.

FIGURE 3. BALD EAGLE NESTING PAIRS BY COUNTIES IN MAINE, 2018.



EXCEPTIONAL #s OF NESTING EAGLE PAIRS IN MAINE TOWNSHIPS

12
ADDISON

11
JONESPORT
LUBEC
PEMBROKE

10
SWANS ISLAND

9
DEER ISLE
HARPSWELL

8
FRENCHBORO

7
DRESDEN
GOULDSBORO
HARRINGTON
PERRY
PHIPPSBURG
STEUBEN

6
BEALS
EDMUNDS TOWNSHIP
MILBRIDGE
VINALHAVEN
WINTER HARBOR
WOOLWICH

5
ARGYLE TOWNSHIP
BAR HARBOR
BLUE HILL
CUTLER
FRANKLIN
INDIAN TOWNSHIP
LINCOLN
NORTH HAVEN
STONINGTON
TRESCOTT TOWNSHIP
WINSLOW
WINTER HARBOR

Over the past 40 years, a remnant eagle population centered in eastern Washington County has recovered its statewide range. Eagle numbers are very impressive in some Maine communities, with highlights listed to the left. Most citizens and visitors to Maine now can encounter bald eagles wherever they are!

Aerial Bald Eagle Nest Surveys

We gratefully acknowledge the tremendous effort and skills of MDIFW warden pilots Jeff Beach, Gary Dumond, Chris Hilton, and Jeff Spencer, who logged 240 hours of flight time during the 2018 aerial bald eagle nest surveys.

The 17 MDIFW staff members who served as observers were: Sarah Boyden, Judy Camuso, Mark Caron, Bob Cordes, Danielle D'Auria, Henry Jones, Scott Lindsay, Kendall Marden, Amy Meehan, Tom Schaeffer, Andrew Smart, Sarah Spencer, Allen Starr, Charlie Todd, Chandler Woodcock, Derek Yorks, and Brad Zitske.

Much of our funding is voluntary. Here's how you can help.

One unfavorable recent trend relates to state funds earmarked for conservation of nongame wildlife, including E/T species. 43 years after passage of the Maine Endangered Species Act, the only State funds available to MDIFW specifically for E/T conservation are derived from charitable contributions. The two major sources, the "Chickadee Checkoff" (contribution on state income tax returns) and the "Loon Plate" (purchases or renewals of a conservation registration for vehicle licenses), have supplied >95% of all state revenue. However, both yield 50% fewer dollars than they did 20 years ago.

In a recent survey of Maine citizens, MDIFW programs for conservation of nongame and E/T species are overwhelmingly endorsed; but unfortunately, that support has not yet translated into a stable funding source. Please consider helping us by donating through the chickadee checkoff, purchasing or renewing a loon plate, or making an independent donation.

This work is supported by the federal Pittman-Robertson program for wildlife restoration, Federal State Wildlife Grants for conservation of species "at risk," and state revenues from citizens who purchase the Loon Conservation Plate or contribute to the Chickadee Check-off on individual income tax returns.

HABITAT CONSERVATION AND MANAGEMENT

What We Do

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

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

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

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

MEET THE HABITAT GROUP

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

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

Jason Czapiga, GIS Coordinator

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

Amy Meehan, Wildlife Biologist and GIS Specialist

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

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

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

GIS Technology Helps MDIFW Survey Breeding Birds Across Maine

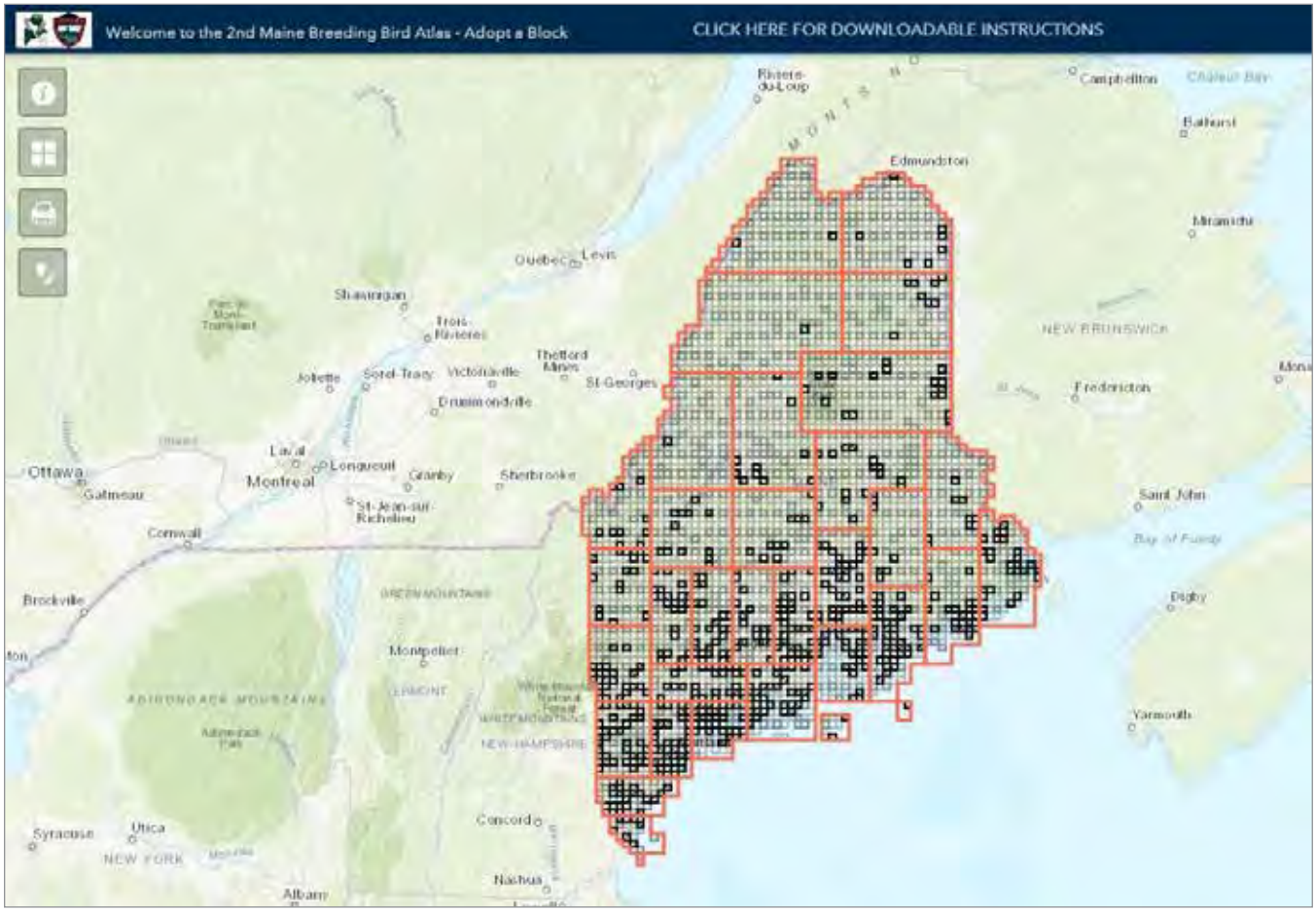
Amy Meehan

In 2018, the Department embarked upon a massive, five-year, statewide citizen science project to determine the distribution and abundance of breeding birds. This ongoing project involves recruiting and organizing hundreds, if not thousands, of volunteer birders, each of whom is responsible for "adopting" one or more of 4,000 nine-square-mile survey blocks across the state and recording observations there.

To facilitate that process, we needed to give volunteers a way to efficiently explore and sign up for available survey blocks. Our solution was to utilize ESRI (Environmental Systems Research Institute) ArcGIS Online software to create a custom mapping application. The Breeding Bird Atlas "Adopt A Block" application lets users explore blocks across the state and sign up to adopt the one(s) they're most interested in. The application also provides downloadable PDF maps of each block with either a topographic or aerial photo background. So far, volunteers have adopted roughly 600 blocks **(Figure 1).**

FIGURE 1. THE SECOND MAINE BREEDING BIRD ATLAS "ADOPT A BLOCK" WEB APPLICATION.

Volunteers can use this to explore the state and sign up to adopt a block to survey.



In future years, we will use this technology to provide updates on the progress of the Breeding Bird Atlas, such as blocks that have been completed, blocks that still need to be surveyed, and blocks where different breeding bird species have been found.

In addition, the Breeding Bird Atlas will be hiring technicians each year to conduct statewide point counts, which involve an observer standing in one spot and counting all birds seen or heard within a given radius. GIS (geographic information system) technology will assist by creating random starting points along roads and then mapping a survey route and points along that route. The technicians can then download the point coordinates into a GPS unit, navigate to each survey point for a count, and link the species they observed to their spatial locations. The resultant data set will help us estimate the abundance of breeding birds (typically measured per square kilometer) and their corresponding habitat associations.

Anyone can contribute to the Breeding Bird Atlas, even if they don't wish to adopt a block! To learn more, go to our website: **maine.gov/ifw/fish-wildlife/maine-bird-atlas/index.html**. To explore Breeding Bird Atlas survey blocks and/or adopt a block, click on the "Browse the interactive map" link.

Citizen Science Web Portal

Don Katnik

The Breeding Bird Atlas is just one of many citizen science efforts crucial to the work we do. Keeping our databases up to date with the current locations of priority wildlife species can be a challenge, especially for species that are uncommon, cryptic, or that live in remote areas—so we rely on the Maine public's passion for wildlife to help.

Our citizen science programs recruit people who are interested in and skilled at identifying particular species to participate in wildlife monitoring. This year, we launched a new web portal **(Figure 2)**, funded partly by a grant from the Maine Outdoor Heritage Fund, to promote these projects.

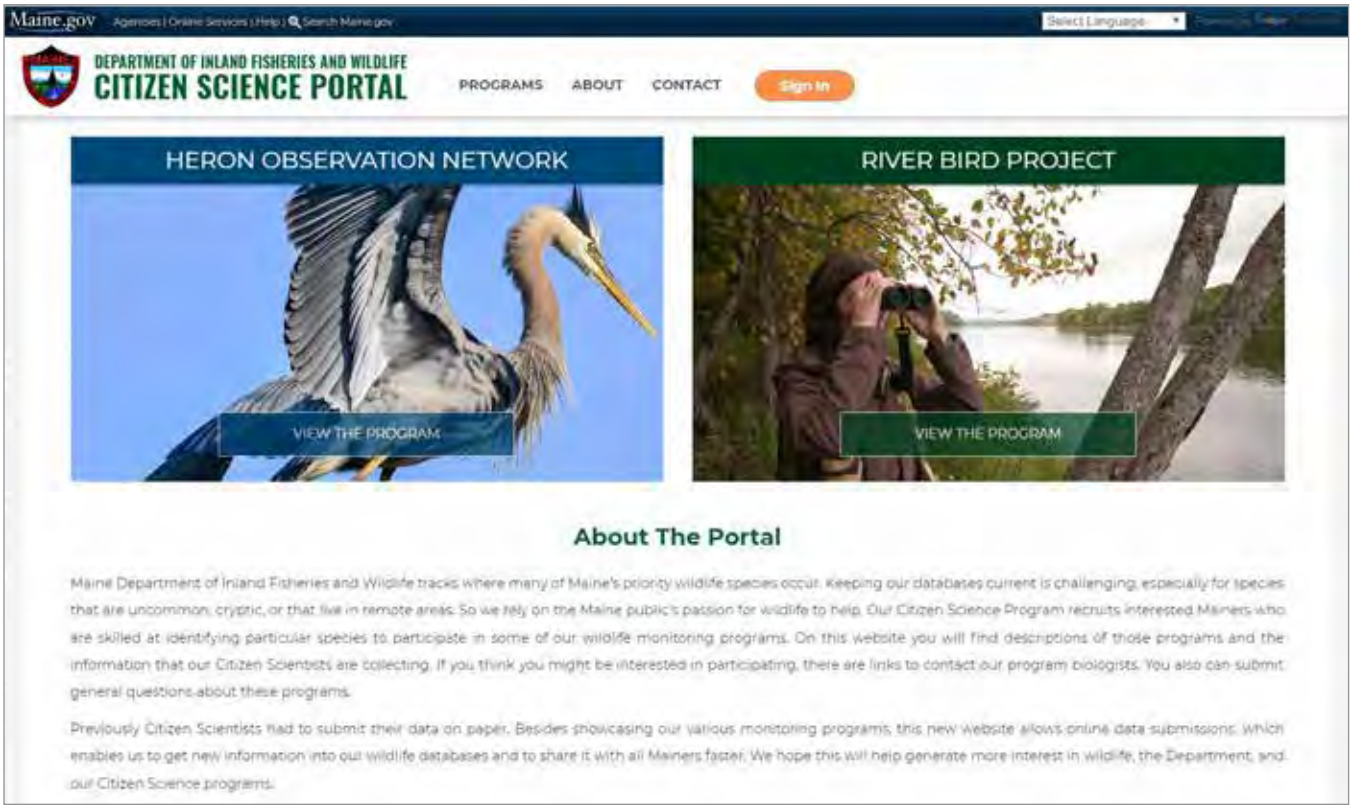
The portal allows users to learn about each project, view interactive maps that display survey data collected to-date, and contact us if they're interested in joining the effort. It also gives current citizen scientists an easy way to submit their monitoring data. These online submissions allow us to get new information into our wildlife databases and back out through the portal maps quickly and accurately.

We hope this will help generate more interest in wildlife, the Department, and our citizen science programs. The portal currently features two major citizen science projects — the Heron Observation Network and the River Bird Project — and we plan to add more soon.

ifw.citizenscience.maine.gov

This work is supported by the federal Pittman-Robertson and State Wildlife Grants programs, a Maine Outdoor Heritage Fund grant, state revenues from sales of hunting licenses and Loon Conservation Plate and Chickadee Check-off Funds.

FIGURE 2. HOME PAGE FOR THE CITIZEN SCIENCE PORTAL OF THE MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE.



BIRD CONSERVATION AND MANAGEMENT

Maine: a Home and a Haven for North American Birds

Aside from being widely valued wildlife resources, birds are also incredible indicators of ecosystem health, with their abundance levels, behaviors, and movements often providing the earliest signs of larger, more widespread trends.

Of the 900 bird species in North America, 427 have been documented in Maine. Our diverse inland and coastal habitats provide nesting space for 225 species, and a place to land for several others that either migrate through or winter here.

Breeding Birds

Inland Maine marks the northern breeding distribution limit for 29 inland species, and the southern limit for another 29. And Maine's coastal islands represent the southern breeding limit of many island-nesting seabirds.

Several species have expanded their breeding ranges into Maine over the past century, including most recently the sandhill crane (Grus canadensis). Two species, the peregrine falcon (Falco peregrinus) and the wild turkey (Meleagris gallopavo), have been reintroduced into Maine following extirpation. MDIFW now carefully monitors and manages both of these species.

Migrating Birds

Maine is located at a constriction point of the Atlantic Flyway – a funnel-shaped migratory path that begins in the eastern Canadian arctic and Maritimes and tapers down North America's east coast. This flyway covers some of the continent's most productive ecosystems, including about a third of the U.S. human population.

The Atlantic Ocean has a channeling effect on birds' migratory movements as they fly south in late summer and fall, and Maine's vast coastline and more than 4,000 coastal islands provide important stopover areas for millions of migrating birds.

Conserving birds and their habitats in Maine's portion of this important flyway is a monumental task.

MEET THE BIRD GROUP

Brad Allen, Wildlife Biologist and Bird Group Leader

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

Erynn Call, Ph.D. Wildlife Biologist

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

Danielle D'Auria Wildlife Biologist

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

THANK YOU, BIRD CONSERVATION VOLUNTEERS!

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:

Diane Winn
Marc Payne and others at Avian Haven
Maine Warden Service pilots Jeff Beach and Jeff Spencer
USFWS pilot/biologist Mark Koneff
Rich MacDonald
Colleen Bovaird
Donna Kausen
Sean Rune
Shannon Buckley
Kate Ruskin
Kate O'Brien
Bruce Connery
Todd Jackson
Bill Carll
Courtney Hagenaars
Tom Berube
Glen Mittelhauser
David Brinker
Tom Hodgman
Louis Bevier
Amber Roth
Evan Adams
Doug Hitchcox
Becky Whittam
Joan Walsh
Brian Olsen
John Drury
Chris West
Bill Hanson
Chris DeSorbo
Wing Goodale
Lucas Savoy
Lauran Gilpatrick
Kevin Regan
Lesley Rowse
Joe Wiley
Margo Knight
Don Mairs
Ron Joseph
Patrick Keenan

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 Maine's Second Breeding Bird Atlas and is 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.

Lindsay Tudor
Wildlife Biologist (retired)

Lindsay coordinates the Department's shorebird program, with current emphasis on shorebird habitat protection under the Natural Resources Protection Act, and piping plover and least tern management. Lindsay's research involves shorebird movements within the Gulf of Maine, and her primary survey responsibilities are coastal shorebirds, including purple sandpipers. Lindsay also oversees the Department's harlequin duck surveys. Lindsay retired in August 2018, after 32 years with the Department. Thank you, Lindsay, for your hard work and dedication! We wish you all the best!

Bill Johnson
Bill Sheehan
Susan Gallo
Laura Minich-Zitske
Don Reimer
Scott Kenniston
Libby Mojica
John Sewell
Sharon Fiedler
Brittany Currier
Ryan Robbins
Ken Janes
Doug Suitor
Michael Fahay
Jill Glover
Julie Johnston
Deanne Richmond
Houston Cady
Jeremy and Addison Polis
James Armstrong
Erik Blomberg
Marek Plater
Dan Grenier
Douglas McMullin
Stephanie Shipp
Merle and Anne Archie
Dan Hill
Dan Frappier
Yankee Chapter of NAVHDA
Tyler Harhart
Madeline Gifford
Allen Milton
Jeff Saucier
Chip McKnight
Carl Tugend
Mark Pokras
Brooke Hafford
Caitlin Gunn
John Brzorad and 1000 Herons
Paul Bunyan Road Association volunteers
The Nature Conservancy
Boothbay Region Land Trust
Maine Coast Heritage Trust
Heron Observation Network volunteers
Maine River Bird Project volunteers
Ogunquit, Wells, and Scarborough piping plover volunteers and many private landowners who have granted us access to their property for surveys and monitoring and MDIFW regional and Augusta staff

BIRD CONSERVATION AND MANAGEMENT UPDATES

Maine's Piping Plovers are still Endangered, but they're Doing Better

Lindsay Tudor

Piping plovers are small, sand-colored shorebirds that nest on sandy beaches and dunes along the Atlantic Coast from Newfoundland to South Carolina. Factors including habitat loss, lack of undisturbed nest sites, and predation have combined to jeopardize piping plover populations over the past century. With less than 2,000 nesting pairs remaining on the Atlantic coast, the piping plover is now a threatened species on the federal level and an endangered species here in Maine.

MDIFW has monitored Maine's piping plover population annually since 1981. In 2008, with only 24 pairs of piping plovers returning to nest, it became clear that we were very close to losing this species from our state. In response, a group of government conservation agencies, municipal officials, landowners, and individuals from private organizations launched a joint effort to protect nesting piping plovers and reverse the declining population trend.

This coalition includes MDIFW, Maine Audubon, U.S. Fish and Wildlife Service (USFWS), Maine Bureau of Parks and Lands, Rachel Carson National Wildlife Refuge, USDA APHIS Wildlife Services, The Nature Conservancy, Bates College, and the towns of Wells, Ogunquit, Saco, Old Orchard Beach, and Scarborough. The aforementioned towns all manage their beaches using guidelines, established in partnership with MDIFW, that balance recreational opportunities with plover habitat preservation. These towns also fund the recruitment and coordination of volunteers to monitor and protect plover nests and chicks during the nesting season.

Thanks to funding from USFWS's Landowner Incentive Program (LIP) and grants from Maine Outdoor Heritage Fund and National Fish and Wildlife Foundation, certain plover beaches were able to increase their law enforcement, predator management, and outreach efforts. Together, these efforts allowed productivity rates to increase to a level that could sustain and grow the population.

Between 2008 and 2018, Maine's piping plover population and distribution steadily increased from 24 pairs nesting on 11 beaches to 66 pairs nesting on 19 beaches. Despite challenging high tides and subsequent flooding on certain beaches, the 2015, 2016, and 2017 nesting seasons each produced over 100 piping plover fledglings – the most fledged on Maine beaches since record keeping began in 1981! Early predictions suggest we will have over 100 fledglings in 2018.

YOU CAN SUPPORT THE PIPING PLOVERS, TOO!

All beachgoers can pitch in to protect the piping plovers by observing these simple guidelines:

- Avoid fenced areas marked with "Restricted Area" signs
- Observe birds and chicks only from a distance, using binoculars
- Keep pets off the beach, or leashed, from mid-April through mid-September
- Don't fly kites near posted areas, as kites resemble hawks and can keep birds away from their nests
- Take your food scraps and trash off the beach when you leave, as they can attract nest predators like skunks and raccoons
- Call the Maine Warden Service to report harassment of birds. It's a federal offense to harm an endangered species. See back inside cover of this report for Warden Service phone numbers.
- If you see a banded piping plover, report your observation at **fws.gov/northeast/pipingplover/report_bands.html.** Information about how to report sightings of banded and flagged piping plovers is available on the website.

This work is supported the federal Pittman-Robertson and State Wildlife Grant programs, USFWS Section 6 Funding, state revenues from the Loon Conservation Plate and Chickadee Check-off Funds, and volunteer assistance.

International Shorebird Survey

Lindsay Tudor

The International Shorebird Survey (ISS), which has been managed by Massachusetts-based Manomet Center for Conservation Sciences since 1974, enlists volunteer observers to conduct surveys of migrating shorebirds in the Western Hemisphere. The purpose of this effort is to identify and document areas of major importance to shorebirds during spring and fall migration, and to determine population status.

Sanderling. Photo by Colleen Bovaird.

Shorebirds (a taxonomic group that includes sandpipers, plovers, yellowlegs, dowitchers, etc.) undertake among the longest migrations in the animal world, from breeding grounds in the high Arctic to wintering areas as far south as the tip of Argentina.

Many species disperse during the breeding season, then congregate in large numbers at key areas along the Atlantic coast during their migrations. These large aggregations offer an opportunity to monitor large numbers of birds in restricted areas.

Manomet organized the ISS to gather consistent information on shorebirds using coastal habitats during migration. To date, more than 800 volunteers have completed over 100,000 census counts at 3,400 locations in 48 states, with additional counts from Canada (Atlantic Canada Shorebird Survey (ACSS) and Central and South America.

Manomet staff continue to recruit volunteers and have simplified ISS data entry. ISS participants may now submit their data using eBird and selecting International Shorebird Survey protocol. For more information, please contact **edalton@manomet.org** or visit the Manomet webpage at **manomet.org.**

The Gulf of Maine is considered a focal area for shorebird conservation by the Atlantic Flyway Shorebird Initiative because of the large numbers of shorebirds that depend on the gulf coastal habitats to rest and refuel during migration.

Maine birders have participated in the ISS since the beginning, and continue to provide information on shorebirds using Maine habitats. In 2017, MDIFW, Maine Audubon, and ISS volunteers surveyed 15 beaches located between Ogunquit and Georgetown as well as 15 Downeast mudflats, recording over 60,000 shorebirds. Species we tallied included semipalmated sandpiper, semipalmated plover, sanderling, black-bellied plover, whimbrel, and greater and lesser yellowlegs.

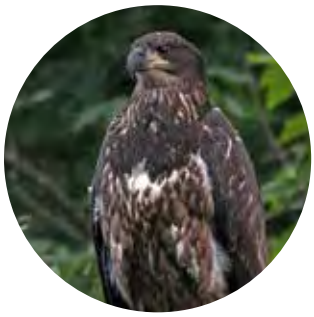
This work is supported by the federal Pittman-Robertson program and volunteer assistance.

Rebounding Rivers — A Success Story for Bald Eagles and Sea-run Fishes

Erynn Call

In the late 19th and early 20th century, Maine's (and America's) bald eagles were extensively disturbed by the alteration of riparian ecosystems and food webs, habitat loss, pollution, dam construction, and chemical contamination. By the late 1800s, Maine rivers that once supported superabundant migratory sea-run fish populations could no longer do so, thus eliminating a nutrient rich food source for eagles.

The combined additional effects of habitat loss and use of DDT led to a significant eagle population decline and, by 1978, only about 600 eagle nests nationwide remained, including just 30 in Maine.



Juvenile Bald Eagle. Photo by Sharon Fiedler.

Through protection of nesting territories and a ban on DDT, eagle populations recovered across the country and continue to expand beyond a nesting population of more than 700 pairs statewide. And with improvements in water quality and focus on restoring diadromous fishes, the rivers are also recovering.

The Penobscot River is New England's second largest river, draining about one-third of Maine. It once contained an abundant diadromous fish community, including millions of alewives, blue-back herring, American shad, striped bass, American eel, Atlantic and shortnose sturgeon, rainbow smelt, tomcod, and Atlantic salmon. We know that populations of these species plummeted in the 1930s when dam construction blocked migratory routes; but it has remained uncertain how the current status of these fish and the marine nutrients they deposit is influencing the river food web.

Intensive conservation efforts aimed at restoring river connectivity, sea-run fishes, and the associated food web within the Penobscot River Watershed have doubled as opportunities to study how nutrients flow through an impounded river system. We conducted one such study in collaboration with the University of Maine at Orono, with the following objectives:

(1) Examine the diet of bald eagle nestlings from different nesting territories

(2) Document the relative importance of marine-derived nutrients in the diet of bald eagle nestlings along a coastal/marine to inland/freshwater gradient in an impounded system (the Penobscot River in Maine), using carbon, nitrogen, and sulfur stable isotopes from feathers and representative prey items

(3) Assess isotopic data in siblings as indicators of diet similarity

(4) Determine whether isotopic data from nestlings were related to their prey consumption as described by a pellet analysis

Data from this study are being analyzed now, and the results will improve our understanding of river ecosystems' structure and function, including trophic relationships with key species like the bald eagle. What we learn about eagle nestlings' diet will help us understand how riparian system changes may affect foraging patterns; and in the context of past and predicted watershed changes, this data will inform future bald eagle population management.

This work is supported by the federal Pittman-Robertson program, the Maine Outdoor Heritage Fund, The Nature Conservancy, and state revenues from sales of hunting and fishing licenses.

Two Years Later, Two More Herons Tagged for Tracking

Danielle D'Auria

In May, we began trapping bait fish to stock bins from which the herons would feed. Every day for several weeks, a team of biologists, teachers, students, and other volunteers spent time baiting the bins and monitoring game cameras. Once a heron was lured to a bait bin and began habitually feeding from it, the team set out to capture it for tagging.

On June 21, Nokomis Regional High School teacher Bill Freudenberger and his student Beau Briggs joined MDIFW biologists at 3:15 a.m. to set traps and wait in a blind for an unsuspecting heron to get caught as it tried to feed from the bait bin at dawn.

Less than three hours later, they had a heron in hand. And within an hour, that heron, now named Warrior by the students after their high school mascot, became the sixth heron in Maine to be tagged with a GPS transmitter.

Warrior is the second tagged heron adopted by Nokomis Regional High School. The first was Nokomis, a female who we now know winters in Haiti. We do not yet know if Warrior is a male or female, but we sent a blood sample to a lab for determination. To date, we have not received any movement data from Warrior's transmitter, probably due to poor cell coverage in its home area, so we do not yet know if that heron is nesting and where.

This project has given us a better understanding of the habits and movements of Maine's great blue herons, a state Species of Special Concern due to a decline in nesting pairs along the coast.

The capture crew with tagged great blue heron, Warrior. From L to R: Carl Tugend, MDIFW volunteer; Danelle D'Auria, MDIFW biologist; Bill Freudenberger, Nokomis Regional High School teacher; Beau Briggs, Nokomis Regional High School student; and Brittany Currier, MDIFW contractor. Photo by MDIFW.

MDIFW biologists ensure the perfect fit for Warrior's transmitter. Photo by MDIFW.

Two days later, on June 23, biologists set out to capture another heron – this time in Orrington. While several herons had been feeding from the bait bin there all month, biologists had been "skunked" on three prior trapping attempts. This time, though, just a few minutes after climbing into the blind, they captured a great blue heron in a trap. While no teachers were available that day, two students from Center Drive School's Heron Club witnessed the measuring, tagging, and release of Snipe, named by the students after the bird character in the movie Up. Snipe appears to be nesting in a colony in Brewer that hosted two of our other tagged herons, Sedgey and Snark, both males who unfortunately died within the last year.

The solar-powered GPS transmitters, purchased in 2016 from German company e-obs with funds from the Maine Outdoor Heritage Fund, are designed to last several years.

When fully charged, they record a GPS location as often as every five minutes. Once a day, at around 6 pm, the transmitters connect via cell towers to download the GPS location data to **movebank.org**, where anyone can view and download it for use in programs such as Google Earth, ArcMap, or Microsoft Excel. Two herons tagged in 2016, Cornelia and Nokomis, are still alive and transmitting data.

This project has given us a better understanding of the habits and movements of Maine's great blue herons, a state Species of Special Concern due to a decline in nesting pairs along the coast. The data provided by the transmitters can

Just before Snipe is released. From L to R: Andrew Faulkingham, Center Drive School student; Chip McKnight, MDIFW volunteer; and Colby Slezak, MDIFW intern. Photo by MDIFW.

Snipe, a great blue heron captured in Orrington, was named by the middle school students at Center Drive School. Photo by MDIFW.

shed light on daily and seasonal movements, energy budgets, nesting and feeding habitat requirements, survival and adult mortality, territory and home range sizes, colony fidelity (whether a bird returns to the same colony year after year), migration routes, wintering locations, and how predation and disturbance limit nesting success. In the first two years of this study, we documented:

- wintering sites in Florida, the Bahamas, Cuba, and Haiti;
- a heron who switched its nesting colony;
- variability in timing (initiation date and duration) of migration among individuals; and
- seasonal changes in foraging habitat use

The other main objective of the Heron Tracking Project is to connect students of all ages to the tagged herons and the places they nest, feed, and winter. Students are involved with the field work leading up to the tagging of each bird, and then they follow them online, using the data to answer their own questions about the herons' lives. Our tagged herons have been the subjects of student research projects for fifth graders at Harpswell Community School, high school students for the Maine State Science Fair, a Wetlands Ecology and Conservation class at University of Maine, and Wildlife Capstone Projects at Unity College. There are endless opportunities to learn from the data, and thus, we hope to get even more students involved.

For more information on the Heron Tracking Project and how you can view or download the data, please visit **maine.gov/wordpress/ifwheron/tracking-project.**

This work is supported by the federal Pittman-Robertson program, the Maine Outdoor Heritage Fund, the Maine Birder Band Fund, and volunteer assistance.

MAINE BIRD ATLAS 2018-2022

The Maine Bird Atlas

Adrienne J. Leppold

Have you ever had a phoebe nesting under your porch eves? Or seen a robin in your yard with food in its mouth, maybe even feeding its young? Out on a hike, have you ever seen a wild turkey, ruffed grouse, or woodcock, along with a nest or little ones? Maybe you've been fortunate to observe eagles adding sticks to a nest, or simply noticed the osprey nests on the power transmission lines along I-95. These are just some examples of thousands of possible observations that would help us during our five-year effort to document the distribution and abundance of all breeding and wintering birds across the entire state.

Sound challenging? With the combined help of professional field biologists and passionate citizen scientists, we hope it won't be!

What is a Bird Atlas?

A biological atlas maps the distribution, and sometimes abundance, of a species group over a fixed area and time. Bird atlases are among the most common wildlife monitoring efforts for a few reasons:

- Birds are excellent indicators of environmental health
- Bird conservation is of paramount importance
- Many people can find and identify birds, and enjoy doing so

Because of Maine's varied habitats and landscapes, nearly half of the 900 bird species found in North America can be found in Maine at some point during their annual life cycle, either as spring or fall migrants or as summer or winter residents. Birds enrich our lives, and Maine's people and visitors value them and the ecological benefits they provide (e.g., pollination and pest control services), as evidenced by the millions of dollars birding and bird-related activities add to our state's economy.

The first Maine breeding bird atlas was created 33 years ago, between 1978 and 1983. Launched this year, the data collection portion of the new Maine Bird Atlas project will continue through 2022, after which time the data will be summarized and published into a finished product that could serve as a go-to resource for everyone from biologists to birdwatchers, students, environmentalists, artists, and more. At MDIFW, the updated atlas will improve our understanding of Maine's bird diversity and distribution, allowing us to better identify and evaluate our conservation priorities and management actions.

A house wren at a nest box. Photo by Amy Meehan.

A male red-winged blackbird carrying food. Photo by Amy Meehan.

Adult male hairy woodpecker feeding a recently fledged young. Photo by Amy Meehan.

THE MAINE BIRD ATLAS PROJECT AFTER 6 MOs

618
PARTICIPANTS

9,300
BIRD CHECKLISTS

7,012
HOURS OF SURVEY EFFORT

EARLY RESULTS

Now, for some numbers…six months in, we're pleased to announce that the project has already recruited 618 participants, all of whom have contributed almost 9,300 bird checklists and amassed over 7012 hours of survey effort. We have divided the state into "blocks", which are the survey unit for the project and are ~9 square miles in size. As of early July 2018, 621 of the 4,080 blocks in the state have been "adopted", which means someone has committed to making sure they are completely surveyed by the end of the project.

We have 221 species documented for the state. Of those, we have confirmed breeding (the ultimate observation goal) for 183.

As with any large citizen science project, errors are inevitable. The species total may include some wintering or migrating species, but staff will be sure to get this first season's data checked and sorted out during the fall and winter.

We have already confirmed nine species breeding in the state that were not documented as breeding during the first atlas: Manx Shearwater, Great Egret, Sandhill Crane, American Oystercatcher, Common Murre, Red-bellied Woodpecker, Merlin, Fish Crow, and Carolina Wren.

While confirming breeding for a species requires actual observation of nesting activity or still-dependent young, it's not as hard as it sounds. In fact, all of the examples given in the first paragraph would be entered as confirmed observations. It isn't even necessary to find actual nests in order to confirm breeding; in fact, we do not encourage ANY disturbance of nests or nesting activity, and instead set a rule of always observing from a distance.

To contribute as a citizen scientist, you don't need birding experience, you just need a desire to get outside and learn about the natural world.

HOW TO GET INVOLVED

If you're interested in learning more about the project or getting involved, please visit our website at **maine.gov/birdatlas.**

To contribute as a citizen scientist, you don't need birding experience, you just need a desire to get outside and learn about the natural world around you (though binoculars help too). And even if field work isn't your thing, you can still support the project in one of several other ways.

Finally, thank you to all our volunteers, especially our block adopters! You're contributing to a very important project, and we couldn't do this without you!

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

Eastern Mallards in Decline

Brad Allen

For decades, the mallard has been one of Eastern North America's most abundant duck species; but in the past 20 years, populations have declined. In response, MDIFW has reduced the 2019-2020 mallard bag limit from four per day to two per day. This fall, the 2018 bag limit will remain at four per day.

Four drake mallards. Photo by Paul Cyr.

Conditions here in Maine are not necessarily reflected in other mallard breeding areas to our west. Most (60%) of the mallards harvested in the Atlantic Flyway are produced in the northeastern United States and another 25% come from eastern Canada.

In the case of eastern mallards, biologists use two breeding population surveys and estimates from banding and harvest trends to track populations. All of these data suggest a significant population decline in mallard abundance, leaving biologists with little doubt that the decline is real, and mandating changes in hunting season regulations.

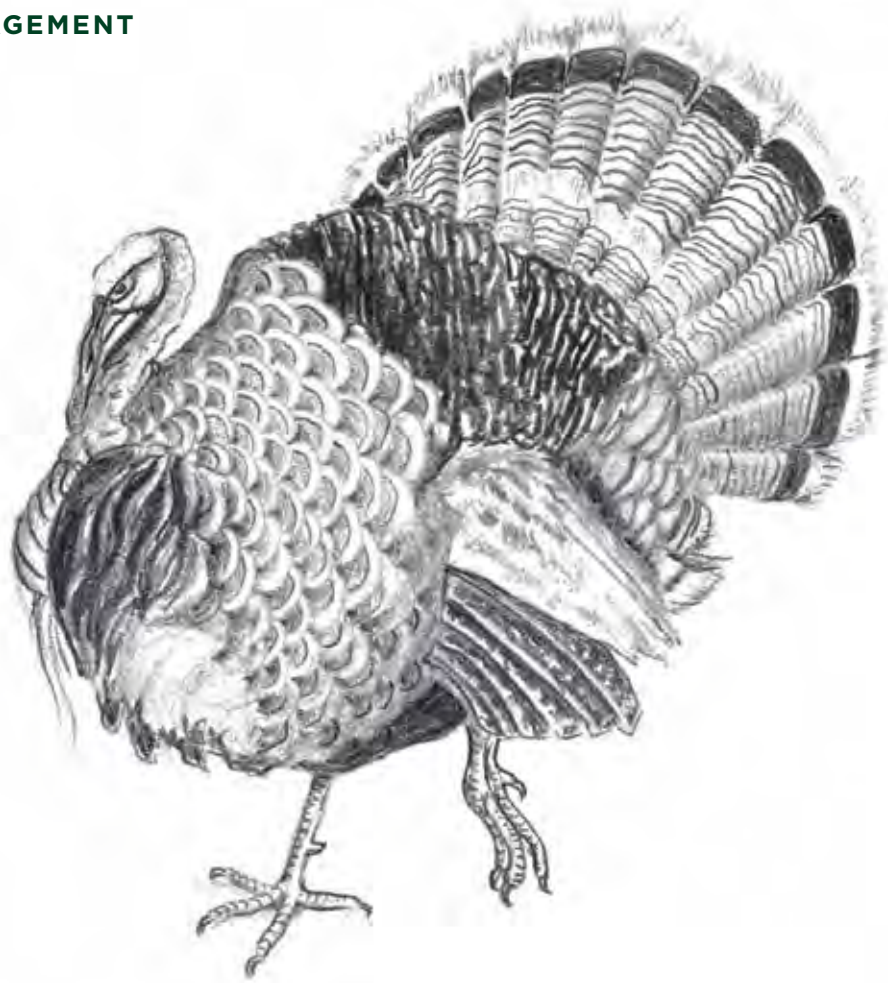
Mallard populations in eastern North America have declined about 20% since 1998, even as the mallard harvest in the U.S. portion of the Atlantic Flyway has decreased. Based on the best available data, eastern mallard populations can no longer support a 60-day, four-bird bag limit. Recent hunter opinion surveys indicate that hunters in the Atlantic Flyway value maximizing hunting days afield over maximizing bag limits, so the Atlantic Flyway Council and USFWS chose to restrict the bag rather than reduce the season length.

The big question remains: Why are eastern mallards declining? Biologists are currently struggling with this question and are working to identify the factors that may be causing the population decline. Theories include a general decline in winter feeding sites resulting in lower survival rates of so-called urban mallards, decreases in habitat quality, and hybridization with game-farm mallards causing a change in survivability, but none of these hypotheses have been rigorously tested.

The proposed restriction on the mallard bag limit will not affect the general duck season length or the overall six bird bag limit in the Atlantic Flyway. Further, there has not been a formal recommendation for a hen mallard restriction with the change to a two-mallard bag limit in 2019. Biologists are still assessing biological and scientific data and gathering input from hunters before making a final decision on this.

Last, there is no set timeline for how long the bag limit will remain at two mallards per day. For now, it is viewed as an interim bag limit while biologists re-evaluate all available data to improve the population model and harvest strategy —a process that is expected to take at least two years. The hope is that the mallard population will respond to the decreased harvest pressure starting in 2019, and eventually there will be opportunity for more liberal bag limits.

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



GAME BIRDS

Wild Turkey

NEW WILD TURKEY RESEARCH PROJECT

MDIFW, in cooperation with the University of Maine and the National Wild Turkey Federation (NWTF), recently began a study of how wild turkeys use the Maine landscape that will inform wild turkey management and hunting season selection.

LOCALIZING WILD TURKEY POPULATION ESTIMATES

In the past, we have estimated turkey populations based on number of males harvested during the spring hunting season. This has limited us to estimating the population at a state scale. And while the distribution of wild turkeys in Maine is extensive, we know that populations in pockets of the state vary widely.

This new project will help us more confidently estimate the wild turkey population on smaller scales, such as at the Wildlife Management District (WMD) level. And by combining data from the new study with seasonal harvest numbers, weather trends, turkey productivity, and natural mortality figures, we'll be able to set better-informed season lengths and bag limits for different parts of the state.

TRACKING TURKEYS WITH BACKPACKS & BANDS

To conduct the study, we are using radio telemetry and banding to monitor wild turkey hens throughout the year. We trap the hens in the winter months when wild turkeys tend to flock up in concentrated areas rich in over-winter food sources. We take advantage of this survival strategy by concentrating food in a smaller area; and once the turkeys are utilizing this food regularly, we set a net to capture the flock.

At this point, we band the hens, fit them with a "backpack" radio transmitter, and release them. Over the year, at intervals ranging from a few days to a week, we locate the hens with a small hand-held unit and antennae; and based on the signal we receive, we're able to document each hen as alive or dead. We then plug this survival data into a population model that gives us accurate population estimates on a WMD level.

We also band all the male wild turkeys we capture, but males are not given transmitters. Instead, we use the proportion of banded males reported in the harvest to further inform the population and survival estimates.

TABLE 1. WILD TURKEY SPRING (2005-2017) AND FALL (2005-2016) REGISTERED HARVESTS.

SEASON	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
SPRING	6,236	5,931	5,984	6,348	6,043	6,077	5,445	6,079	6,553	5,750	4,852	4,852	5,597
FALL	157	198	1,843	685	712	1,205	667	958	2,182	1,814	2,718	2,749	*

**Data not available at time of this report*

WHAT WE'RE LOOKING FOR, AND WHY

During the nesting season, we monitor hens for certain aspects of nesting, including nest initiation date, hatch date, and reproductive success. We'll be using this information to assess whether the timing of our spring hunting season, which is designed to begin when most wild turkey hens are nesting, is appropriate. We already know it's important to allow hens to be fertilized before starting a hunting season, but questions remain about the time period that immediately follows.

In southern and central Maine, this new population trend assessment model will help us to manage a growing wild turkey population and the ensuing challenges of human/wild turkey conflicts. With hunting as the primary tool for managing wild turkey populations, this new data will allow biologists to confidently adjust certain bag limits and season lengths for the best possible outcome in each area (Table 1).

This new project will help us more confidently estimate the wild turkey population on smaller scales, such as at the Wildlife Management District level. We'll be able to set better informed season lengths and bag limits for different parts of the state.

This work is supported by the federal Pittman-Robertson program and state revenues from the sales of hunting licenses. Funding match will be provided through a combination of University of Maine funds, in-kind services, and funds from a National Wild Turkey Federation research grant.

Ruffed Grouse

Data are compiled by geographic region and MDIFW calculates the number of grouse seen per 100 hours of moose hunting effort (**Table 2**). Based on survey results, the 2017 statewide average of 41 grouse seen per 100 hours of moose hunting increased substantially compared to 2016, which was the second lowest of the last 15-year period.

Ruffed Grouse.
Photo by Amy Meehan.

TABLE 2. GROUSE SEEN PER 100 HOURS OF MOOSE HUNTER EFFORT IN MAINE FOR THE LAST 15 YEARS (2003-2017).

LOCATION	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NORTHEAST	35	27	11	26	37	31	48	47	59	44	30	59	46	31	58
NORTHWEST	50	56	24	45	44	51	101	100	81	93	62	70	82	50	64
EASTERN LOWLANDS	29	24	8	20	53	23	34	34	30	34	30	62	26	19	28
WEST & MOUNTAINS	26	30	13	25	44	19	36	36	32	50	38	40	28	23	32
DOWNEAST	21	20	9	22	19	28	30	29	15	13	15	14	10	2*	19*
STATEWIDE	32	31	13	28	39	30	50	49	43	47	35	52	43	25	41

**Low sample size of moose hunter surveys in this area*

MIGRATORY GAME BIRDS

Woodcock and Waterfowl

Kelsey Sullivan

MDIFW collaborates with the USFWS in monitoring migratory game bird populations and assessing harvest of these species. To monitor populations, we conduct several surveys throughout the year targeting specific migratory bird species groups such as sea ducks, dabbling ducks, geese, and American woodcock.

MDIFW staff, USFWS staff, and volunteers completed 50 woodcock singing ground survey routes in Maine in the spring of 2017. In 2017, the average number of males heard on Maine's SGS routes was 3.18. The 10-year Maine average is 3.75 males/route.

WOODCOCK HUNTING SEASON

An estimated 3,200 woodcock hunters harvested 6,700 woodcock in Maine in 2016. The recruitment index of 1.6 immature (young of the year) to one adult female in the 2016 harvest was below the long-term average of 1.7 young/adult female (1963–2016). The recruitment index is a measure of the ratio of immature woodcock per adult female. Maine hunters provided 936 woodcock wings from the 2016 hunting season for that survey.

WATERFOWL

Waterfowl harvest metrics are derived from the USFWS Harvest Information Program. Harvest estimates for the 2009 to 2016 waterfowl seasons are listed in **Table 3.**

TABLE 3. MAINE WATERFOWL HARVEST 2009-2016.

SPECIES	2009	2010	2011	2012	2013	2014	2015	2016
AMERICAN BLACK DUCK	5,364	3,377	2,133	3,300	3,500	2,300	807	2,700
MALLARD	12,711	8,379	7,441	14,000	10,200	9,200	4,159	8,000
GREEN-WINGED TEAL	4,923	3,189	2,042	2,300	4,600	1,500	1,242	1,900
WOOD DUCK	7,641	8,567	5,989	6,700	6,500	3,200	3,166	5,500
RING-NECKED DUCK	1,763	1,688	454	600	1,200	600	217	800
COMMON GOLDENEYE	1,469	313	318	600	700	500	497	600
TOTAL*	33,871	39,100	31,500	39,900	36,000	21,600	12,119	27,000
CANADA GOOSE	4,700	9,194	3,717	9,500	8,800	8,900	7,196	11,400
SEA DUCKS								
COMMON EIDER	4,355	4,505	6,400	5,200	3,100	1,000	917	1,800
LONG-TAILED DUCK	656	2,321	2,695	NA	200	100	423	800
SCOTER	890	1,092	674	3,200	1,800	900	141	1,100
TOTAL SEA DUCK HARVEST	5,901	7,918	9,769	8,400	5,100	2,000	1,481	3,700
TOTAL WATERFOWL HARVEST	44,472	56,212	44,986	57,800	49,900	32,500	20,796	42,100

**All Regular Ducks including some species not listed in this table*

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

MAMMAL CONSERVATION AND MANAGEMENT

About the Mammal Group

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 MAMMAL GROUP

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

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

Nathan Bieber
Wildlife Biologist (deer)

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

Randy Cross
Wildlife Biologist (black bear)

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

2017-2018 MAMMAL GROUP CONTRACT WORKERS AND VOLUNTEERS

Deer Project
Micah Ashford
Holly Bates
Ryan Bechtold
Kaylin Brown
Paul Campbell
Carly Davis
Wendall Harvey Jr
Sue Kelly
Gerry Lavigne
Tim Lentz
Josh Matijas
Eldon McLean
Roger Milligan
Ian Montgomery
Jessie Paulson
Brittany Peterson
Kyle Ravana
Carl Tugend
Anneliese Washakowski
Connor White
Rachel Whitney

Lee Kantar
Wildlife Biologist (moose)

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

Jennifer Vashon
Wildlife Biologist (black bear and Canada lynx)

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

Shevenell Webb
Wildlife Biologist (furbearers and small mammals)

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

Moose Project
Jake Feener
Alicia Miller
Matt O'Neal
Colby Slezak
Cassandra Stiles
Carl Tugend
Kyle Watter

Bear Project
Lisa Bates
Jake Feener
Zack Gadow
Colleen Kostovick
Ethan Lamb
Evan Whidden
Carl Tugend

Lynx Project
Katherine Trickey

Bat Project
Alexander Beaulieu
Molly Bennett
Kiley Davan
Christopher Heilakka
Josh Matijas
Jessie Paulson
Erickson Smith
Lara Wilber

Other Small Mammals
Anneliese Washakowski

New England Cottontail Project
Katrina Fernald
Andrew Johnson
Parker Schuerman
David Shoemaker
Jeff Tash
David Tibbetts

WHITE-TAILED DEER

2017 Deer Harvest

Maine residents harvested 25,330 deer in 2017, representing 93% of the total deer harvest.

Season Dates and Structure

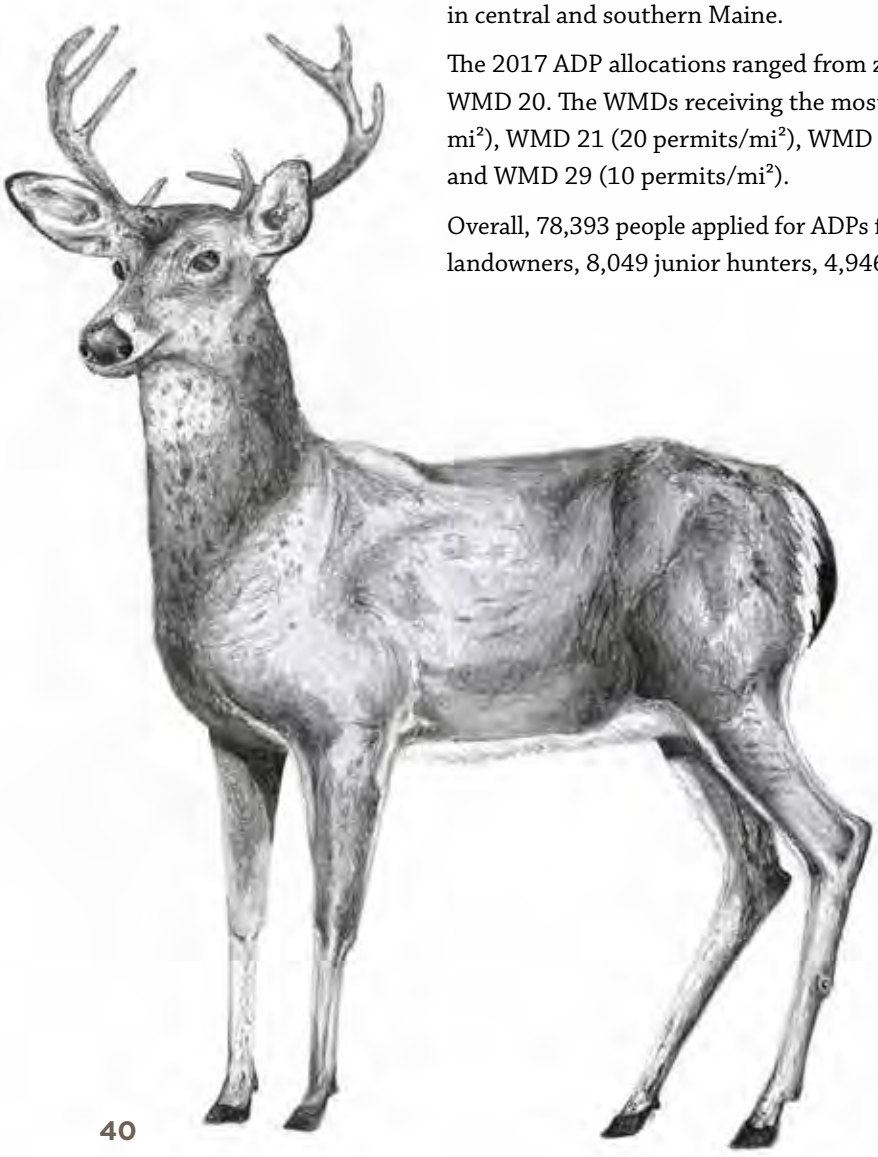
Maine offered five different structured hunting seasons (Expanded Archery, Regular Archery, General Firearms, and two Muzzleloader seasons), giving hunters a total of 79 days to pursue white-tailed deer in 2017.

Doe Quotas and Any-Deer Permits Issued

There were 66,050 Any-Deer Permits (ADP) distributed among 22 Wildlife Management Districts (WMDs) to meet the doe harvest objective of 7,114 adult does. Because many hunters elect not to harvest a doe, or not to hunt, MDIFW applies an expansion factor to each WMD to ensure a sufficient number of ADPs are issued to meet doe removal goals for that district. This expansion factor results in more permits being issued than the number of does expected to be harvested. An expansion factor of 10, for example, indicates that MDIFW must issue 10 permits to harvest one adult doe. The average statewide expansion factor is usually between six and seven, with higher expansion factors occurring in WMDs in central and southern Maine.

The 2017 ADP allocations ranged from zero in WMDs 1, 4, 5, 10, 11, 19, and 28 to 9,650 in WMD 20. The WMDs receiving the most ADPs per square mile were WMD 24 (36 permits/mi^2), WMD 21 (20 permits/mi^2), WMD 22 (18 permits/mi^2), WMD 20 (17 permits/mi^2), and WMD 29 (10 permits/mi^2).

Overall, 78,393 people applied for ADPs for the 2017 hunting season: 73,432 residents, 9,498 landowners, 8,049 junior hunters, 4,946 non-residents, and 1,913 Superpack permittees.



OVERALL HARVEST

Maine's deer hunters registered 27,233 total deer during the 2017 hunting seasons **(Table 1)** – 3,721 (15.8%) more than in 2016. Roughly 86% of the deer harvest occurred during the four-week firearms season.

YOUTH HARVEST

Youth day on October 21 resulted in the harvest of 322 adult bucks and 554 antlerless deer, for a 33% increase over the 2016 Youth Day.

2017 DEER PERMITS BY THE NUMBERS

37,501 RESIDENT PERMITS*

7,999 LANDOWNER PERMITS*

7,057 JUNIOR HUNTER PERMITS*

2,438 NON-RESIDENT PERMITS

1,453 SUPERPACK PERMITS WON

Overall, 78,393 people applied for ADPs for the 2017 hunting season: 73,432 residents, 9,498 landowners, 8,049 junior hunters, 4,946 non-residents, and 1,913 Superpack permittees.

**Comprised of both residents and non-residents*

TABLE 1. STATEWIDE SEX AND AGE COMPOSITION OF THE 2017 DEER HARVEST IN MAINE BY SEASON TYPE AND WEEK.

	ADULT		FAWN				PERCENT BY SEASON AND WEEK		
SEASON	BUCK	DOE	BUCK	DOE	TOTAL DEER	TOTAL ANTLERLESS DEER	TOTAL	ADULT BUCK	ANTLERLESS
ARCHERY	847	873	184	195	2,099	1,252	8%	4%	14%
Expanded	614	662	151	157	1,584	970	6%	3%	11%
Oct	233	211	33	38	515	282	2%	1%	3%
YOUTH DAY	322	360	102	92	876	554	3%	2%	6%
REGULAR FIREARMS	16,487	4,540	1,241	1,020	23,288	6,801	85%	91%	75%
Opening Sat	2,011	715	182	181	3,089	1,078	11%	11%	12%
Oct 30-Nov 4	3,580	1,072	301	236	5,189	1,609	19%	20%	18%
Nov 6-11	3,563	839	254	193	4,849	1,286	18%	20%	14%
Nov 13-18	3,571	755	203	164	4,693	1,122	17%	20%	12%
Nov 20-25	3,762	1,159	301	246	5,468	1,706	20%	20%	19%
MUZZLELOADER	**599**	**261**	**55**	**55**	**970**	**371**	**4%**	**3%**	**5%**
Nov 27-Dec 2	364	97	22	20	503	139	2%	2%	2%
Dec 4-9	235	164	33	35	467	232	2%	1%	3%
TOTAL	18,255	6,034	1,582	1,362	27,233	8,978	100%	100%	100%

Records corrected for errors and omissions

114 records in registration with no sex-age recorded

BUCK HARVEST

The statewide antlered (adult) buck harvest totaled 18,280, a 7.6% increase from the 2016 hunting season. (Table 2). Excluding WMD 29, the five WMDs producing the most bucks per square mile in 2017 were (in descending order) districts 22, 24, 21, 23, and 25. Department biologists estimate 8,957 (49%) of the harvested antlered bucks were 1½ year old deer sporting their first set of antlers.

TABLE 2. SEX AND AGE COMPOSITION AND HARVEST TOTALS FOR THE 2017 DEER HARVEST IN MAINE BY WILDLIFE MANAGEMENT DISTRICT.

	ADULT		FAWN		TOTAL		HARVEST PER 100 ADULT BUCKS		HARVEST PER 100 SQ MILES HABITAT		
WMD	BUCK	DOE	BUCK	DOE	ANTLERLESS DEER	ALL DEER	DOES	ANTLERLESS	ADULT BUCKS	ALL	ADULT DOES
1	93	0	0	0	0	93	0	0	7	7	0
2	91	15	3	1	19	110	16	21	8	9	1
3	131	26	9	4	39	170	20	30	15	19	3
4	94	1	1	0	2	96	1	2	5	5	0
5	83	1	0	0	1	84	1	1	6	6	0
6	348	91	17	12	120	468	26	34	24	33	6
7	382	81	13	12	106	488	21	28	28	35	6
8	291	51	16	14	81	372	18	28	15	19	3
9	115	30	3	0	33	148	26	29	13	16	3
10	72	1	0	0	1	73	1	1	8	8	0
11	298	2	0	0	2	300	1	1	18	18	0
12	532	87	28	21	136	668	16	26	58	73	9
13	444	100	23	23	146	590	23	33	79	105	18
14	287	71	19	14	104	391	25	36	39	53	10
15	1,345	297	84	67	448	1,793	22	33	144	192	32
16	1,457	492	150	116	758	2,215	34	52	189	287	64
17	2,220	805	197	173	1,175	3,395	36	53	166	254	60
18	358	35	11	8	54	412	10	15	29	33	3
19	164	1	0	0	1	165	1	1	14	14	0
20	1,036	546	148	127	821	1,857	53	79	178	320	94
21	1,147	535	157	122	814	1,961	47	71	238	407	111
22	1,172	608	171	152	931	2,103	52	79	271	485	140
23	1,737	666	163	153	982	2,719	38	57	222	348	85
24	570	449	99	114	662	1,232	79	116	260	562	205
25	1,333	502	101	91	694	2,027	38	52	190	289	72
26	1,334	181	62	41	284	1,618	14	21	148	180	20
27	550	125	12	10	147	697	23	27	75	95	17
28	286	4	2	3	9	295	1	3	26	27	0
29	310	251	60	63	374	684	81	121	213	471	173
UNKNOWN	6	3				9					
STATEWIDE	18,280	6,054	1,549	1,341	8,944	27,233	33	49	64	95	21

Data corrected for errors and omissions

Nine deer from unknown WMDs

ANTLERLESS HARVEST

Overall, 8,944 antlerless deer were registered by hunters. The statewide total harvest of adult (yearling and older) does was 6,054, leaving the harvest below the Department's 7,114 doe recommendation. The additional antlerless harvest was comprised of 1,549 male and 1,341 female fawns.

HARVEST BY MAINE RESIDENTS

Maine residents harvested 25,330 deer in 2017, representing 93% of the total deer harvest **(Table 3).** The areas of the state that produced the most non-resident deer kills were primarily along the western Maine-Canada border **(Tables 4 and 5).** The seasons with the highest percentage of resident kills were Youth Day (97.5%), Archery (96.6%), Muzzleloader (95.7%), and Firearms (92.4%, **Table 8**).

TABLE 3. 2017 MAINE DEER HARVEST BY SEASON AND RESIDENCY.

SEASON AND WEEK	RESIDENTS	NON RESIDENTS	UNKNOWN	TOTAL	PERCENT BY RESIDENTS
ARCHERY	2,027	71	1	2,099	96.6%
Expanded	1,548	35	1	1,584	97.7%
Oct	479	36	0	515	93.0%
YOUTH DAY	854	21	1	876	97.5%
REGULAR FIREARMS	21,521	1,753	14	23,288	92.4%
Opening Sat	3,076	10	3	3,089	99.6%
Oct 30 - Nov 4	4,836	351	2	5,189	93.2%
Nov 6 - 11	4,374	472	3	4,849	90.2%
Nov 13 - 18	4,152	536	5	4,693	88.5%
Nov 20 - 25	5,083	384	1	5,468	93.0%
MUZZLELOADER	928	41	1	970	95.7%
Nov 27 - Dec 2	470	32	1	503	93.4%
Dec 4 - 9	458	9	0	467	98.1%
TOTAL	25,330	1,886	17	27,233	93.0%

TABLE 4. 2017 MAINE DEER HARVEST BY COUNTY AND RESIDENCY.

COUNTY OF KILL	RESIDENTS	NONRESIDENTS	UNKNOWN	TOTAL	PERCENT BY RESIDENTS
ANDROSCOGGIN	1,580	23	0	1,603	98.6%
AROOSTOOK	972	115	0	1,087	89.4%
CUMBERLAND	2,237	71	2	2,310	96.8%
FRANKLIN	955	138	3	1,096	87.1%
HANCOCK	1,228	63	0	1,291	95.1%
KENNEBEC	2,595	82	2	2,679	96.9%
KNOX	1,165	35	0	1,200	97.1%
LINCOLN	865	25	0	890	97.2%
OXFORD	1,656	256	7	1,919	86.3%
PENOBSCOT	2,674	182	0	2,856	93.6%
PISCATAQUIS	790	205	0	995	79.4%
SAGADAHOC	1,033	21	1	1,055	97.9%
SOMERSET	2,259	340	1	2,600	86.9%
WALDO	1,696	151	1	1,848	91.8%
WASHINGTON	936	47	0	983	95.2%
YORK	2,609	127	0	2,736	95.4%
UNKNOWN	80	5	0	85	94.1%
TOTAL	25,330	1,886	17	27,233	93.0%

TABLE 5. 2017 MAINE DEER HARVEST BY WILDLIFE MANAGEMENT DISTRICT AND RESIDENCY.

	RESIDENTS		NONRESIDENTS			
WMD	NUMBER	PERCENT	NUMBER	PERCENT	UNKNOWN	TOTAL
1	61	65.6%	32	34.4%	0	93
2	97	88.2%	12	10.9%	1	110
3	162	95.3%	8	4.7%	0	170
4	42	43.8%	53	55.2%	1	96
5	64	76.2%	20	23.8%	0	84
6	448	95.7%	20	4.3%	0	468
7	333	68.2%	149	30.5%	6	488
8	231	62.1%	141	37.9%	0	372
9	113	76.4%	35	23.6%	0	148
10	57	78.1%	16	21.9%	0	73
11	244	81.3%	56	18.7%	0	300
12	598	89.5%	66	9.9%	4	668
13	509	86.3%	81	13.7%	0	590
14	309	79.0%	82	21.0%	0	391
15	1,633	91.1%	160	8.9%	0	1,793
16	2,135	96.4%	80	3.6%	0	2,215
17	3,116	91.8%	279	8.2%	0	3,395
18	379	92.0%	33	8.0%	0	412
19	139	84.2%	26	15.8%	0	165
20	1,762	94.9%	95	5.1%	0	1,857
21	1,930	98.4%	31	1.6%	0	1,961
22	2,073	98.6%	30	1.4%	0	2,103
23	2,538	93.3%	179	6.6%	2	2,719
24	1,201	97.5%	29	2.4%	2	1,232
25	1,958	96.6%	68	3.4%	1	2,027
26	1,569	97.0%	49	3.0%	0	1,618
27	684	98.1%	13	1.9%	0	697
28	283	95.9%	12	4.1%	0	295
29	654	95.6%	30	4.4%	0	684
UNKNOWN	8		1		0	9
TOTAL	25,330		1,886		17	27,233

BIOLOGICAL ASSESSMENT

MDIFW sampled more than 6,979 white-tailed deer during the 2017 hunting season to assess the status and health of the state's deer populations. Some of the characteristics we monitored included yearling antler beam diameters, yearling frequencies in the harvest, estimated sex ratios, and mortality rates.

The antler diameter of yearling bucks in a WMD can help us identify when white-tailed deer have become overly abundant in that district. When there are too many deer in an area, the amount of forage available decreases, limiting availability of preferred foods and preventing deer from achieving optimum nutrition and peak antler growth.

Antler beam diameters within the range of 15.5 to 16.8 mm indicate that a deer population is likely in balance with the availability of forage. If measurements are larger, there is enough forage available for the population to grow. If the measurements are smaller, the animals have become too abundant in the WMD and have reduced the availability of quality forage. In 2017, Maine's yearling bucks expressed overall good health with an average beam diameter of 17.3 mm and range of 15.2 mm to 19.1 mm across the state.

Past research has shown that the percentage of yearling bucks within the adult buck harvest can be used as an estimate of all-cause annual mortality for male white-tailed deer. In 2017, 49% of the male harvest was comprised of yearling bucks **(Figure 1).** This number reflects the proportion of yearlings in the harvest, not the population.

DOE:BUCK RATIOS

MDIFW monitors sex ratios (doe:buck) in all Maine WMDs. A sex ratio skewed towards does can be preferable in areas of desired population growth, but breeding success may begin to decline if the doe:buck ratio exceeds ~4:1. In 2017, Maine's WMDs averaged 2.0 does per buck and ranged from 1.14 to 3.28 does per buck **(Figure 2).**

A sex ratio skewed towards does can be preferable in areas of desired population growth, but breeding success may begin to decline if the doe:buck ratio exceeds ~4:1.

FIGURE 1. YEARLING MALE FREQUENCY IN THE 2017 MAINE DEER HARVEST

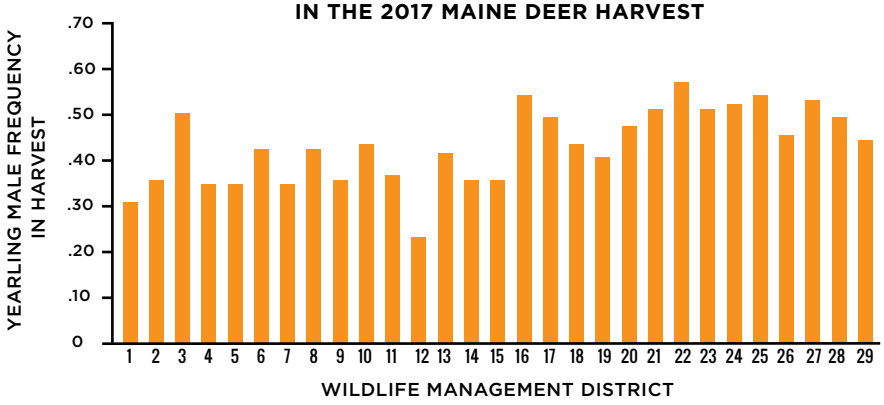
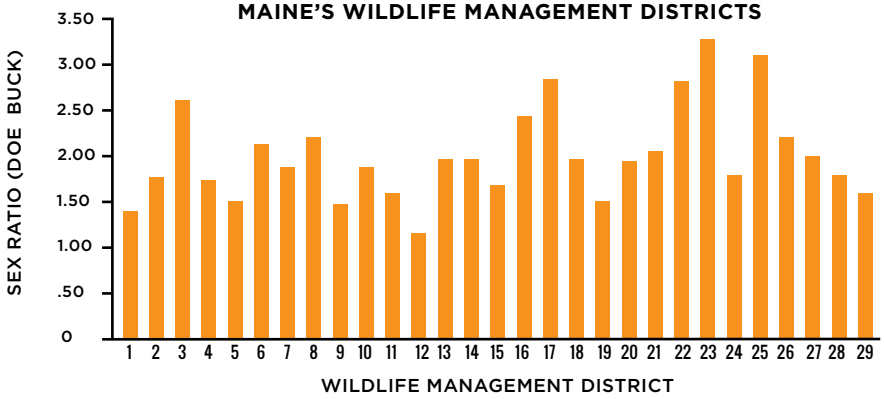
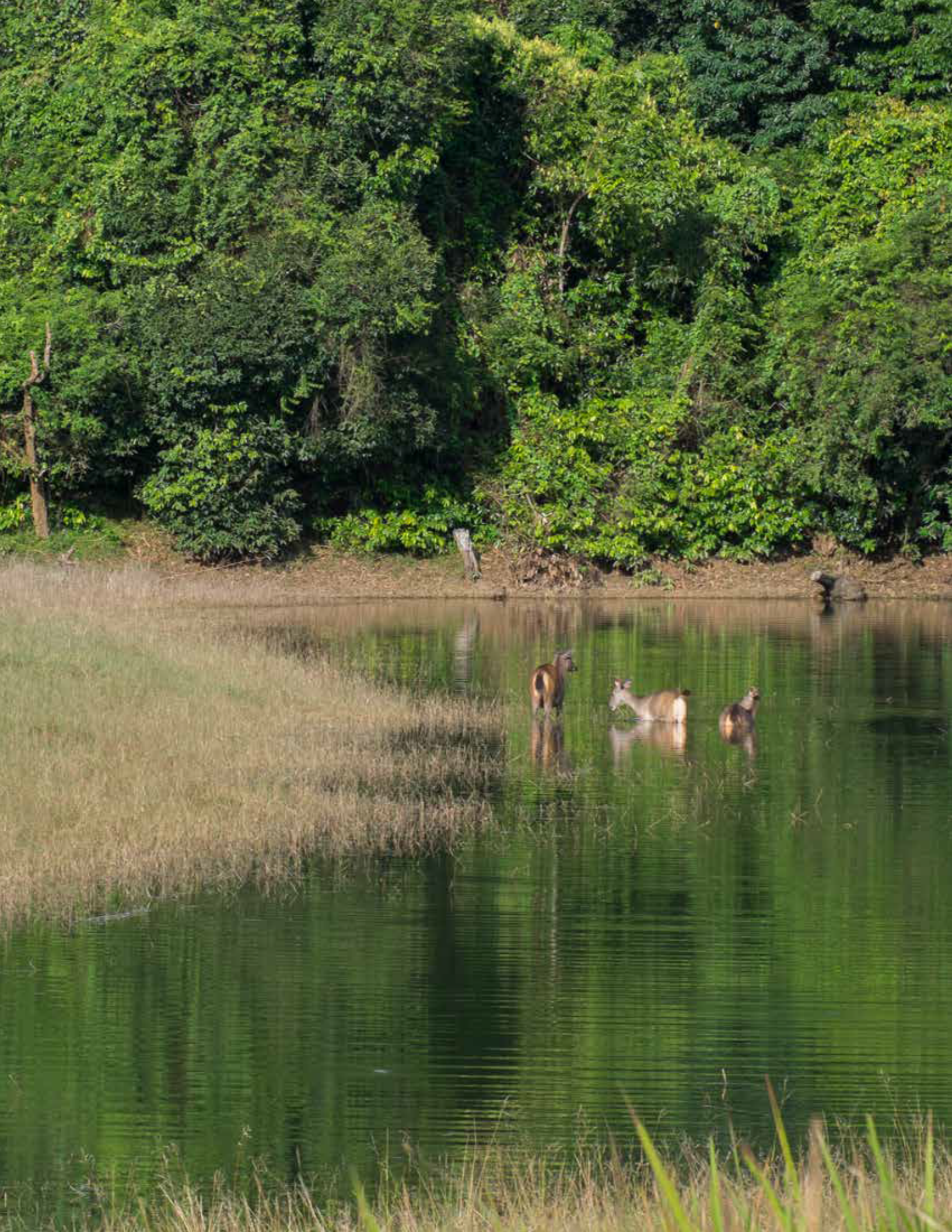


FIGURE 2. ESTIMATED SEX RATIO OF DEER IN MAINE'S WILDLIFE MANAGEMENT DISTRICTS





Disease Monitoring in Maine's Deer and Moose

Nathan Bieber

Chronic Wasting Disease

Chronic wasting disease (CWD) is a fatal brain disease that impacts white-tailed deer, mule deer, caribou, moose, and elk. It is similar to mad cow disease, which occurs in cattle, and it has a 100% mortality rate in deer.

CWD occurs in wild deer populations in 23 U.S. states and two Canadian provinces, but it has not yet been found in Maine. CWD can persist in the environment outside of a host for many years, and recent research has shown that plants can uptake the disease agent and subsequently become a potential disease vector.

It has not yet been recorded as being transmissible to people, but a similar human disease does exist.

Together, we can keep Maine CWD-free

WHAT MDIFW IS DOING

MDIFW has monitored white-tailed deer for CWD since 1999, during which time we have screened nearly 10,000 wild deer. 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 states and provinces that are not adjacent to our state.

WHAT YOU CAN DO

Prevent the spread: You can prevent the spread of disease in the deer population by refraining from feeding deer in the winter, as high population densities within a small area can increase disease transmission. Also, refrain from using urine-based lures, as CWD has been shown to be spread via bodily fluids.

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

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

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

MOOSE

Lee Kantar

Since the re-institution of moose hunting in 1980, moose season timing (split seasons started in 2002) and areas open to hunting have changed several times.

2017 Moose Harvest

Season Dates and Structure

The 2017 split-season framework allowed permit-holding Maine moose hunters to hunt for six days in September, October, and/or November. Season dates were:

Sep 25-30, Oct 9-14, Oct 23-28 (WMDs 1-4 and 19 only), and Oct 28*-Nov 25 (WMDs 15 and 16 only)

SEPTEMBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

NOVEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	22	23	24	24	25
26	27	28	29	30		

Maine Residents Only

Maine Residents & NonResidents

**Maine residents only. Non-resident hunt started Oct. 30.*

2017 MOOSE PERMITS BY THE NUMBERS

47,448
TOTAL APPLICATIONS

34,156
RESIDENT APPLICATIONS

13,292
NON-RESIDENT APPLICATIONS

5.5%
SELECTION RATE (RESIDENTS)

1.5%
SELECTION RATE (NON-RESIDENTS)

Moose Permits and Applicants

TOTAL MOOSE PERMITS

The annual allocation of moose hunting permits is a function of WMD-specific management goals. Permit levels changed in three WMDs from 2016 to 2017, resulting in a decrease of 60 permits issued statewide (2,080 total). In the three affected WMDs (22, 23, and 26), Wildlife Division biologists determined that permit allocations were unnecessary given the low hunting success rates and low moose densities in these areas.

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

ANTLERLESS-ONLY PERMITS (AOPS)

In 2017, a total of 220 Antlerless Only Permits (AOPs) were allotted to five WMDs (1-4 and 19). The number of AOPs issued can alter or stabilize a district's moose population. Consequently, WMDs that can only sustain limited cow mortality are allocated fewer AOPs, and WMDs that can support higher cow mortality rates and would benefit from population size and structure management are issued more AOPs.

ANY-MOOSE PERMITS (AMPS)

Any-moose Permits (AMPs; Bull, cow or calf) are allocated in moose-sparse southern Maine areas to allow for a small harvest. To honor Southern Maine landowners' recommendations, this season coincides with the November firearms season for deer.

Statewide Statistics for 2017

Overall, 1,518 moose were registered during 2017 (Table 1).

TABLE 1. 2017 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.

				2017 REGISTRATIONS	
WMD	SEASON	PERMIT TYPE	# OF PERMITS	KILL	SUCCESS RATE
1	SEP	BOP	150	122	81%
	OCT	BOP	125	101	81%
	2nd OCT	AOP	50	40	80%
	*WMD Subtotals		325	263	81%
2	SEP	BOP	100	80	80%
	OCT	BOP	100	91	91%
	2nd OCT	AOP	50	43	86%
	*WMD Subtotals		250	214	86%
3	SEP	BOP	75	64	85%
	OCT	BOP	60	53	88%
	2nd OCT	AOP	50	38	76%
	*WMD Subtotals		185	155	84%
4	SEP	BOP	125	93	74%
	OCT	BOP	75	57	76%
	2nd OCT	AOP	50	36	72%
	*WMD Subtotals		250	186	74%
5	SEP	BOP	100	80	80%
	OCT	BOP	25	21	84%
	*WMD Subtotals		125	101	81%
6	SEP	BOP	100	80	80%
	OCT	BOP	25	21	84%
	*WMD Subtotals		125	101	81%
7	OCT	BOP	125	86	69%
	*WMD Subtotals		125	86	69%
8	OCT	BOP	175	124	71%
	*WMD Subtotals		175	124	71%
9	OCT	BOP	75	58	77%
	*WMD Subtotals		75	58	77%
10	OCT	BOP	60	29	48%
	*WMD Subtotals		60	29	48%
11	SEP	BOP	25	18	72%
	OCT	BOP	25	21	84%
	*WMD Subtotals		50	39	78%
12	OCT	BOP	35	21	60%
	*WMD Subtotals		35	21	60%
13	OCT	BOP	35	16	46%
	*WMD Subtotals		35	16	46%
14	OCT	BOP	35	23	66%
	*WMD Subtotals		35	23	66%
15	NOV	AMP-B		7	NA
	NOV	AMP-C		1	NA
	*WMD Subtotals		25	8	32%
16	NOV	AMP-B		3	NA
	NOV	AMP-C		3	NA
	*WMD Subtotals		20	6	30%
17	OCT	BOP	20	6	30
	*WMD Subtotals		20	6	30%
18	OCT	BOP	40	15	38%
	*WMD Subtotals		40	15	38%
19	SEP	BOP	45	28	62%
	OCT	BOP	30	16	53%
	2nd OCT	AOP	20	11	55%
	*WMD Subtotals		95	55	58%
27	OCT	BOP	10	3	30%
	*WMD Subtotals		10	3	30%
29	OCT	BOP	20	9	45%
	*WMD Subtotals		20	9	45%
OVERALL WMD TOTALS			2,080	1,518	73%

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

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

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

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

2017 Bull Harvest

TOTAL HARVEST, AGE DISTRIBUTION

Among the 1,338 antlered bulls killed during the Sept/Oct 2017 season (a total of 58 less than the 2016 harvest of 1,396), biologists aged 1,220 of them by counting the cementum annuli on a tooth extracted from the animal. Ages were distributed as follows:

- 1½ years old (yearlings sporting their first set of antlers): 11% (133)
- 2½ years old: 19% (205)
- 3½ years old: 20% (214)
- Mature bulls (aged at 4½ to 18½ years): 50%

AVERAGE WEIGHT

On average, breeding bulls lose approximately 15% of their body mass during the rut (September to October). In 2017, this translated to a 7% decrease in average dressed weights from the September to October seasons (728 in Sept. vs. 674 in Oct.)

RECORD WEIGHT

The heaviest bull weighed in at 1,005 pounds field dressed (no digestive tract, heart, lungs, or liver). He was 6½ years old and was killed in WMD 4 during the September season.

RECORD ANTLER SPREAD

The largest antler spread was 62.6 inches with 20 legal points. He was 9½ years old.

ANTLER STATS

Sixteen percent of the antlered bulls sported cervicorn antlers (antlers without a defined palm), 51% were yearlings, and 12.5% were mature bulls (>4 years old). The oldest was 12½ years old.

Antlerless Harvest

TOTAL HARVEST

The 2017 statewide harvest of adult (yearling and older) cows was relatively close to the 2016 harvest (149 in 2017 vs. 156 in 2016). In addition, 15 calves (5 males and 10 females) were harvested for a total harvest of 164 antlerless moose, including the those taken as part of the 45 AMPs issued within the southern zones.

MOOSE REPRODUCTIVE DATA

Antlerless permits during the second October season allow MDIFW to collect reproductive data critical to assessing and monitoring moose population health and growth. In 2017, hunters in WMDs 1-4 and 19 removed and brought in 66 sets of moose ovaries for examination by biological staff.

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

Of the cow moose examined this year, 91% of the cows older than 2½ years were pregnant.

MDIFW biologists can forecast a cow's reproduction rates by looking at corpora lutea, which are identifiable structures within the ovaries that indicate ovulation and potential pregnancy rates. Overall, there were 1.1 corpora lutea per cow for cows older than 3½ years. While this is an improvement from 2016, moose in the northern portion of the state still have relatively low reproductive rates (number of calves being born to a cow). We expect additional samples to provide a clearer picture of this relationship, both in northern Maine and regionally.

Hunter Participation, Residency, & Success Rate

In 2017, 1,880 residents and 200 non-residents won moose permits. Out-of-state hunters came from 34 states (as far away as Guam! - about an 8,000-mile drive to WMD 4), with the highest percentage (17%) coming from Pennsylvania.

Overall, 73% of moose hunters were successful – a percentage just slightly lower than 2016's 75% rate. Success rates over the last 10 years have been around 80%.

The resident success rate was 60% and the non-resident success rate was 98%. 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.

Conditions for all seasons were unseasonably warm, with record-setting heat in October.

Changes for the 2018 Moose Season

SEPTEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

OCTOBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

NOVEMBER

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	22	23	24	24
25	26	27	28	29	30	

Maine Residents Only Maine Residents & NonResidents

In 2018, there will be four separate moose hunting periods in Maine.

- The September season will run from Sep 24-29 in WMDs 1-6, 11, and 19, and for the first time, it will also be open in WMDs 10, 18, 27, and 28.
- The October season will run from Oct 8-13 in WMDs 1-14, 17-19, 27, and 28.
- In WMDs 15 and 16, the season will coincide with November's deer season, which runs from Oct 29 through Nov 24. Opening day for Mainers will be on Saturday, Oct 27.
- WMDs 1-6 will have an additional moose hunt from Oct 22 through Oct 27.

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

Comprehensive Moose Management in Maine

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

Moose Adult Cow and Calf Survival Study

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

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

Since 2014, we have captured 375 moose and fitted them with GPS collars. These collars enable us to track moose locations and movements over time, and to be notified via text/email message if a moose dies.

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

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

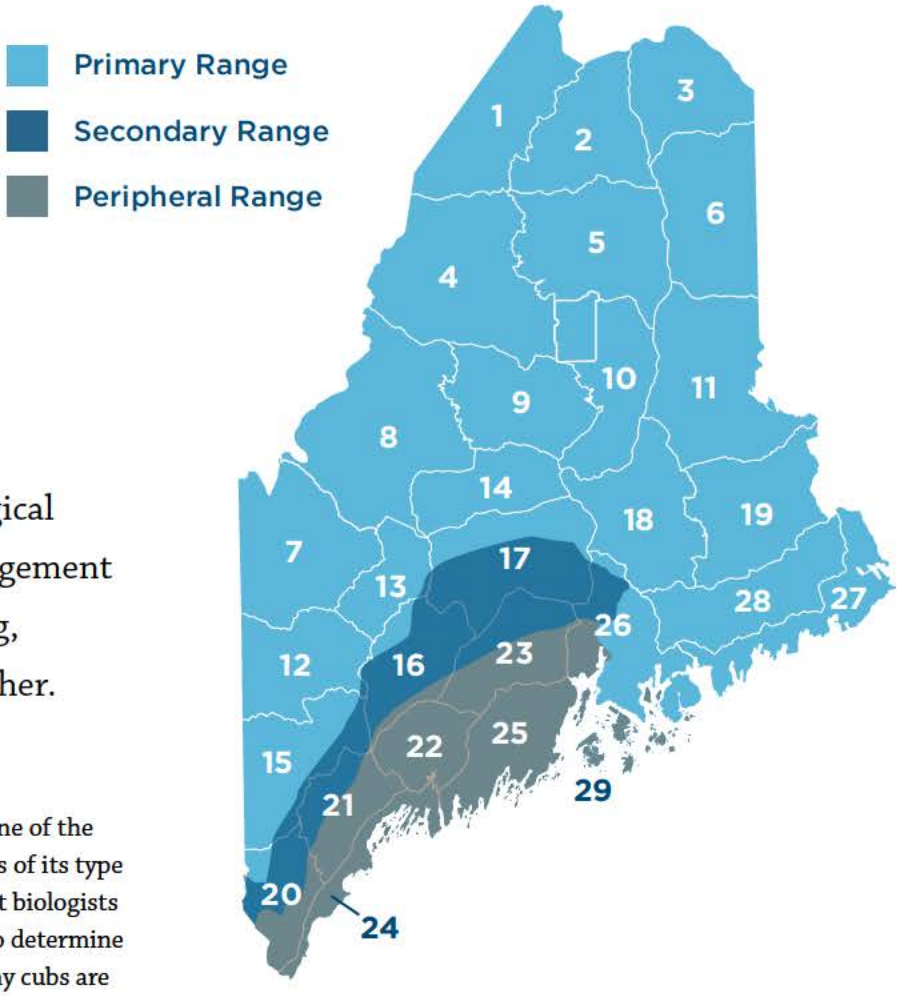
This work is supported by the federal Pittman-Robertson program, state revenues from the sales of hunting licenses, and volunteer assistance

BLACK BEAR

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 prized animals.

Today, Maine's expansive northern, eastern, and western forest supports one of the largest black bear populations in the lower-48 states **(Figure 1).** This population is valued by hunters and wildlife watchers alike; but when bear-human conflicts happen, bears' value can diminish.

FIGURE 1.



MDIFW strives to balance biological and social needs by basing management decisions on the bear monitoring, harvest, and conflict data we gather.

Monitoring

MDIFW's black bear monitoring program is one of the most extensive and longest-running programs of its type in the U.S. Over the last 40 years, Department biologists have captured and tracked over 3,000 bears to determine their health and condition, estimate how many cubs are born each year, and determine annual cause-specific mortality rates.

Population Management

To maintain the bear population at a healthy and socially acceptable level, the Department's primary tool is hunting.

Since 2005, Maine's black bear population has steadily increased. The population grew from 23,000 in 2004 to ~36,000 in 2015, and annual harvest levels remain below what would be needed to stabilize it.

Maine offers a variety of traditional bear hunting methods, but the odds of taking a bear are low. More than 90% of bears are harvested with bait, 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 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 then presents management strategies that would allow everyone to continue enjoying black bears without too many conflicts in backyards and neighborhoods.

Living with Black Bears

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

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

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

WHEN & WHY CONFLICTS HAPPEN

Most human-bear conflicts occur in the spring and early summer, after bears emerge from their winter dens and find it difficult to locate high-quality natural foods. As they search, they sometimes encounter food odors (bird seed, garbage, compost, and grills) that attract them to backyards and neighborhoods. Once berries begin to ripen in late summer, bears return to wooded areas to forage, and conflicts with humans decline. However, when these natural foods are not abundant, bears are more likely to continue searching for food provided by people.

SOLUTIONS

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

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

While hundreds of bear conflicts are reported each year, many can be prevented by simply **removing** or **securing** common bear attractants each spring.

	1 REMOVE & STORE INSIDE BETWEEN APRIL 1 AND NOVEMBER 1	2 SECURE & CLEAN
BIRD SEED 	• Take bird feeders down • Store seed and feeders indoors (you can still feed birds in the winter)	• Rake up bird seed from the ground
GARBAGE 	• Store garbage cans in a building or enclosed by electric fence • Take to curb on morning of pickup	• Keep outbuilding and garage doors closed at all times • Dumpster lids and doors should be kept closed and latched • Use bear resistant dumpsters or garbage cans
GRILLS 	• Store grill inside when not in use • If you are having bear conflicts, stop grilling until bear moves on	• Burn off food residue • Dispose of food wrappers and grease cups
LIVESTOCK & PET FOOD 	• Store livestock and pet food inside • Feed pets inside	If you feed your pets or livestock outside: • Clean dishes daily • Remove leftover food daily

FOR MORE INFORMATION

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

Black Bear Hunting and Trapping

SEASONS & PERMITS

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

Starting in 2015, the season began opening one day early (the last Saturday in August) for youth hunters. Since then, the number of bears harvested by youth hunters has grown from 22 in 2015 to 35 in 2017. The general hunting season for black bears opens the last Monday in August and closes the last Saturday in November.

BEAR HUNTING

Hunters may harvest bears in the fall through a variety of methods. They can still-hunt or hunt near natural food sources throughout the three-month period, but other methods are staggered throughout the season. Hunting bears over bait is only allowed for the first four weeks of the season, while hunting with dogs is permitted for six weeks that overlap with the last two weeks of bait season.

Hunting over bait is the most popular method for resident and non-resident bear hunters alike, although, since 2013, we have seen an increase in the proportion of bears harvested using dogs.

In 2017, 67% were taken over bait, 21% with dogs, 4% in traps, 3% of bears by deer hunters, and 1% by still-hunting or stalking prior to deer season. The remaining 4% were taken by hunters that did not report their method **(Table 1).**

BEAR TRAPPING

Trappers can harvest a bear in September or October using either a cable foot restraint or cage-style trap. In 2017, 126 bears were taken in traps, mostly (81%) by residents.

Since 2008, trappers have been required to purchase a separate permit to trap a bear, and permit sales indicate rising interest, especially among residents. Trapping permit sales peaked in 2014 at 676, likely in response to a ballot initiative that, if passed, would have eliminated traps, bait, and dogs as legal harvest methods. In 2017, 611 trapping permits were purchased, 538 by residents and 73 by non-residents.

A new law that took effect in late September of 2011 allows two bears to be harvested if one is taken by trapping. Although only a small proportion of hunters and trappers take advantage of this opportunity, the number of individuals harvesting two bears increased incrementally each year to 24 hunters by 2015. However, in 2016, the increasing trend broke with only 15 hunters/trappers harvesting a second bear in 2016 and 22 in 2017.

GEOGRAPHIC CONSIDERATIONS

Few bears were harvested in central and coastal Maine (i.e., Knox, Lincoln, Waldo, Androscoggin, Cumberland, Sagadahoc, Kennebec, and York counties), where bear populations are low and hunting opportunity is limited.

Since 2005, Maine's annual bear harvest has averaged around 3,000 animals, which is below the level needed to stabilize the bear population. In 2017, the harvest was slightly lower than average, with 2,897 bears registered at check stations. Harvest numbers tend to fluctuate from year to year, often with alternating high and low years, but the alternating trend was disrupted in 2016 with surprisingly similar numbers again in 2017 (**Figure 2**).

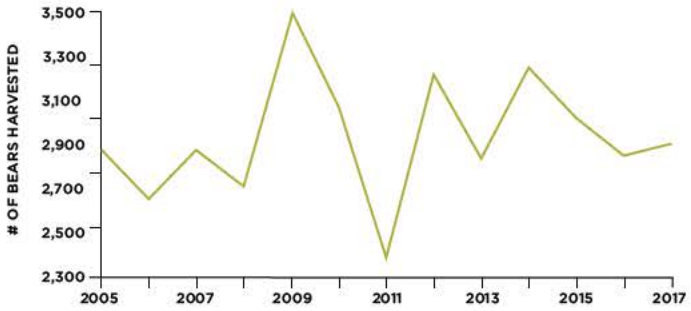
TABLE 1. NUMBER OF BEARS HARVESTED IN MAINE IN 2017 BY WILDLIFE MANAGEMENT DISTRICT (WMD).

	METHOD OF TAKE										
WMD	HUNTING WITH BAIT	WHILE DEER HUNTING	HUNTING WITH DOGS	SPOT AND STALK	TRAPPING	UNKNOWN[1]	TOTAL HARVEST	ARCHERY[2]	ASSISTED BY GUIDE	RESIDENT	NON-RESIDENT
1	91	1	36	0	10	5	143	11	131	16	129
2	88	3	34	2	6	1	134	8	116	23	111
3	148	1	27	4	5	3	188	9	147	60	130
4	166	1	8	2	0	5	182	12	117	64	118
5	99	0	56	2	3	13	173	11	146	25	149
6	179	4	26	4	3	10	226	27	149	66	160
7	72	4	26	1	10	6	119	4	69	54	66
8	130	7	81	0	16	5	239	16	148	122	117
9	77	4	29	2	2	4	118	12	75	47	71
10	74	5	17	1	5	3	105	8	79	25	80
11	150	3	50	8	10	2	223	22	161	66	157
12	51	9	28	2	10	5	105	11	29	75	30
13	23	3	16	1	6	5	54	6	29	21	33
14	38	6	31	2	3	3	83	4	58	38	47
15	36	7	8	0	6	10	67	8	8	60	7
16	4	3	0	0	3	0	10	0	0	10	0
17	39	6	8	0	5	4	62	0	20	39	23
18	131	5	25	2	9	4	176	11	103	86	90
19	105	3	53	0	1	1	163	11	143	25	138
20	4	4	0	0	2	0	10	0	0	10	0
21	3	0	0	0	0	0	3	0	0	2	1
22	0	0	0	0	0	1	1	0	0	1	0
23	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0
25	1	0	0	1	0	0	2	0	1	0	1
26	46	1	3	0	6	2	58	9	14	48	12
27	51	4	9	3	3	1	71	1	24	40	29
28	121	3	43	0	2	2	171	16	122	65	109
29	0	0	0	0	0	0	0	0	0	0	0
UNREPORTED	0						11				
STATEWIDE	1,927	87	614	37	126	95	2,897	217	1,889	1,088	1,808

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

[2]*This includes 53 bears harvested with a crossbow.*

FIGURE 2. BEAR HARVEST IN MAINE



Many factors may influence the black bear harvest rate; but since most bears are taken over bait, natural food abundance during the baiting season is the primary one. A shortage of natural foods in the late summer and early fall increases bears' interest in bait and their overall activity, improving overall harvest rates. Conversely, when natural foods are abundant, harvest rates decline.

Even though abundant natural foods cause bears to forage later in the fall and become increasingly vulnerable to deer hunters in November, the harvest by deer hunters is too low to increase overall harvest levels. In 2017, with an abundance of beech nuts and acorns and a correspondingly low bait harvest of 1,927 bears, the 170,000 Maine deer hunters still only harvested 87 bears.

Weather, especially during the first two weeks of the baiting season, also impacts the final tally.

RESIDENT VS. NON-RESIDENT HARVEST NUMBERS

Although non-resident permit holders account for just over half of Maine's bear hunters, they contribute ⅔ of the total harvest.

In 2017, non-resident hunters harvested 68% of bears taken during bait season and 66% of those taken during hound season, but only 29% of the bears taken by spot and stalk (up from 3% in 2015 and 2016), 18% taken while deer hunting (up from 3% in 2015 and 2016), and 20% of those taken by trapping.

THE INFLUENCE OF MAINE GUIDES

Most non-residents use Maine Guides for their hunt, and that could explain their overall higher success rates leading up to deer firearm season (36% compared to 20% for Maine residents). Guides also appear to have boosted non-residents' spot and stalk success, as the proportion of bears taken by spot and stalk methods with a Maine Guide also increased from 3% in 2016 to 18% in 2017.

HUNTER PARTICIPATION

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

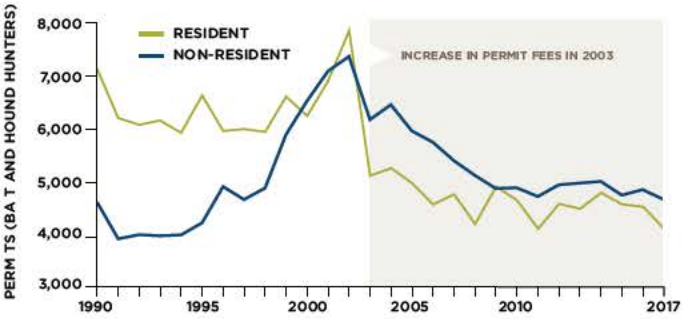
RESIDENTS

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

NON-RESIDENTS

Non-residents, who became more interested in hunting Maine black bears following the closure of the Ontario spring bear hunt in 1999, also lost some interest with the fee increase. While not as many non-residents dropped off initially, the decline has continued, likely due to economics and increased opportunities to hunt bears in other states. This is particularly significant since non-residents' higher success rates have a greater influence on the final harvest level. **(Figure 3).**

FIGURE 3. RESIDENT VS. NON-RESIDENT PERMITS



Over the next few years, we will explore options to increase hunting opportunities and promote bear hunting to increase hunter participation.

NEW PERMITS FUNDING BLACK BEAR RESEARCH AND MANAGEMENT

Since 2008, trappers have been required to purchase a bear permit to harvest a bear, and non-residents have also been required to purchase a permit to take a bear during deer firearms season. Funds from these permit sales are dedicated to bear research and management. Currently, we are using these funds to age teeth from harvested black bears, which will allow us to monitor trends in Maine's bear population, including its age structure.

In 2017, 837 non-resident bear permits for deer season and 611 trapping permits were sold.

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

CANADA LYNX

Jennifer Vashon

A Northern Species

Canada lynx, as their name implies, are found primarily in Canada; but their range also extends to several northern U.S. states with similar habitat and weather patterns **(Figure 7).**

FIGURE 7. CANADA LYNX RANGE

Graphic by IUCN Red List

In Maine, lynx are found primarily in our northern spruce/fir forest, where snow depth often remains above a foot for at least three months of the year. Boreal forest and winter snow pack are essential components for supporting lynx; and like snowshoe hare, lynx have large, well-furred feet that give them a competitive advantage in deep snow and enable them to thrive in harsh winter conditions.

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

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

Lynx are prey specialists, and their diet is composed primarily of snowshoe hare; so where snowshoe hare thrive, lynx thrive, too. 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.

Over the last 15 years, people in northern Maine have been seeing lynx more regularly. Since lynx are naturally calm animals, and are generally ambivalent to the presence of people, they often remain in the area long enough for a viewer to snap a photo or capture a video. This opportunity to watch a lynx in their natural environment makes for a truly unique and memorable experience.

Why are Lynx in Maine Thriving?

More than 90% of Maine's land area is classified as forest – the highest percentage of any U.S. state. And within the expansive spruce and fir forests of northern Maine, conditions are ideal for lynx: human development is low, snow cover is ideal, and a combination of natural and human disturbances have created a 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 isolated event, combined with the ongoing harvest schedule, has created many young, dense, regenerative thickets perfect for snowshoe hare (and therefore lynx).

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

Lynx 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

MAINE'S FIRST LYNX SNOW TRACKING STUDY

MDIFW began collecting baseline information on the status of lynx in the 1990s by conducting winter snow track surveys along the Maine/Quebec border. During the next decade, in an effort to document the distribution of lynx in the state, we expanded this effort to most of northern and western Maine. Between 2003 and 2008, MDIFW biologists surveyed 91 northern Maine towns and found lynx in 43 (47%) of them.

MAINE'S FIRST LYNX TELEMETRY STUDY

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

Through the study, biologists were able to identify lynx habitats and determine the size of the areas lynx were using. We found that lynx were spending most of their time in regenerating spruce/fir clearcuts with some of Maine's highest snowshoe hare densities, and that a male would typically share an area with two to three females, who would each produce 1 to 5 kittens per year.

In 2006, 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 produce the first data-driven statewide population estimate for Maine lynx.

SNOW TRACKING 2.0

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

Preliminary results from this effort suggest that lynx now occupy a greater percentage of the available habitat in Maine. Of the 45 towns surveyed to date, biologists have found lynx in 39 (87%). The survey should be complete this winter, giving us a current statewide distribution of lynx, including the percentage of towns they currently occupy.

TELEMETRY 2.0

In the fall of 2015, biologists launched a second telemetry study wherein 17 lynx (11 males, six females) were captured, primarily along the southern edge of Maine's lynx range, and equipped them with GPS collars. These collars allow biologists to identify the habitats lynx are using across Maine and compare them both to each other and to previous telemetry studies. They also allow biologists to locate lynx denning sites and estimate how many young are born each year.

Although three of the 17 collars failed to send sufficient locational information, data from 14 GPS collars indicated that these areas support resident lynx with established home ranges. A subadult female 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 four of the six female lynx during the denning period, and we know that two produced litters of two kittens each. We plan to equip another 10 lynx with GPS collars during the fall of 2018. With the habitat and productivity data we collect, we should be able to determine which forest conditions continue to support lynx, and we'll be able to an updated statewide population estimate. This information will be made available to the USFWS, forest managers, and the general public.

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

FURBEARERS

The term "furbearers" refers to all mammals that are harvested primarily for their pelts. In Maine, this includes coyote, red and gray fox, bobcat, fisher, marten, raccoon, skunk, short and long-tailed weasels, mink, river otter, beaver, muskrat, red squirrel, and opossum.

The pelts of all furbearers, except weasel, raccoon, squirrel, muskrat, skunk, and opossum, are tagged for tracking the furbearer harvest. Pelt tagging is one of the primary population indices used in our furbearer management systems.

Furbearers are primarily trapped, but fox, coyote, bobcat, raccoon, opossum, and skunk can also be hunted. Small game that can be hunted include snowshoe hare, red and gray squirrels, woodchuck, and porcupine.

Overview of Trapping Season

Trapping effort, as indicated by the number of active trappers or traps being set, was lower than normal this past year. The low harvest of furbearers this past trapping season **(Table 1)** is likely a reflection of this low trapping effort.

Trapping effort was likely impacted by low fur prices **(Table 2)** and the additional trapping regulations that were implemented in 2015/16 (e.g., lynx exclusion devices statewide when setting body gripping traps on dry land, chain and swivel configurations for foothold traps).

Although the overall trend was fewer animals trapped last year, there was a slight increase in the beaver, coyote, fox, and otter harvests compared to the previous year **(Table 13)**.

Upon discussion with the trapping community, it seems the lynx exclusion devices are working to harvest marten. The downward trend in marten harvest this past year could have resulted from lower trapper effort and a decline in mast tree production the year prior, which have been shown to affect marten populations.

The adoption of the lynx exclusion devices for fisher seems to be less positive, and the Department will continue to monitor how this tool affects the fisher harvest.

TABLE 1. ANNUAL HARVEST OF NINE FURBEARING SPECIES IN MAINE FROM 2008-2017 TRAPPING AND HUNTING SEASONS.

SPECIES	17-18	16-17	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09
Beaver	4,873	4,107	4,953	3,578	7,841	9,063	15,769	6,976	10,765	9,119
Bobcat	180	195	228	126	136	205	239	305	281	407
Coyote	1,137	940	1,421	1,032	1,315	1,746	2,072	1,808	1,822	2,003
Fisher	260	336	292	686	656	1,339	973	1,230	1,149	1,485
Red Fox	473	419	586	295	589	1,058	1,067	1,020	985	955
Gray Fox	245	143	320	548	334	437	346	344	253	182
Marten	387	1,088	394	1,211	1,041	4,047	1,439	3,613	2,703	2,291
Mink	380	464	1,203	1,168	1,376	2,256	2,422	2,123	1,498	1,374
Otter	531	322	496	292	408	762	1,405	857	743	571

TABLE 2. FURBEARER PELT PRICES (AVERAGE ROUNDED TO NEAREST DOLLAR) REPORTED BY FUR HARVESTERS AUCTION INC. FROM 2012-2017.

SPECIES	2017	2016	2015	2014	2013	2012
Beaver	$14	$14	$18	$23	$31	$33
Bobcat	$81	$42	$92	$153	$163	$99
Coyote	$31	$41	$43	$45	$33	$44
Fisher	$58	$32	$70	$77	$121	$70
Red Fox	$23	$19	$29	$40	$60	$52
Gray Fox	$18	N/A	$16	$26	$35	$27
Marten	$77	$32	$55	$71	$133	$90
Mink	$12	$12	$10	$17	$27	$23
Otter	$29	$21	$41	$53	$95	$87
Muskrat	$4	$3	$5	$10	$12	$9
Skunk	$5	$5	$8	$5	$3	$4
Raccoon	$7	$3	$10	$13	$22	$13
Weasel	$3	$2	$5	$5	$5	$4
Opossum	N/A	N/A	$2	$2	$4	$1

Furbearer Management

In 2016, the Department started two projects to strengthen its furbearer monitoring program.

The first project involves the mandatory submission of tooth samples from harvested bobcat, fisher, marten, and otter. These teeth provide the Department with the age and sex structure of the harvest, which will be used in conjunction with tagging and effort data to monitor population trends.

The second project involves monitoring forest carnivore populations (with an emphasis on marten and fisher) using trail cameras. This project will provide population trends for large areas of the state based on occupancy rates (i.e., the number of areas that have marten or fisher living in them vs. the number searched). Ultimately, the goal of the project is to develop a trail camera protocol that we can use to monitor fisher, marten, and, potentially, other furbearers into the future.

Tooth samples for marten, fisher, bobcat, and otter were extracted from jaws and sent to the lab for aging.

Tooth Submissions

YEAR 1 (2016-17)

The furbearer trapping and hunting season of 2016/17 marked the first year of mandatory tooth sample submission for every bobcat, fisher, marten, and otter harvested. MDIFW collected nearly 1,200 tooth samples, representing 32% of the bobcat, 70% of the fisher, 59% of the marten, and 79% of the otter harvest(s).

The number of teeth submitted was exceptional for the first year of the program, especially considering the delay in publicizing information on the new rule.

In general, most of the animals that were harvested tended to be young (four years old or younger). The oldest age for species harvested in 2016/17 was 11 years old for bobcat, eight years old for fisher, nine years old for marten, and 10 years old for otter.

YEAR 2 (2017-2018)

In the second year of the program (2017/18), the Department received 123 bobcat, 246 fisher, 354 marten, and 399 otter tooth samples, representing 68% to 91% of the harvest of each species. Biologists and volunteers have cleaned, prepped, and shipped tooth samples to a laboratory that specializes in tooth aging.

The age and sex data collected from these samples provide insight into how intensively these species are being harvested. When multiple years of age and sex data are combined with overall harvest numbers and trapper effort, biologists will be able to use mathematical modeling to develop population trends for these species.

Trail Camera Monitoring Project

In January 2017, MDIFW and the University of Maine hired a Ph.D. student to develop a protocol for monitoring and tracking marten and fisher population trends.

During summer 2017 (June-September) and winter 2018 (January-April), Year One survey stations were set for a minimum of two weeks, covering 15 study areas, from west (Rangeley Lakes) to east (Grand Lake Steam) and north to Eagle Lake, Musquacook Lakes, and including Baxter State Park.

Each study area was chosen to include townships representing one of four landscape categories related to overall timber harvest history:

(1) high harvest in a contiguous block

(2) high harvest surrounded by low harvest (disjunct)

(3) low harvest contiguous, or

(4) low disjunct

Year Two surveys were underway during summer 2018. These included a subset of the initial study areas to facilitate year-to-year analyses, as well as new study areas in moderately harvested townships. This study design will help assess the role of land management trends on both the presence (occupancy) and detectability of carnivore species.

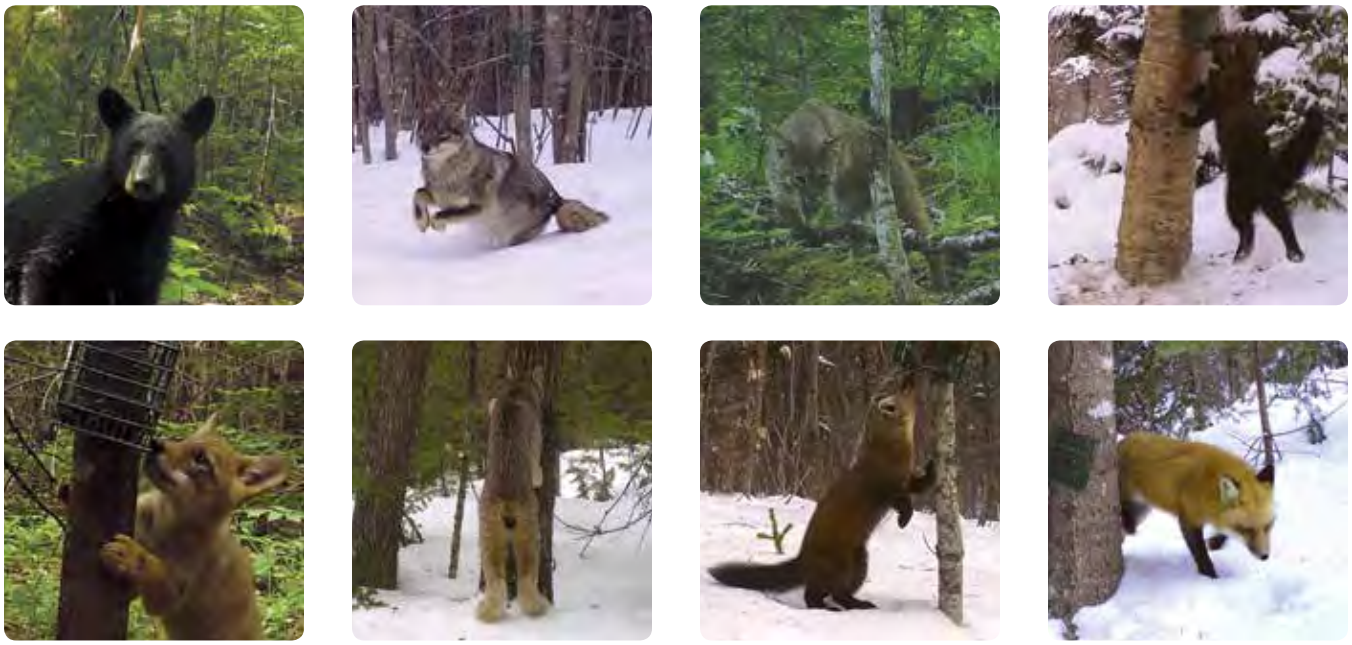
During Summer One (June-September 2017), 121 stations were set, each consisting of three individual camera sites. At each site, a Bushnell HD camera was placed overlooking a piece of bait (specifically, beaver meat treated with a skunk-based scent lure that served as a long-range attractant).

These sites were set 100m apart in a straight line, at variable distances from roads. Habitat data, such as dominant tree species, estimates of basal area and course woody debris, and distance to nearest water, were collected as well. Following a few cases of camera damage by black bears, protective camera boxes were installed.

During Winter One (January-April 2018), 119 of the 121 stations were accessible to re-survey. At these stations, cameras and bait were placed as close as possible to the original trees. Severe weather in March delayed the last deployment of cameras until April, and retrieval of the final stations was also delayed due to mud conditions and closed trails in Baxter State Park.

As of August 2018, the image data indicated that carnivore species were detected as expected, but some species were more readily detected during particular seasons **(Figure 8).** All stations should be retrieved by mid-September 2018, followed by a more detailed image tagging process to prepare data for analyses. This upcoming fall and winter, the focus will be on database management and preliminary analyses to compare detectability across seasons.

FIGURE 8. A SAMPLE OF SPECIES DETECTED DURING THE 2017/18 CAMERA TRAPPING SURVEYS (FROM L TO R, TOP TO BOTTOM: BLACK BEAR, COYOTE, BOBCAT, FISHER, COYOTE, LYNX, MARTEN, AND RED FOX).



SMALL MAMMALS

Northern Bog Lemming

The northern bog lemming (NBL) can be found in tundra and alpine environments across Canada and Alaska, but it is a state-threatened species in Maine.

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 has only been found in Maine at four sites, 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 DNA APPROACH

The Department has partnered with Dr. Zach Olson at the University of New England to develop a survey technique for NBL 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, small amounts of cellular material are shed from its intestinal wall. 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 was successful in developing a technique to differentiate NBL from other rodents based on their genetic code. In 2016, fecal pellets were collected from three of our four 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.

The technique utilized in 2016 worked, but it was time consuming.

DNA APPROACH, 2.0

This fall, biologists will be investigating the feasibility of an additional sampling technique called environmental DNA (eDNA). Using this technique, DNA is extracted from water samples, often from a stream system, where it is suspected that a species of interest lives upstream. Since DNA is in every component of an animal's body (tissue, hair, shed skin, etc.), DNA material sluffs off and is carried into aquatic systems.

With this technique, scientists can detect species just by sampling the water within the environment they inhabit. If Dr. Olson's lab is able to successfully develop an eDNA approach to sample NBL, it would enable the Department to sample large swaths of the state quickly and efficiently.

Bats

Shevenell Webb

The Department is continuing to expand our understanding of bat communities in the state. This includes developing long-term monitoring programs for the different species and identifying and addressing specific research needs. Updates on two of our bat programs follow:

DRIVING SURVEYS

During Summer 2017, Department staff conducted driving surveys with acoustic detectors to develop baseline abundance data on eastern red, silver-haired, and hoary bats (often referred to as "tree bats").

We selected two transects (paths to drive through) per regional office, for a total of 14. Each transect had landscape-scale features representative of the region, and we sampled them under the following conditions:

- Surveys started one half hour after sunset
- Drivers maintained 20 mph as a speed
- Surveys were done on nights without precipitation and winds less than 10 mph
- All transects were 25-30 miles in length
- Two surveys per transect were conducted within a single seven-day period

This represented the first successful statewide driving survey effort **(Table 1)**.

The same transects were sampled in each region during Summer 2018, and the results will be analyzed during the fall. These data will be used to develop a metric of bats per mile and a transect population estimate using a Royle/Nichols heterogeneity model in program Presence.

For future years, the Department plans to maintain the current sites and potentially expand sampling in collaboration with partners and volunteers. With repeated annual surveys, MDIFW will develop its first trend data for tree bats and a subset of cave bats. Concerns exist nationwide regarding tree bats and anthropogenic stressors, and these baseline trend data provide much needed information for the Department.

TABLE 1. RESULTS OF ACOUSTIC DRIVING SURVEYS CONDUCTED STATEWIDE DURING THE MATERNITY SEASON (JUNE 1- JULY 31) IN 2017.

Data represents number of bats encountered per mile of survey when results from two surveys from the same transect are averaged for each species. Dates represent the first and second date of survey for a given transect.

REGION	ROUTE	DATE	TRANSECT (MILES)	EPFU*	LANO*	LABO*	LACI*	MYLU*
A	FRYBERG/SEBAGO	JUL 6/10	28.64	1.92	0.70	0.03	0.31	0.07
A	YORK	JUL 12/19	29.00	3.21	0.41	0.24	0.03	0.00
B	NOBLEBORO	JUN 15/20	27.10	1.03	0.15	0.07	0.30	0.00
B	WALDO COUNTY	JUN 6/13	29.00	0.69	0.14	0.03	0.24	0.03
C	STUD MILL	JUL 7/13	33.40	0.09	0.27	0.00	0.15	0.00
C	SUNRISE TRAIL	JUN 21/27	29.10	0.14	0.00	0.00	0.07	0.00
D	PHILLIPS_WILTON	JUL 22/25	28.00	1.46	0.32	0.04	0.25	0.14
E	RIP DAM-LILY BAY	JUL 26/AUG 4	30.70	0.88	0.39	0.13	0.26	0.13
E	MOOSEHEAD WEST	JUL 21/22	28.80	0.52	0.56	0.28	0.10	0.03
F	MOLUNKUS	AUG 2/4	32.80	0.91	0.98	0.15	0.46	0.00
F	FLATIRON POND	JUL 25/AUG 1	30.50	1.93	1.34	0.13	0.85	0.13
G	MARS HILL	JUL 17/24	30.50	0.00	0.36	0.00	0.20	0.00
G	ROCKY BROOK ROAD	JUN 20/25	30.30	0.00	0.66	0.00	0.96	0.00

**EPFU = big brown bat, LANO = silver-haired bat, LABO = eastern red bat, LACI = hoary bat, MYLU = little brown bat.*
No eastern small-footed, northern long-eared, or tri-colored bats were documented.

NON-TRADITIONAL HIBERNACULA STUDY

It's well known that myotis bats use caves and mines for hibernation; therefore, these structures are referred to as traditional hibernacula.

However, these are not the only places bats hibernate. Research in Acadia National Park (ACAD) indicates one or more species of myotis bats (eastern small-footed, northern long-eared, little brown) may also hibernate throughout the winter in between the rocks in talus slopes and cliff faces. Since Maine has few traditional hibernacula, gaining a better understanding of our non-traditional alternatives will help Maine biologists conserve these bat species.

Researchers at MDIFW and ACAD recently partnered on a pilot study to document whether myotis bats were using other talus slopes in coastal and inland areas.

During the winter of 2017/18, the Department used acoustic monitors that record the high frequency sounds of bat calls to identify which talus slopes bats were using. In April (the month bats typically emerge from hibernacula), Department biologists used mist nets and infrared cameras at the talus slopes where they detected winter bat activity to confirm bat emergence.

This effort yielded imagery of bats over talus slopes at sunset and the capture of one myotis bat. Unfortunately, the captured bat escaped the net before we could verify the species. Together, the acoustic monitoring, mist netting, and camera information collected during this pilot study provided evidence to support a larger investigative effort of bats' use of Maine's talus slopes and cliff faces as hibernacula.

Over the next several years, Department and ACAD biologists will be working with a graduate student at the University of Maine to expand the investigation. The expanded project's goals are to:

1. Identify what factors influence occupancy of hibernating bats on talus slopes and use them to build a predictive model of talus hibernacula occurrence in the northeastern U.S.
2. Identify which bat species use talus hibernacula, and to what extent.
3. Investigate fungal loads of *Pseudogymnoascus destructans,* the causative agent of White-Nose Syndrome, to determine if loads differ between talus and cave/mine hibernacula.

Stay tuned for updates on this exciting research project!

This work was supported by the federal Pittman-Robertson and State Wildlife Grants programs, US Fish and Wildlife Service White-Nose Syndrome grants, and state revenues from the sales of hunting and trapping licenses.

New England Cottontail

Wally Jakubas

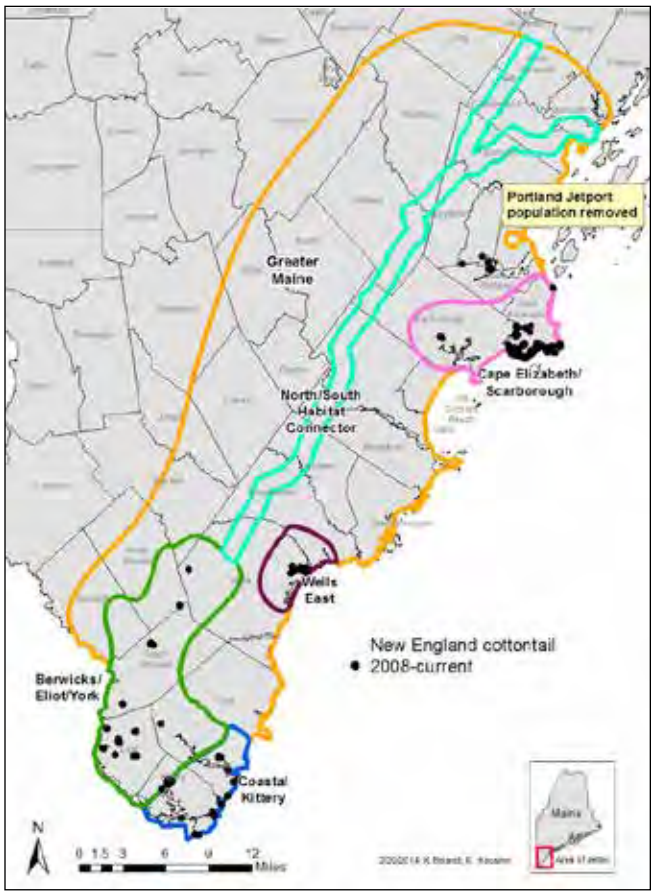
About the Rabbit

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

In 2004, the Department closed the hunting season on NEC; and in 2007, we listed the species as endangered. As of the winter of 2012-2013, there were no known populations of NEC north of Portland and less than 300 rabbits left in the state. New England cottontails now exist in three populations in Maine: 1) Cape Elizabeth/Scarborough, 2) Wells, and 3) Kittery/York/Elliot **(Figure 1).**

FIGURE 1. MAINE'S FIVE FOCUS AREAS AND APPROXIMATE LOCATION OF REMAINING NEW ENGLAND COTTONTAIL (NEC) POPULATIONS.

Cottontail populations are denoted by black dots and focus areas are named and delineated by various shades of gray lines. Because there are no NEC populations currently in the Greater Maine focus area, it has a lower priority for management than other focus areas. The North/South Habitat Connector is not a focus area but denotes a power utility right-of-way that NEC may use as a travel corridor.



The decline of NEC in Maine and other northeastern states raises concern over the status of other wildlife species that use brushy/old field habitats. There are at least 42 Species of Greatest Conservation Need (SGCN) that use habitats similar NECs, including the eastern towhee, woodcock, and black racer.

Dense shrubby habitat is rare in southern Maine and makes up less than three percent of the land base. Therefore, most NEC restoration efforts are targeted at creating or maintaining dense shrublands that benefit NEC and other wildlife.

The New Challenge

Traditionally, the four biggest challenges to NEC recovery in Maine have been:

1. Little remaining shrubland habitat
2. Small population sizes
3. Low genetic diversity resulting from isolated NEC populations and low rabbit numbers **(Figure 9)**
4. The social and biological limitations associated with restoring shrubby habitat

Unfortunately, a new threat has emerged to the restoration of NEC populations in Maine: the eastern cottontail rabbit (*Sylvilagus floridanus*). Until last year, Maine was the only state in the northeast that did not have eastern cottontail rabbits. Eastern cottontails are similar in appearance to NECs, but they are not native to New England. Around 1899, state wildlife agencies and hunting clubs introduced tens of thousands of eastern cottontails into states south of Maine, primarily to provide more hunting opportunity. Eastern cottontails were introduced on top of native NEC and snowshoe hare populations. The introduction of non-native animals or plants often threatens native wildlife populations. In this case, the introduced eastern cottontail rabbit can feed in a wider variety of habitats than NEC rabbits, resulting in higher survival and reproductive rates than NEC. Eventually, eastern cottontails can displace NEC when the two species occur together. Rhode Island, for example, lost most of its NEC population and now primarily has eastern cottontails.

Last year, wildlife biologists verified a population of eastern cottontails on Badgers Island (Kittery) and on Kittery's mainland. These rabbits likely came from across the river in Portsmouth NH, which has a large eastern cottontail population. Although biologists cannot say for certain how the rabbits arrived on Badgers Island, there is growing evidence (photographs, road-killed rabbits) that eastern cottontails may have used the recently rebuilt Memorial Bridge, which is over 800 feet in length, to access the island from New Hampshire. Biologists were successful in trapping most of the eastern cottontails off Badgers Island last year and were able to trap the only known eastern cottontail population on the mainland in Kittery. MDIFW continues to work with the City of Portsmouth and the Maine and New Hampshire Departments of Transportation to discourage further bridge crossings by these rabbits. The Department will continue its eastern cottontail trapping efforts to ensure a population does not become established on the mainland.

Habitat Restoration Efforts

MDIFW gets a tremendous amount of help conducting habitat restoration and NEC recovery projects from its partners in the USFWS, Natural Resources Conservation Service (NRCS), the Wildlife Management Institute, and Wells National Estuarian Reserve. Most of the NEC habitat restoration work in Maine occurs on private lands, and so we're especially appreciative of the many landowners who have participated in NEC conservation efforts.

Approximately 536 acres on 30 public land and non-NRCS private land sites are being, or have been, actively managed for NEC. These acres include existing habitat that is actively being maintained or enhanced, newly created habitat, and completed management.

A notable acquisition in 2017 was the Getchell Pasture property, a 180-acre parcel acquired by the Town of Wells that includes a reverting field, an extensive scrub-shrub wetland, and an upland forest. Jeff Tash, NEC Restoration Coordinator, presented a NEC management plan for this property to the Wells Town Council and gained approval for the Department to start habitat restoration work in late-summer 2018. The Department secured funding for this work through a Competitive State Wildlife Grant from the USFWS.

Meanwhile, we are continuing to identify and prioritize potential parcels for the Great Thicket National Wildlife Refuge through work that includes a comprehensive GIS-based parcel analysis.

Research Efforts

Drs. Kovach and Kristensen of the University of New Hampshire completed a study titled "Developing Improved Methods for New England Cottontail Population Estimation in Maine: Towards Reliable Assessment of Range-wide Conservation Goals." This study demonstrates a method for estimating the abundance of NEC using a spatially explicit capture–recapture model. The study was published in a scientific journal, and the Department is currently using this method to measure cottontail abundance on key management areas.

Monitoring Efforts

The Department continues to monitor NEC populations each winter. This work is coordinated out of MDIFW's regional office in Gray, ME by Cory Stearns.

RANGE-WIDE OCCUPANCY STUDY

One aspect of this work is our participation in a range-wide study to determine trends in the number of NEC-occupied habitat patches occupied in Maine, New Hampshire, Massachusetts, Rhode Island, New York, and Connecticut. This ongoing study helps guide NEC management efforts by letting wildlife managers know whether NEC populations are expanding or contracting geographically.

Biologists search brushy habitat patches for fecal pellets, which they send to laboratories in New Hampshire and Rhode Island for DNA analysis, which tells us whether the pellets were from a NEC, eastern cottontail, or snowshoe hare.

By combining Maine's occupancy data with that of other states, biologists will get an overall picture of the range-wide trend of the NEC population and whether population restoration measures are effective.

INVESTIGATING NEW RABBIT SIGHTINGS

In addition to the occupancy surveys, the Department surveys areas in Maine where biologists receive reports of new rabbit sightings or suspect NEC might occur. This includes historically-occupied patches that have not been surveyed in years. This past winter, three new areas were confirmed to have NEC, and rabbits were detected at two sites where they had not been seen in eight to 10 years.

ABUNDANCE SURVEYS AT MANAGEMENT SITES

Finally, Department biologists conduct abundance surveys at specific NEC management sites in an effort to closely track the number of rabbits at a site and/or to measure the effectiveness of certain habitat restoration efforts.

Like the range-wide occupancy study, measuring abundance also involves collecting pellets – but it requires us to collect many more. For these surveys, biologists walk through extremely thick brush and collect up to 60 pellets from each habitat patch. The pellets are then sent to a laboratory where DNA analysis tells us which individual rabbit deposited the pellet. Once the rabbit's identity is known, biologists use the spatially explicit capture-recapture model developed by Drs. Kovach and Kristensen to determine the number of rabbits living in the habitat patch.

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.

REPTILE, AMPHIBIAN, AND INVERTEBRATE CONSERVATION AND MANAGEMENT

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 Group (RAI) is challenged with coordinating research and conservation priorities for this diverse suite of organisms, including the 100+ reptiles, amphibians, and invertebrates currently 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 natural heritage.

The Reptile, Amphibian, and Invertebrate Group (RAI) is one of the Department's few units devoted entirely to nongame and endangered species services 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).

MEET THE REPTILE, AMPHIBIAN, AND INVERTEBRATE GROUP

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

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

Beth Swartz, Wildlife Biologist

Beth serves as the Department's lead biologist on a wide range of invertebrate taxa, with recent efforts 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 atlasing effort for bumble bees, including a newly listed federal endangered species – the rusty patched bumble bee. 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 serves as 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 black racers, Blanding's, spotted, and wood turtles in Maine, and coordinating Maine's efforts with those of several working groups on these species across the Northeast. Derek is also studying and helping to develop recommendations for how to mitigate the impacts of roadways on Maine's reptiles and amphibians.

SEASONAL STAFF AND PROFESSIONAL COOPERATORS

The RAI Group could not address such a diverse suite of taxa without the expert assistance of the following professionals (in 2017-2018):

Samantha Beaulileau
Dr. Catherine Bevier
Kalyn Bickerman-Martens
Paul M. Brunelle
Dr. Ron Butler
Dr. Aram Calhoun
John Calhoun
Dr. Matthew Chatfield
Dr. Frank Drummond
Ken Hotopp
Dr. Malcolm Hunter
Chris Introne
Dr. Michael Kinnison
John Klymko
Scott Lindemann
Dr. Cynthia Loftin
Derek Moore
Ethan Nedeau
Trevor Persons
Gannon Pratt
David Putnam
Dr. Leif Richardson
Marcia Siebenmann
Dr. Reginald Webster
Dr. Herb Wilson

AMPHIBIANS AND REPTILES

Phillip deMaynadier and Derek Yorks

By eastern U.S. standards, Maine is a large and climatically diverse state. Thus, while North American reptiles and amphibians (herpetofauna) are richest 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 has 36 known species of herpetofauna, including 18 amphibians and 18 reptiles, one of which is extirpated (timber rattlesnake) and two introduced (mudpuppy salamander and red-eared slider turtle). While Maine has a lower diversity of reptiles and amphibians than most eastern states, it provides some of the most extensive and intact remaining habitat for the species it hosts, several of which are of regional and national conservation concern. A relatively high proportion (~33%) of Maine's native herpetofauna 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 reptiles and amphibians 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 2018 annual meeting in Amherst, Mass. Some of Northeast PARC's projects to date include: drafting model state herpetofauna regulations; compiling a list of regional species of conservation concern; publishing management recommendations for important habitats; developing fact sheets on emerging amphibian and reptile diseases; designing guidelines for identifying Priority Amphibian and Reptile Conservation Areas (PARCAs); developing best management practices for turtle road crossing structure; and coordinating regional working groups for priority species, such as the wood turtle and Blanding's turtle.

THE PARCA PROJECT

Habitat loss and fragmentation is the greatest threat to reptiles and amphibians worldwide. The PARCA project aims to develop a network of areas in the U.S. focused specifically on the unique conservation needs of reptiles and amphibians.

Areas (PARCAs) are nominated using scientific criteria and expert review, drawing on concepts of species rarity, richness, regional responsibility, and landscape integrity. PARCAs are nonregulatory designations whose purpose is to raise public awareness and spark voluntary habitat protection by landowners and conservation partners. PARCAs are not designed to compete with existing landscape biodiversity initiatives, but to complement them as another spatially-explicit layer of conservation consideration. With support from the U.S. Fish and Wildlife Service, MDIFW is working closely with researchers at the University of Maine Cooperative Fish and Wildlife Research Unit (Cyndy Loftin), Tennessee State University (William Sutton), and the Association of Fish and Wildlife Agencies (Priya Nanjappa) to develop a framework for identifying candidate PARCAs throughout the Northeast.

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

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

Maine Amphibian and Reptile Atlas Project (MARAP)

Phillip deMaynadier and Derek Yorks

From 1984-1988, MDIFW, in cooperation with Maine Audubon and the University of Maine, conducted the Maine Amphibian and Reptile Atlas Project (MARAP). During a four-year period, over 250 volunteers from around the state contributed approximately 1,200 records of observations of amphibians and reptiles. This initiative culminated in the 1992 publication of the book, *The Amphibians and Reptiles of Maine.* The first edition sold out within two years of publication.

2ND EDITION (1999)

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

CONTINUING DATA COLLECTION

Since the publication of the most recent atlas, MDIFW has continued to collect data and maintain a comprehensive database on the distribution of Maine's 35 extant amphibian and reptile species (33 native and 2 exotic). As of spring 2018, over 12,000 records from more than 1,300 volunteers had been logged. Additionally, a new graduate student at University of Maine Orono, Scott Lindemann, conducted targeted surveys during the 2018 field season throughout northern and Downeast Maine to help fill gaps in our understanding of specific species, including the gray tree frog, pickerel frog, northern water snake, common snapping turtle, and others.

INSIGHTS

The MARAP project has 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 similar across the state. MARAP findings have also helped to inform specific species' conservation status assessments (e.g., endangered, threatened, special concern, SGCN). There is still much to learn about the distribution and ecology of Maine's herpetofauna, and we encourage members of the public to share their photo observations by submitting a MARAP reporting form, available on MDIFW's website in the Species Information section.

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

How can you help?

Please submit observations of any of the four state-listed reptiles below as soon as possible.

derek.yorks@maine.gov

207-941-4475

Eastern box turtle (endangered)

Blanding's Turtle (endangered)

Black Racer (threatened)

Spotted Turtle (threatened)

Blanding's and Spotted Turtles

Derek Yorks

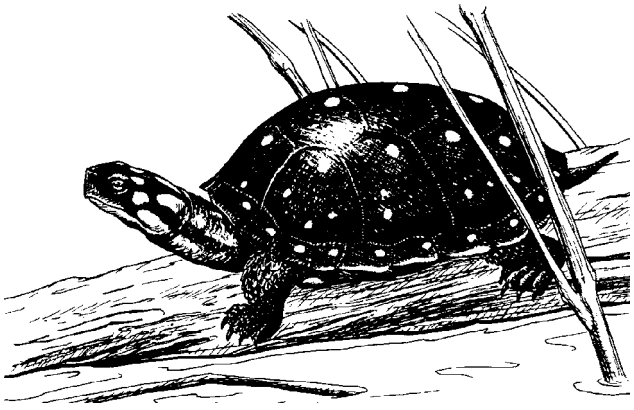
For over 20 years, MDIFW has actively researched the distribution and status of Blanding's and spotted turtles in Maine.

Blanding's turtles (endangered) are 7 to 10 inches long with a yellow throat and light-colored flecking on a helmet-shaped shell.

Spotted turtles (threatened) are 5 to 6 inches long with yellow spots on the head, tail, and legs and a slightly domed, yellow-spotted black shell.

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

Blanding's Turtle. Drawing by Abigail Rorer.



Spotted Turtle. Drawing by Mark McCollough.

SURVIVAL CHALLENGES

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

Both Blanding's and spotted turtles are long-lived animals that take a minimum of seven (spotted) to 14 (Blanding's) years to reach reproductive age. This, coupled with low hatching success, places increased importance on adult survivorship. Recent population analyses of several freshwater turtle species indicate that as little as 2 to 3% additive annual mortality of adults is unsustainable, leading ultimately to local population extinction. In other words, losing just a few breeding adult turtles each year to roadkill may be the greatest threat to the persistence of Blanding's and spotted turtles in Maine.

CONSERVATION EFFORTS

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

1. **Conservation of Blanding's Turtle in the Northeast:** MDIFW and our partner agencies in four other northeastern states were awarded a U.S. Fish and Wildlife Service Competitive State Wildlife Grant to implement collaborative conservation measures for Blanding's turtles. This is the second such award our states have been jointly given for Blanding's turtle conservation, and our renewed effort focuses on implementing on-the-ground conservation actions and standardized population assessments that we identified in the 2014 Conservation Plan for Blanding's Turtles in the Northeastern United States. These next steps toward maintaining and enhance functional Blanding's turtle populations include improvements to and monitoring the use of nesting habitat, efforts to reduce road mortality, population and demographic studies at priority sites, and targeted outreach to landowners and land trusts hosting high-value populations. In 2017, Maine biologists initiated intensive trapping studies at three Blanding's turtle sites, and, in 2018, expanded intensive surveys to two additional sites.
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, temporary yellow warning signs were installed in strategic locations to alert motorists to the possible presence of rare turtles on the roadway. The signs are deployed seasonally, coinciding with the period when overland turtle movements are greatest. This reduces "sign fatigue" by local commuters, increasing the signs' impact. This signage project was one of the first of its kind among northeastern states and is now in its 13th year.
3. **Maine Turtle Roadkill Survey:** In 2010, we partnered with Maine Audubon and MDOT to launch Wildlife Road Watch, a volunteer initiative to report wildlife-road interactions (both alive and dead). In 2014, we began monitoring for road mortality at previously documented Blanding's and spotted turtle crossing and roadkill sites and potentially important road-crossing sites identified in a predictive GIS model. We expanded this effort in 2018 as the Maine Turtle Roadkill Survey – a partnership between MDIFW and Maine Audubon to refine the predictive model, improve survey methods, and enlist citizen scientist volunteers to collect data at roadways where turtles are at risk. Data generated from these efforts will help us plan future wildlife roadkill mitigation efforts such as additional signage areas, critter crossings, exclusionary fencing, etc. Most volunteer participants adopted a road segment for repeated monitoring, but they were also encouraged to report incidental sightings. For more information on the Wildlife Road Watch program, visit **inaturalist.org/projects/maine-turtle-roadkill-survey.**
4. **Improving Nesting Habitat at Priority Blanding's Turtle Sites:** MDIFW, in partnership with local land trusts, private landowners, and the U.S. Forest Service, is working to monitor, manage, and, in some cases, create or enhance nesting habitat at several of Maine's most promising Blanding's turtle sites. Biologists are using time-lapse cameras at nesting areas to document nesting females and gather data that will help them effectively manage this critical resource. Most nesting sites were created by human disturbance, and, without periodic managed disturbance, these bare gravel, sand, or soil areas are eventually overcome with vegetation. This habitat-focused effort will improve long-term viability of regionally important populations of Blanding's turtles in Maine. In addition to reducing the need for nesting females to travel outside interior areas of core sites, management of nesting areas may serve to enhance nest success and hatchling survival by directing females away from marginal nesting habitat, such as backyards, gravel pits, roadsides, and agricultural lands, where eggs and hatchlings are more susceptible to human-caused disturbance and subsidized predators.
5. **Conservation and management of the Spotted Turtle in the Eastern U.S:** 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 its distribution in York County is well understood, isolated populations have also been recently confirmed in another four counties as far as central and mid-coast Maine. MDIFW's efforts to assess spotted turtle populations under this grant began in 2017 and will continue in 2018 on a wider scale. Special effort will be made to gather baseline data at sites supporting this species throughout its range in the state.

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

Northern Black Racers

Derek Yorks

The state-endangered northern black racer is Maine's largest and rarest native snake. Black racers can grow to a length of six feet, though the largest adults in Maine are closer to five feet. They are recognized by their large size, jet black coloration, smooth scales (lacking keels), and distinctive white chin. When encountered, racers typically flee rapidly, but, if they feel cornered, they may stand their ground, strike, and/or vibrate their tail tips, mimicking the warning display of rattlesnakes.

BLACK RACER HABITATS IN MAINE

In northern New England, black racers are habitat specialists and are most commonly found in dry 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 one of the most commonly encountered snake species. Despite its prevalence elsewhere, the black racer reaches its northern range limit in Maine and has a 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 10 modern, documented sites.

MONITORING BLACK RACER POPULATIONS

In the spring of 2016, MDIFW biologists began a three-year project seeking to confirm and document new or poorly-known occurrences and to establish a monitoring program at sites where black racer populations occur. In the 2016 season, we tracked seven individual racers using VHF radio transmitters, and in 2017 and 2018, we tracked nine individuals at two sites. In 2017, we added a monitoring program that uses repeated time-constrained transect surveys to assess populations, and we continued these surveys in 2018. The data we gather on northern black racer occupancy, abundance, and habitat use will guide this rare and striking reptile's future conservation.

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

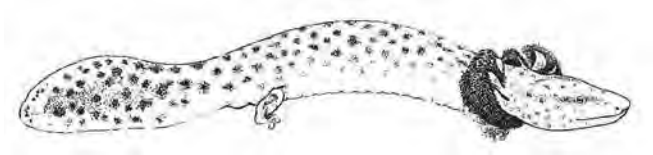
Northern Black Racer. Photo by Derek Yorks.

The Introduced Mudpuppy

Phillip deMaynadier

The mudpuppy is Maine's largest, only non-native, and possibly least studied amphibian species. Entirely aquatic in all life stages, the mudpuppy 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 has spread to potentially 14 waterbodies across three major central Maine watersheds. This exotic salamander species 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 mudpuppy introductions have negatively affected Maine's aquatic communities, but its ecological interactions as both predator or prey are also largely unstudied. Anecdotally, fishermen have expressed concerns that the mudpuppy interferes with fishing gear, is a possible fish larvae predator, and could be competing with game fish for food resources. Indeed, mudpuppies do have a broad diet that can include fish eggs, small fish, aquatic insects, mollusks, crayfish, and other amphibians.



Mudpuppy. Drawing by Abigail Rorer.

All of these taxa include constituent SGCN species in Maine, many of which overlap the mudpuppy's potential range. More study is needed to assess the ecological effects of mudpuppies in Maine's local aquatic communities, including improved documentation of their current range, abundance, and diet.

NEW MUDPUPPY STUDY

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

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

eDNA SAMPLING

In addition to these direct objectives, this project will also inform novel mudpuppy environmental DNA (eDNA) detection protocols in development at the University of Maine (Dr. Michael Kinnison) 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 cost-effective alternative to traditional survey methods for amphibians, fish, and other taxa. The challenge of mudpuppy detection and management presents an exciting opportunity to develop new techniques that combine eDNA sampling with traditional direct observation and trapping methods to determine and validate occupancy estimates for Maine's only exotic amphibian.

IMPROVED TRAPPING TECHNIQUE

Following a thorough literature review of mudpuppy biology and capture techniques, we developed a methodology to trap salamanders through the ice using modified, baited minnow traps. Our trapping method has been successful, with a total of 134 mudpuppies captured between February and April of 2017 and 211 mudpuppies captured between January and March of 2018. To date, mudpuppies have been confirmed using this technique from seven waterbodies including Salmon Lake (Belgrade/Oakland), North Pond (Smithfield/Rome), Long Pond (Livermore), Messalonskee Lake (Belgrade/Oakland), Togus Pond (Augusta), Long Pond (Belgrade/Mount Vernon), and Great Pond (Belgrade/Rome). Notably, our capture rate of 0.488 animals per trap night compares favorably to those of other mudpuppy studies using similar methodology from within the species' native range, where capture rates range from 0.028 (Vermont) to 0.69 (Ontario). Our capture rates on Long Pond (Belgrade/Mount Vernon) equaled 1.45 animals per trap night, a rate exceeding that of any reports in the scientific literature from elsewhere in the species range.

GUT CONTENT EXAMINATIONS

Dr. Cathy Bevier's laboratory at Colby College has dissected more than 100 mudpuppies to examine contents from both stomachs and intestines. This work is ongoing, but preliminary gut content identifications include remains from the following major taxa: crayfish (Decapoda), mayflies (Ephemeroptera), amphipods (Amphipoda), damselflies and dragonflies (Odonata), snails (Gastropoda), mussels (Bivalvia), worms (Annelida), fish, and plant matter. The presence of fish hooks in the stomachs of three mudpuppies suggests occasional interference with fishing gear.

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

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 most 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 those 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 20 years, several species of native bumble bees have all but disappeared, and others have drastically declined throughout their ranges. On a global scale, habitat loss, pesticides, diseases and parasites introduced with commercially-raised bumble bees, and intensive agricultural practices likely all play a role in bumble bee declines, and we are working to understand which factors are at play in Maine.

The Maine Bumble Bee Atlas: Keeping Track of Native Pollinators

In 2015, MDIFW and the University of Maine initiated the Maine Bumble Bee Atlas (MBBA), a project to improve our understanding of Maine's bumble bee fauna diversity, distribution, and conservation status. This five-year statewide survey enlists the help of volunteer citizen scientists statewide to collect data on what species are present, where they occur, what habitats they use, and how abundant they are.

YEAR THREE PROGRESS REPORT

During the project's first three years, over 230 volunteers were trained in a standardized survey protocol and provided field equipment. This enthusiastic and productive group of citizen scientists then went to work and, by the end of the third field season, contributed more than 17,000 new bumble bee records! Their data showed that 13 of the 17 species historically known to occur in Maine **(Table 1)** were still present, and some species had decreased in relative abundance while others had increased.

TABLE 1. BUMBLE BEES OF MAINE.

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

The four previously-documented species not yet found in MBBA surveys are the rusty patched bumble bee, American bumble bee, Ashton's cuckoo bumble bee, and indiscriminate cuckoo bumble bee. All four are known to have declined in other parts of their range, and it is possible they are now extirpated from Maine. The rusty patched bumble bee has experienced a 90% decline in both numbers and distribution throughout its entire North American range and, in March of 2017, became the first ever bumble bee to be protected by the U.S. Endangered Species Act. While the species has not been documented in Maine for about a decade, we are still hopeful that one of our MBBA volunteers will discover a remnant population. With two more seasons to gather data, and more volunteers being trained each year, there is still much to discover and learn about Maine's bumble bee fauna and their conservation needs.

For more information about the Maine Bumble Bee Atlas and how to participate, visit the project website at **mainebumblebeeatlas.umf.maine.edu.**

You can also follow the project on Facebook at facebook.com/MaineBumblebeeAtlas.

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

Dragonflies and Damselflies

Phillip deMaynadier

Insects in the Order Odonata, damselflies and dragonflies are conspicuous components of Maine's wildlife diversity and valuable biological indicators of freshwater ecosystem integrity. Nearly 36% of the total North American fauna — 158 species — have been documented in Maine. Northeastern North America is a regional hotspot for odonate diversity, and several of Maine's species are of national and global conservation concern.

REGIONAL ODONATA CONSERVATION ASSESSMENT

To better understand northeastern damselflies and dragonflies' vulnerability to historical and current threats, MDIFW and partners in New Hampshire (NH Audubon Society) and New York (NY Natural Heritage Program) recently completed a regional conservation assessment of Odonata and their habitats.

Boreal snaketail. Photo by John Abbott.

RANKING SPECIES VULNERABILITY

As part of the study, we developed and applied a prioritization framework for 228 species of dragonflies and damselflies occurring in the northeastern U.S. Using data from over 248,000 records shared by experts from Virginia to Maine, we calculated a single regional vulnerability rank (R-rank) reflecting each species' degree of relative extinction risk in the Northeast. R-ranks ranged from R1 (most vulnerable) to R5 (least vulnerable) and were based on three rarity factors (range extent, area of occupancy, and habitat specificity), one threat factor (vulnerability of occupied habitats), and one population trend factor (relative change in range size).

DETERMINING REGIONAL RESPONSIBILITY

Next, we combined the R-rank list with an analysis of the degree of endemicity (% of the species' U.S. and Canada range within the Northeast) as a proxy for regional responsibility. This gave us a list of species of combined vulnerability and regional management responsibility.

ASSESSMENT OUTCOMES

Overall, we found 18% of the northeastern region's Odonata to be imperiled (R1 or R2). Eight such species are found in Maine, including two state-listed species: boreal snaketail (threatened) and ringed boghaunter (threatened). Freshwater habitats, peatlands (bogs and fens), low gradient streams and seeps, high gradient headwaters, and larger rivers host a disproportionate number of the region's imperiled Odonata.

IMPLICATIONS AND ACTIONS

This assessment will help to inform the allocation of limited state and federal conservation resources and foster collaborative Odonata conservation efforts across state lines, and we also expect that the process will guide and standardize conservation assessments of other invertebrate taxa. After completing the study, we recommended that a regional damselfly and dragonfly conservation working group be formed to help standardize protocols for surveys, monitoring, habitat protection, and education, thereby developing a framework for a coordinated comprehensive conservation plan for northeastern Odonata.

In 2017, a small such working group was organized with a goal of greater inter-state coordination in the study and conservation of some of the Northeast's rarest endemic damselflies known as "Bluets" (Enallagma spp). As part of this project, MDIFW is cooperating with Dr. Ron Butler from the University of Maine at Farmington to conduct standardized surveys of historical pond locations for the scarlet bluet and New England bluet, both of which are Species of Greatest Conservation Need (SGCN) in Maine's Wildlife Action Plan.

Contact Phillip deMaynadier at **phillip.demaynadier@maine.gov** to receive a copy of the northeastern conservation assessment of Odonata or to learn more about MDIFW's efforts to conserve the state's damselfly and dragonfly fauna.

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

Butterflies

Phillip deMaynadier

Juniper hairstreak, Clayton's copper, and spicebush swallowtail are just some of the state's rarest butterflies — colorful both in name and on the wing. Attractive and ecologically important, butterflies have garnered increasing attention from scientists and the public as sentinels of habitat change.

To improve our knowledge of these and other priority butterflies, MDIFW is actively conducting statewide surveys. By documenting their distribution and status, we hope to improve our understanding of the state's butterfly fauna and prioritize conservation efforts towards the most vulnerable species.

BASELINE ATLAS

In 2002, MDIFW received a grant from the Maine Outdoor Heritage Fund to contract a professional lepidopterist, Dr. Reginald Webster of New Brunswick, to help assemble a comprehensive assessment of the state's butterfly fauna. Drawing from published literature and specimen records located in museums and amateur collections throughout the Northeast, Reggie helped MDIFW develop the first baseline atlas and database of Maine's butterfly fauna. The baseline atlas project compiled nearly 9,000 records and added 11 previously undocumented butterflies to the state list, which now stands at 126 species. Of special note is the relatively high proportion (~17%) of resident Maine butterflies and skippers that are extirpated (regal fritillary) or state-listed as endangered, threatened, or special concern (19 species) — a pattern consistent with global trends elsewhere for the group. Download a copy at **mbs.umf.maine.edu/Publications.htm.**

MAINE BUTTERFLY SURVEY

The long-standing Maine Butterfly Survey (MBS) completed its final field season in 2015. This 10-year statewide volunteer butterfly atlas originally took flight in 2006, coordinated by MDIFW in partnership with experts from the University of Maine at Farmington (Dr. Ron Butler), Colby College (Dr. Herb Wilson), and Dr. Reginald Webster of New Brunswick. Following in the tradition of previously successful state-sponsored wildlife atlasing projects, including the Maine Damselfly and Dragonfly Survey, data from the MBS was generated by >200 trained citizen scientists. The survey fills information gaps on distribution, abundance, flight seasons, and habitat relationships of one of Maine's most popular and vulnerable insect groups. Some of the project's significant scientific contributions include:

- A comprehensive database of approximately 34,500 Maine butterfly records
- A museum-quality specimen and photo voucher collection
- Nine new state (and one national) species records added to the Maine butterfly list
- A Maine butterfly website that includes a state checklist, data on volunteer survey effort, species distribution maps, flight period, and other survey results
- Numerous scientific publications and newsletters highlighting novel contributions to the field of butterfly study

The next phase of the MBS is to complete the transition from the field to the laboratory and office in preparation for the project's penultimate product – a published Atlas and Conservation Assessment of the Butterflies of Maine and the Maritimes, in collaboration with the Atlantic Canada Conservation Data Centre. We hope that this publication will both summarize the scientific state of knowledge of the butterflies of Acadia and serve as an accessible tool for introducing new members of the public to the fascinating world of butterflies, and possibly other invertebrates. Progress is ongoing, with approximately 20 species accounts drafted and maps and flight histograms nearly completed for all species.

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

Mayflies

Beth Swartz

Mayflies, or "shadflies" as they are often called, are a diverse group of insects with over 160 species found in Maine. Some species inhabit lakes and ponds, but most live in the flowing waters of streams and rivers. Belonging to the Order Ephemeroptera – named for the short lifespan of the winged adults – mayflies spend nearly their entire lives underwater, where they play a significant role in the food webs of aquatic ecosystems. The often-abundant nymphs are a major consumer of algae and decomposer of plant material, 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). The most popular flies tied by fly-fishers, to mimic their quarry's natural prey, 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 two as threatened, and both are identified as Priority 1 Species of Greatest Conservation Need (SGCN) in Maine's 2015 Wildlife Action Plan.

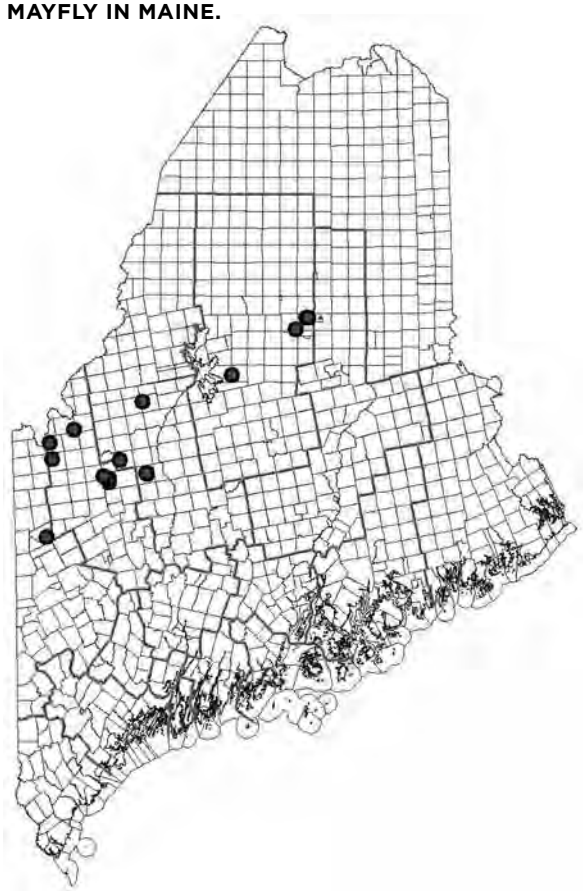
The Roaring Brook mayfly holds the distinction of being among the rarest in the world. For many years, it was only known from a single adult specimen collected on Mt. Katahdin in 1939, until surveys conducted by MDIFW in 2003 confirmed the species was still present on the mountain. Since then, MDIFW has surveyed approximately 160 streams and documented a total of 14 where the mayfly occurs. All of these sites are clustered in the mountains of north central and western Maine **(Figure 1).** Other researchers have also collected a specimen in the Green Mountains of Vermont and another in the White Mountains of New Hampshire. While we now know the Roaring Brook mayfly is not confined just to Mt. Katahdin, it does appear to be New England's only endemic mayfly, restricted to cold, undisturbed, high-elevation streams of the northern Appalachian Mountain Range.

The Tomah mayfly, once thought to be extinct, was rediscovered in Tomah Stream (Washington County) in 1978 and has since been documented at 18 sites across northern, eastern, and central Maine and at least one site in New York. The nymphal stage of the Tomah mayfly, unlike other mayfly species, is carnivorous, preying largely upon other mayfly nymphs. This species depends on highly productive, seasonally-flooded, sedge meadows along large streams or rivers to complete its life cycle. Although sedge meadows are not an uncommon habitat type in Maine, the Tomah mayfly is only known to inhabit a limited number of sites.

In addition to these threatened species, 13 other mayflies in Maine are considered special concern and SGCN. Many of them are only known from one or two sites, but comprehensive surveys have never been done. To help plan future surveys, the Department has contracted mayfly expert Marcia Siebenmann to document all previous survey efforts for Maine's state-listed and special concern mayfly species. She is currently entering 40 years of data into a database that will help us track known occurrences and coordinate where to search for new populations of these uncommon insects.

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

FIGURE 1. DISTRIBUTION OF ROARING BROOK MAYFLY IN MAINE.



Brook Floaters

Beth Swartz

Maine is home to 10 species of freshwater mussels, three of which are listed as threatened under the Maine Endangered Species Act (**Table 2**). One of those three, the brook floater, has been the focus of intensive survey efforts by MDIFW over the past several years. This species has declined throughout its Atlantic Coast range and is listed as endangered or threatened in nearly every state where it still occurs. It is currently undergoing a status review by the U.S. Fish and Wildlife Service to determine if federal protection under the U.S. Endangered Species Act is warranted.

BROOK FLOATER HABITAT

In most locations where it is found, the brook floater is observed in very low densities with little evidence of reproduction. One reason for the brook floater's decline is its need for clean, relatively undeveloped, undammed riverine habitat. In Maine, its stronghold is in streams and rivers of the Penobscot River watershed, but it also occurs in the Pleasant River (Cumberland County), Sheepscot River, St. George River, lower Kennebec River watershed, and several Downeast rivers.

Brook Floater Drawing by Ethan Nedeau

TABLE 2. FRESHWATER MUSSELS OF MAINE.

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

BROOK FLOATER SURVEY

Over the past nine years, the Department has focused on intensively surveying all streams and rivers where the brook floater has been documented. Many of these sites had not been visited for over 20 years, and little was known about the brook floater's status at each. MDIFW contracted Ethan Nedeau (Biodrawversity, LLC), a mussel biologist with extensive experience studying brook floaters in the Northeast, to conduct the surveys. So far, Ethan has surveyed more than 30 of the state's 40 historical streams and rivers and found some interesting results. At Maine's only southern brook floater occurrence, the Pleasant River in Cumberland County, severe erosion and sedimentation, likely caused by adjacent land use during the last decade, have nearly extirpated the species.

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

Conversely, some sites like Kenduskeag Stream, West Branch Union River, and the Passadumkeag River showed relatively large, healthy populations — and the East Branch Pleasant River (Piscataquis County) may have the largest and healthiest population throughout the brook floater's North American range. At each site he surveys, Ethan documents the numbers and density of brook floaters, as well as habitat use and potential threats. In 2018, he surveyed the St. Croix River and Tomah Stream in Washington County and the Penobscot River mainstem and West Branch Dead Stream in Penobscot and Piscataquis Counties. This information will contribute to a regional brook floater conservation status assessment — a collaborative project between MDIFW and 12 other northeastern states — and a federal status review.

U.S. FISH & WILDLIFE BROOK FLOATER GRANT

In 2016, the U.S. Fish and Wildlife Service awarded MDIFW and several partnering states a Competitive State Wildlife Grant for a rangewide brook floater conservation and restoration effort. In 2017, the team got to work developing a long-term monitoring protocol for states to use throughout the species' range. Surveys conducted using this protocol will provide comprehensive data about the status of each population and allow us to monitor trends over time in a standardized way. In 2018, MDIFW implemented the monitoring protocol at two sites: one in Wesserunsett Stream in Kennebec County and one in the East Branch Pleasant River in Piscataquis County. Individual brook floaters at each site were marked with a uniquely numbered tag, measured, and put back where they came from. Successive visits over the next few years to relocate and remeasure tagged mussels will give us information about population size, age structure, survival and growth. We also will share data about Maine's brook floaters and the habitats they live in with other states where the species is not doing as well as it is here. Because we host some of the best remaining populations throughout the species' range, Maine will play a key role in the future conservation of the brook floater.

More information on Maine's mussels can be found in *The Freshwater Mussels of Maine* (Nedeau et al. 2000), available through the Department's online store (mefishwildlife.com) or Information Center (207-287-8000).

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

SPECIAL HABITATS FOR REPTILES, AMPHIBIANS, AND INVERTEBRATES

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

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

Pollinator Habitat

Beth Swartz

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

Pollinator Habitat. Drawing by MDIFW.

POLLINATORS IN PERIL

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

HOW YOU CAN HELP

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

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

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

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

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

Avoid chemical herbicides and pesticides – Herbicides kill many of the flowering plants that pollinators feed on, and insecticides can kill bees and other insect pollinators – either directly or by affecting their abilities to forage, reproduce, or care for their colonies. There are safer alternatives that can still help you manage plant diseases and insect pests around your home and garden.

For more information, visit the Xerces Society at **xerces.org/pollinator-conservation**.

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

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.

These habitats provide wildlife with a rich, highly valuable fish-free food base fed by surrounding organic forest matter. Isolated from streams and subject to periodic drying, vernal pools 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, where the season's first herbaceous forage is available. 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), and rare plants that include the featherfoil (threatened) and sweet pepperbush (special concern). Some of these species could face extinction in Maine without the distribution of high-value vernal pools throughout their range.

Vernal Pool. Photo by Phillip deMaynadier.

DEFINING AND PROTECTING SIGNIFICANT VERNAL POOLS

In 2006, MDIFW and the Department of Environmental Protection (DEP) developed a definition of Significant Vernal Pools — the most recent Significant Wildlife Habitat under the state's Natural Resource Protection Act (NRPA) — which was approved by the 120th Maine Legislature. Criteria for designating significant vernal pools include: a) the presence of a state endangered or threatened species, or b) evidence of exceptional breeding abundance by specialized amphibian indicator species. To date, MDIFW has reviewed over 3,200 vernal pools statewide in collaboration with MDEP, and only 20 to 25% of the pools assessed have been found to meet standards for regulatory significance under NRPA. Using scientifically-derived and legislatively-approved criteria for defining a high value (significant) subset of Maine's vernal pools helps MDIFW biologists prioritize those vernal pools with the greatest wildlife habitat values.

ONGOING EFFORTS AND HOW TO HELP

MDIFW cooperates with the Departments of Environmental Protection (DEP) and 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 there are several publications available offering voluntary techniques for protecting vernal pools and their wildlife. 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.

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

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.

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 is now tracked as a rare natural community by the Maine Natural Areas Program (MNAP, **maine.gov/dacf/mnap**). Many dry woodlands and barrens also 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.

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

Pine Pitch Woodlands and Barrens. Photo by Phillip deMaynadier.

a variety of highly specialized plants and animals. Several rare and endangered species persist in the state's remaining intact barren communities, mainly in the towns of Kennebunk, Wells, Waterboro, Sanford, Shapleigh, Hollis, and Fryeburg. These unique habitats are especially rich in rare butterflies and moths, hosting species that feed on the specialized barrens vegetation, 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 rare plants.

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

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 they are all characterized as sun-soaked places with standing water, abundant vegetation, and high biological production. Many of Maine's amphibians, reptiles, and invertebrates depend on these wetlands for some or all of their life cycle.

WILDLIFE HUBS FOR MAYFLIES, MINK FROGS, AND EVEN MOOSE

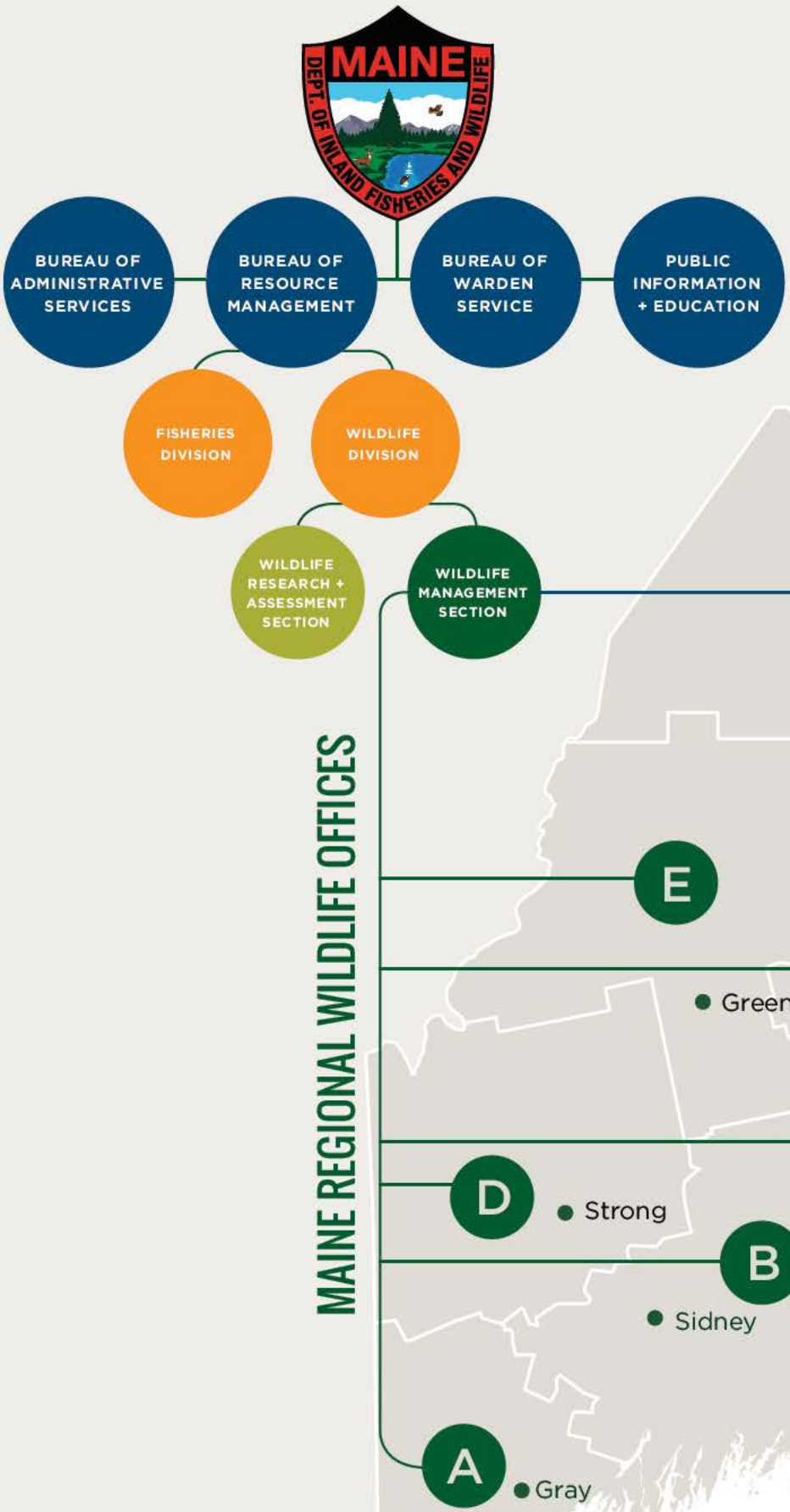
Across Maine's forest-dominated landscape, marshes and shrub swamps serve as focal points of wide-ranging wildlife. The mixture of lush herbaceous vegetation found above and below the water surface provides amphibians with shelter from predators, plus food in the form of invertebrate prey or the vegetation itself. Frogs, including leopard frogs (special concern), pickerel frogs, green frogs, bull frogs, mink frogs, gray tree frogs, and spring peepers, breed and often live here year-round. Many reptile species, including spotted turtles (threatened), Blanding's turtles (endangered), painted turtles, ribbon snakes (special concern), garter snakes, and northern water snakes, thrive here too. And these habitats are also hugely important to several invertebrates, perhaps most conspicuously dragonflies and damselflies, as well as non-RAI species like waterfowl, beaver, muskrat, and moose.

CRITICAL HABITAT FOR BLANDING'S TURTLE

Recent assessment and planning efforts focused on Blanding's turtles in Maine, through the Competitive State Wildlife Grant (U.S. Fish and Wildlife Service), have highlighted the special importance of marshes and shrub swamps for this rare species. 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. High-value marshes and shrub swamps are often at the core of their home ranges, generally serving as overwintering and late summer feeding areas. Information gathered from this project will help Maine biologists understand what specific characteristics of marshes and shrub swamps are critical for the survival of this species in Maine.

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

Shrub Swamp.
Photo by Phillip deMaynadier.


MAINE
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BUREAU OF ADMINISTRATIVE SERVICES
BUREAU OF RESOURCE MANAGEMENT
BUREAU OF WARDEN SERVICE
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FISHERIES DIVISION
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Jonesboro
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Sidney
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Gray

WILDLIFE MANAGEMENT

Ryan Robicheau

The Wildlife Management Section (WMS) is responsible for supporting Maine Department of Inland Fisheries and Wildlife (MDIFW) efforts through activities that include, among others, collecting harvest data for species that are hunted or trapped (to inform management decisions), conducting species surveys, working with private landowners to manage habitat (to support management systems and recovery plans), reviewing proposed development projects, responding to nuisance wildlife, providing regional input on statewide regulatory or management recommendations, and providing information to the public.

Our responsibilities also include oversight and management of state-owned Wildlife Management Areas (WMAs), where we plan and implement activities that enhance habitats and provide for public access and use, particularly for hunting, trapping, and fishing. These activities include everything from water level manipulation for waterfowl to timber management, field mowing/maintenance, apple tree release and plantings, vegetation control, and prescribed fire management. In the most recent reporting period, we conducted wildlife habitat management on more than 11,825 acres.

The WMS includes seven regional wildlife offices located in Gray, Sidney, Jonesboro, Strong, Greenville, Enfield, and Ashland, as well as a Lands Management Program and a biologist assigned to our sister agency, the Department of Agriculture, Conservation and Forestry.

On the following pages, we share highlights from each of the regional offices, touching on how each region has carried out the Wildlife Management Section's responsibilities, as well as what the Lands Management Program is doing to plan for, prescribe, promote, and maintain Maine's wildlife habitats.

REGION A GRAY

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Scott Lindsay
Regional Wildlife Biologist

Cory Stearns
Assistant Regional Wildlife Biologist

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Assistant Regional Wildlife Biologist

Working to Restore Southern Maine's Young Forest Habitat

Young Forests and Wildlife

Cory Stearns

MAINE'S YOUNG FORESTS AND THEIR WILDLIFE ARE ON THE DECLINE

In Southern Maine, as in much of the northeastern U.S., the amount of young forest habitat (which includes thickets of shrubs and young trees) has declined dramatically in the last 50 years. In the 1970s, it covered about 25% of York and Cumberland counties; today, it occupies about 3%. Subsequently, wildlife species that depend on this habitat type, including American woodcock, eastern towhee, prairie warbler, and New England cottontail, have also declined. In the '70s, New England cottontail was an abundant Maine game species, occurring as far inland as Porter and Auburn and as far east as Belfast. Today, it's a State Endangered species found in only six towns, all south of Portland. If young forest creation in southern Maine continues the decline it's on now, populations of New England cottontail, brown thrashers, chestnut-sided warblers, and many other species will continue to decline as well, and some may disappear completely from southern Maine.

HOW TO START A FOREST

Young forests are created when mature forests are disturbed. This happens naturally via forest fires, insect infestations, and beaver-induced flooding, or by timber harvesting. Maine's decline over the past 50 years can be explained by three parallel trends: first, to protect people and property, humans have worked to limit or prevent natural disturbances; second, in Southern Maine, many woodlots have been turned into developments; and third, land management programs have focused more on preserving older forests.

YOUNG FOREST MANAGEMENT IS A HABIT, NOT AN EVENT

The largest obstacle facing young forest restoration is the ephemeral (short-term) nature of this habitat type. Left untouched, young forests become old forests. Trees grow taller, shading the shorter trees and shrubs below and causing many to die. As the habitat matures, stem density decreases, plant species composition changes, and young forest specialists like the New England cottontail no longer find the area suitable, having lost the food sources and cover that young thickets provide.

TOGETHER, WE CAN REVERSE THE TREND

If a landscape is managed to always provide some young forest habitat (such as when a property is set up on timber harvest rotation), the species can persist even as one area outgrows its suitability. MDIFW and our conservation partners (which include the Natural Resource Conservation Service, U.S. Fish and Wildlife Service, and regional land trusts) are actively attempting to restore Southern Maine's young forest habitat by managing portions of Department-owned Wildlife Management Areas (WMAs) for young forest, and by recruiting private landowners to do the same. Landowners and managers can help by learning about and sharing the importance of young forest habitat, and by managing a portion of their property to always provide it. For more information on how to do so, and on the species you'll be helping, refer to **youngforest.org, newenglandcottontail.org, timberdoodle.org**, or contact one of your local regional wildlife biologists.

REGION B SIDNEY

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G. Keel Kemper
Regional Wildlife Biologist

Kendall Marden
Assistant Regional Wildlife Biologist

John Pratte
Assistant Regional Wildlife Biologist

Animal Damage Control (Nuisance Wildlife)

G. Keel Kemper

The bread and butter of any regional wildlife biologist's career is having to solve conflicts between the wildlife we protect and manage and the people we serve. Whether it is a skunk under the porch, a deer in the garden, beavers in the culvert, or bats in the attic, we address each problem with a custom approach guided by a well-thought-out department policy. Collectively, we refer to these problems and their solutions as Animal Damage Control (ADC).

ADC AGENTS: YOUR LOCAL WILDLIFE PROBLEM SOLVERS

Because there are simply not enough department personnel to handle everyone's wildlife problems across the vast landscape that is Maine, we rely on registered Animal Damage Control Agents for assistance. These are private citizens who are available to provide wildlife solutions to the public, for a fee, under the direction of their local game warden or regional wildlife biologist.

CATEGORIZING NUISANCE WILDLIFE

We generally divide nuisance wildlife into two broad categories: home and garden pests and heavily regulated species.

Home and garden pests include skunks, raccoons, woodchucks, porcupine, fox, coyote, squirrels, and other small mammals. Problems associated with these species are typically solved quite easily with live trap and removal, exclusion, deterrence, or lethal removal. Most ADC agents are well-versed in solving these simple problems and are given greater latitude with them.

Heavily regulated species have a higher profile and more regulations associated with them. Examples include beaver, deer, bear, fisher, otter, and wild turkey. Addressing problems with these species requires a more conservative approach. Every problem is unique, as is every corresponding solution. In these cases, ADC agents may work collaboratively with MDIFW, with the most sensitive problems addressed by the regional biologist in consultation with the local game warden.

DIFFERENT SPECIES, DIFFERENT SOLUTIONS

Certain wildlife species present unique challenges that require an alternate approach. For example, Canada Goose problems are notoriously hard to solve, and landowners are given greater latitude in how they can harass geese to address the problems. However, the ultimate regulatory authority for Canada Goose resides with the Federal Government Animal Plant Health Inspection Service (APHIS), and efforts to remove geese by lethal means require permits from them.

Beavers are another example. These MVPs of the wildlife world account for many of the wildlife problems that department personnel and ADC agents address. Excessive beaver numbers, low pelt prices, and ubiquitous wetlands make them a constant challenge to landowners, road commissioners, and forest managers. Together, we use a variety of tools to tackle beaver problems in a way that honors the superior habitat contributions this species makes.

LETHAL REMOVAL IS RARELY REQUIRED

In general, Maine people expect that those charged with protecting our wildlife resources will not solve a wildlife problem by simply shooting the offending critter. While lethal removal may be an appropriate solution in certain rare circumstances, it is only used with caution after a series of step-down approaches or less aggressive solutions have failed to solve the problem.

If you have a nuisance wildlife problem, rest assured that someone has had the same problem before, and that your regional wildlife biologist or local game warden knows the solution. So before taking the problem into your own hands, give them a call – they have the experience and expertise you need, and they're more than happy to help.

REGION C JONESBORO

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Tom Schaeffer
Regional Wildlife Biologist (Retired June, 2018)

Carl Tugend
Assistant Regional Wildlife Biologist

Joshua Matijas
Assistant Regional Wildlife Biologist

Environmental Review

Sarah Spencer

As Regional Wildlife Biologists, we spend a lot of time out in public – whether it's collecting biological data from harvested animals at registration stations, home residences, or butcher shops; conducting species surveys from the air, land, or water; or managing wildlife to meet public-generated goals out on Department-owned lands. In general, these visible and interactive duties are highly familiar to the public.

Fewer people, however, know about the work we perform under the umbrella of Environmental Review. This work, while lesser-known, accounts for a significant amount of our time and effort and is essential for the Department to achieve one of our primary, legislated mandates: to preserve, protect, and enhance the inland fisheries and wildlife resources of the state.

WHAT IS ENVIRONMENTAL REVIEW?

Environmental Review is the process of assessing proposed development projects or activities to determine whether they're likely to negatively affect priority wildlife species or habitats protected by a suite of laws and regulations, and subsequently making recommendations to regulatory agencies. The agencies then use this information to inform their permit response.

THE ACTIVITIES

Environmental Review covers a broad range of proposed activities, from forest management plans for woodlots containing priority habitats or species, to proposals to build residences (including camps) next to wetlands, to industrial-scale planned developments, to zoning change petitions by state regulatory agencies.

THE REGULATIONS

Regulations that trigger Environmental Review include the Maine Endangered Species Act (MESA), the Natural Resources Protection Act (NRPA), Mandatory Shoreland Zoning, Site Location law, and Stormwater rules. Many people have heard of MESA and may even know how it complements the federal Endangered Species Act. Similarly, many people are familiar with the Mandatory Shoreland Zoning law administered by municipalities. NRPA, which protects Significant Wildlife Habitats as recognized by the legislature, is less widely known.

THE AGENCIES

Most of the cases we work on are administered by the Maine Department of Environmental Protection (MDEP) or the Land Use Planning Commission (LUPC). MDEP administers NRPA, and MDIFW is responsible for rating and mapping the Significant Wildlife Habitats that qualify. These include Deer Wintering Areas, Inland Waterfowl/Wading Bird Habitat, Seabird Nesting Islands, Shorebird Areas, Significant Vernal Pools, and Tidal Waterfowl/Wading Bird Habitats.

THE PROCESS

Assessment

When certain activities or projects overlap with critical habitat or species occurrences, regulatory agencies request that Department wildlife biologists conduct an assessment to determine the project or activity's impact. In doing so, MDIFW biologists analyze numerous variables. These include land characteristics and features of the project site, the extent and alignment of a protected habitat, seasonal and/or behavioral characteristics of the species involved, and observational records of species or habitat. We also conduct scientific literature review for any recorded and predictable effects.

Recommendations

When providing recommendations for projects that overlap critical habitat or species occurrences, regulatory agencies take a prioritized step-down approach. This starts with avoidance, then moves to minimization, and finally, mitigation.

PLAN A - AVOIDANCE

Obviously, impacts can be eliminated if a site plan can be redesigned or relocated to avoid critical habitat. Avoidance is always the goal, so it is in a landowner or developer's best interest to facilitate pre-application discussions between an applicant, landowner, and/or consultant, the regulatory agency, and MDIFW biologists as early as possible, and certainly before making a commitment to purchase and/or develop a property that may be subject to Environmental Review.

PLAN B - MINIMIZATION

If complete avoidance is not possible, we will examine opportunities to minimize the project's impact and make those an integral part of our recommendation to the agency.

PLAN C - MITIGATION

Only after an exhaustive examination of other options or modifications will a regulatory agency determine that an applicant must mitigate to offset negative impacts on protected resources. This typically takes the form of permanent habitat protection through enhancement or acquisition as close to the project site as possible. At this point in the process, our role is to ensure that the habitat proposed as mitigation is of equal or greater habitat value.

While Environmental Review isn't something wildlife biologists are frequently seen doing, and may not seem as interesting as other, better-known parts of our job, it undeniably helps our Department achieve its mission and has a lasting impact on the wildlife resources of Maine.

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Surveying Maine Wildlife

Chuck Hulsey

Every 10 years, the U.S. government conducts a population census. In an effort to understand how many of us live here and what we are like, Census workers ask questions about how old we are, where we live, and how many people are in our household. When surveying wildlife, biologists want answers to those same questions... except it is hard to get a deer to fill out a questionnaire, much less mail it back.

HOW WE GATHER WILDLIFE DATA

One well-known and crucial information source is the harvest data we get from hunters. By knowing the age-class distribution of game species that are hunted or trapped, we can reconstruct entire populations and make the right management decisions around bag limits, hunting seasons, etc.

Population numbers, distribution, presence/absence, and upward or downward trends are also critical data for non-game species including those that are endangered, threatened, or uncommon. As part of our normal duties, Department biologists use a number of techniques to gather species data. We take live counts from boats, airplanes, cars, and on foot; we mark and capture birds using bands; and we leverage technologies like game cameras and eDNA to scale our efforts and learn more in less time.

Read on for examples of the monitoring techniques we use in a variety of different situations.

PADDLING FOR WATERFOWL COUNTS

It is July as I write this, and all regional wildlife biologists are currently conducting waterfowl population trend surveys. Every year, we paddle the same wetlands and record the number, species, and size class of waterfowl young. We survey each area once in June and again in July. We have surveyed the same areas for decades, always during the same time. This allows us to compare production in 2018 to a five-year average, and see whether a population is trending up or down, or if it's stable.

FLYING FOR BALD EAGLE NUMBERS

This year, many department biologists are flying the coastline, coastal islands, rivers, and lakes in small, fixed-wing aircraft to look for new bald eagle nests and to document any mapped nests that are no longer present. Biologists count active nests from early spring to early summer, flying low and circling each nest. First counts are to see if a nest is occupied with an incubating adult, and the second round is to count young. This helps determine the number of nesting eagles in Maine, as well as nesting success and production. This is an enjoyable duty for those biologists who do not get sick before reaching the end of the runway.

Wildlife Biologist, Chuck Hulsey, preparing for aerial survey. Photo by MDIFW.

POINT-COUNTING AMERICAN WOODCOCK

Each spring, during the three-week window from April to May when male woodcocks are courting females, Biologists drive established routes to participate in the U.S. Fish and Wildlife Service's woodcock singing ground survey. The males attract females with repeated aerial courtship displays throughout the night from dusk to dawn, each of which ends on the ground with a nasal "peent" call.

We start these surveys either 15 or 22 minutes after sunset, depending on sky conditions (mostly clear or mostly cloudy). This allows us to hit a precise, repeatable, narrow window when the birds are active. Each route always starts and ends at the same spot. We make 10 stops, each four-tenths of a mile apart, at which the biologist listens for the male woodcock's "peent" call for exactly two minutes. Upon completion, we mail the survey data sheets to the coordinator at the U.S. Fish and Wildlife Service. The information is used to track population trends and status and becomes part of their process for setting the next fall's hunting season length and bag limits.

BANDING CANADA GEESE

Every summer from late June to early July, regional wildlife biologists and volunteers assist game bird biologist Kelsey Sullivan with the capture and banding of 500 Canada geese as part of a multi-state effort to determine the birds' population numbers and migration patterns along the eastern states.

Some geese are long-distance migrants, moving between the United States and northern Canada. But many only migrate between states or not at all. For the latter, their numbers have grown steadily over the past few decades. In many urban areas and cities, they have exceeded "social carrying capacity," meaning the number of a species that most of the public wants or is willing to tolerate.

Adult Canada geese in Maine drop their primary flight feathers between June 25 and July 15. They cannot fly until those feathers are replaced, and neither can their young. With enough people, biologists use a capture technique of circling and herding large groups of adults and their young into a modular, light, portable holding pen that is erected in less than a minute.

Banding any bird is a population monitoring technique called "mark and recapture." Any bird caught is "marked" with a band that has a unique number. While in-hand, we record the bird's species, sex, age, and location. Once we've gathered that data, we release the bird.

If the bird is recovered, or "recaptured," which for game birds usually happens through hunting, the band will tell the finder how to report the information and return the band (which some veteran waterfowlers refer to as "jewelry"). Most bands are returned without any reward other than the hunter receiving information about their bird. I have taken only two banded ducks, BUT, one had a $100 reward for reporting the band. That bird was part of

a research project, and the reward helped them achieve a near perfect return rate of their banded birds.

We have learned that the 500 geese that we band in Maine each year do not migrate very far. They are part of the regional population in the east, where the management decision is to have relatively liberal seasons and bag limits. Like woodcock, they are legally a migratory species, so the U.S. Fish and Wildlife Service is responsible for season framework, with individual states making decisions within the bounds they set.

FILMING ALL THE ACTION WITH GAME CAMERAS

The growing market demand for game cameras within the hunting and wildlife-watching community has resulted in better, less expensive, smaller cameras that are designed for outdoor deployment and capture high-quality digital images as well as video. Wildlife biologists have used remote cameras for decades, but the early ones were big, expensive, used film, and had limited capacity.

About 20 years ago, wildlife biologist Bob Cordes worked on a river otter research project in Maryland and Pennsylvania where he used remote film cameras to document and evaluate the use of otter "latrine" sites. Footage he has shown during presentations is outstanding. But, he also shows footage where all the movie film captured was a long train going by the river. The train would still be captured in a modern digital camera, but it would use only a fraction of the capacity, and, of course, would cost nothing to develop and view.

Game cameras record images and footage of species activity using motion and infrared sensors. From the footage, biologists can gather "presence-absence" data, which is especially useful for documenting rare or uncommon wildlife. The footage can also stand in for the "mark-recapture" technique if it's possible to individually identify the "captured" animal.

Sometimes Footage Surprises Us

In one case, wildlife managers at the Umbagog Lake National Wildlife Refuge in Oxford County collected very interesting behavior information about one bald eagle. They deployed cameras at loon nests to document the level of human disturbance from boating. They recorded an eagle jumping up and down on loon eggs, breaking them, and eating them. That behavior was unknown, and the damage would normally have been recorded as caused by a mammal. There is an important lesson here, and that is to be careful when assigning cause of mortality — especially if it isn't a socially popular animal.

Wildlife Biologist, Bob Cordes, installing a camera. Photo by Chuck Hulsey.

COLLECTING OTTER eDNA

Advancement in genetic research has opened many survey opportunities in the wildlife profession. Grizzly bear researchers use bait, obstructed by a strand of barbed wire, to collect DNA from hair roots snagged by the wire. For shrinking populations, such as grizzlies in the northwest US, the restriction or inability of a species to meet and mix genetically can cause long-term problems. Genetic information from this type of survey helps guide land conservation for grizzlies.

Maine biologists are evaluating the use of cameras and DNA to supplement other data that they use for furbearer management. One application, like the grizzly bear research, is to collect DNA from Maine river otters swimming in a stretch of water. Amazingly, we can retrieve cells, and subsequently DNA, in the water that have been shed from an otter's digestive tract. This is called eDNA, or environmental DNA, and holds promise for use beyond research. For otter research, it does have the advantage of not collecting data from a passing train.

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Getting Involved in Species Planning

Doug Kane

Maine's regional wildlife biologists are tasked with being the public's first line of communication regarding a wide range of wildlife and wildlife habitat issues or concerns, from birds to bears to environmental permit review and more. Although the backgrounds and areas of expertise of regional staff vary widely, we are usually not thought of as species specialists, but rather as the "jack of all trades." Recently, many regional wildlife biologists were invited to bring their wide-ranging expertise to the table as part of a major species management planning process update.

ADDING REGIONAL INPUT TO BIG GAME SPECIES PLANS

During this new update, which began in 2015, it was decided to group species, when appropriate, for more efficient planning. Our first step toward that was the development of a comprehensive Big Game Management Plan for deer, moose, bear, and turkey. To develop this updated plan, we took a team approach with regional wildlife biologists serving on sub-committees for each of the four big game species. Each sub-committee was tasked with identifying public input needs and drafting management goals, objectives, and strategies. This differed from our previous approach, which involved the species specialist, and to a lesser extent the wildlife planner, doing most of the heavy lifting to develop species management plans and systems.

OPTIMIZING PLAN IMPLEMENTATION

In addition to participating in the development of the Big Game Management Plan, regional staff now also sit on various species working groups tasked with coordinating the plan's implementation. The diverse makeup of these groups, including regional wildlife staff, has provided an excellent combination of expertise, experience, and ideas, while ensuring that the breadth of challenges, opportunities, and differences across the state are all considered and addressed.

In one of our first working group meetings, we took a closer look at the major Department-collected data that drive management decisions. For deer, one of these metrics is winter severity data that we collect across the state every week from December through April. These data, along with temperature information, are used to estimate deer winter mortality rates. Although important in the current deer management system, the time commitment for regional staff to collect this information is a full day once a week for 15-16 weeks. So we asked: Is this metric still valid and useful? Are we collecting enough information, or too much? This group is working to answer those questions, assessing what data is needed, necessary, and the most appropriate metric for management decisions.

Looking ahead, these working groups will continue to question, review, and determine the best possible management methods to ensure the 2015 plan's recommendations are implemented effectively, efficiently, and comprehensively.

REGION F ENFIELD

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Managing Deer Wintering Areas

Allen Starr

Of the 35,385 square miles that we call the state of Maine, MDIFW considers 28,880 of them — about 82% of the state —suitable habitat for deer. With that much habitat available, it seems that there should be plenty of deer on the landscape; and in portions of southern and central Maine, there are. However, northern, western, and eastern Maine are a different story.

THE ROLE OF GEOGRAPHY

Maine's geographic location at the northern extent of North America's deer range has a strong impact on the deer population, particularly their ability to survive the winter. In southern and central parts of the state, winter conditions for deer are a lot less severe with warmer temperatures, less snow, and shorter winters overall. But in northern, western, and eastern Maine (except coastal areas), deer face colder temperatures, a deeper snow pack, and a longer duration of winter conditions.

ADAPTING TO SURVIVE THE WINTERS

White-tailed deer have developed adaptations and strategies to survive long periods of cold temperatures and deep snow. Chief among those strategies is their use of Deer Wintering Areas (DWAs), or deer yards.

Good winter shelter for deer. Photo by Allen Starr.

These mature, dense, coniferous forests contain trees at least 35 feet tall with dense canopy crown closures of 50 to 100%. Composed primarily of cedar, hemlock, spruce, and/or fir, these areas provide warmer daily mean temperatures, reduced wind, and snow depths up to 40% less than open areas or hardwood stands.

The location of DWAs across the landscape is important; usually, they're found at low elevations near bodies of water (lakes, rivers, streams or wetlands). Deer congregate in them year after year to avoid predation and share the energetic cost of creating and maintaining trails while accessing food and winter shelter, and their use is a learned behavior passed from doe to fawn.

MDIFW biologists have been identifying, surveying, and mapping DWAs since the 1950s; but just knowing where deer spend their winters is only part of the equation for deer survival. When it comes to achieving publicly-derived deer population goals, protecting and managing these habitats is of equal, if not greater, importance. In its efforts to do so across Maine's vast landscape, MDIFW employs several tools. Since most DWAs are located on privately owned land, our primary tools are zoning and cooperative agreements with landowners.

ZONING

The zoning process, which in unorganized townships falls under Land Use Planning Commission (LUPC) jurisdiction, is a labor-intensive surveying effort that requires suitable coniferous forest types, periodic ground and aerial documentation of deer use, and a wintering population of 20 deer/sq. mile to reach a threshold of deer use that satisfies designation as a LUPC Fish and Wildlife Protection District (P-FW). When private landowners want to harvest wood in a P-FW, they must work with regional wildlife biologists and develop a Plan Agreement for their activities. Landowners must maintain at least 50% of their P-FW land in conforming coniferous cover, as described above. Back in the 70s and 80s, when these areas were zoned, only 3.5% of any ownership could receive zoning protection.

This resulted in only the core portion or "best of the best" winter shelter being protected. Over time, changes in land ownership, forest practices, and timber harvesting equipment all contributed to a reduction in functional deer winter shelter. This reduction prompted MDIFW to consider additional tools to help increase deer wintering habitat across the landscape.

COOPERATIVE AGREEMENTS

While zoning only preserves winter shelter in a small portion of a deer yard, cooperative agreements, by contrast, take a larger landscape approach, attempting to manage the entire "biological deer yard." This covers a larger area including core shelter (historic and active deer yards with >70% coniferous cover), secondary shelter (areas with 50% - 70% coniferous cover), travel corridors (cover connecting large winter shelter areas, allowing movement and providing access to the entire deer yard), and feeding areas (younger forests adjacent to good shelter). In addition to providing ample area for deer to use during the winter, this larger complex of habitats also gives landowners who conduct timber harvesting activities some extra flexibility. Under these agreements, wildlife biologists and company foresters can cooperatively achieve deer habitat and landowner economic goals.

ONGOING RESEARCH

MDIFW, in partnership with other researchers and private landowners, is currently participating in a cooperative project called The Northeast Deer Research Partnership. In northern Maine and New Brunswick, researchers are studying GPS-collared deer to determine their survival, movements, and landscape use. Other factors, such as food availability, the impact of winter severity, and the impact of predation on deer populations, will be investigated as well. Information from this study will help us better understand the factors impacting deer populations and help us to protect and manage these important habitats.

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Using Prescribed Fire to Maintain Grassland Habitats

Amanda DeMusz

In Maine and across the Northeast, large tracts of grassland are becoming increasingly rare, with many grassland-dependent species seeing population declines.

Maintaining early successional habitats and preventing them from reverting back to shrubland or forestland requires landowners and wildlife managers to take an active role in the manipulation of these tracts of land. Wildlife managers have many tools to manipulate, maintain, or enhance wildlife habitats, and which tool is best for the job depends on the goals of the project and the target species. One common method used to maintain existing grassland habitat is mowing, and another effective method is fire.

PRESCRIBED FIRE: A NEW TOOL FOR MAINE

Prescribed fire has been used extensively in other states for various habitat management goals, but it has had limited practice in Maine. Recently, in conjunction with Maine Forest Service, Region G wildlife biologists used prescriptive fire on two Aroostook County Wildlife Management Areas (WMAs): Pollard Flats in Masardis and Butler Island in Ashland. The goal of these fires was to maintain and enhance grassland habitat and to demonstrate fire as another method of vegetation control.

Pollard Flats is a 223-acre WMA where a combination of extensive grasslands and high-quality wetlands results in some unique habitat types very important to certain game and non-game wildlife species. One of the main focuses of this area is grassland bird habitat. While it may not seem like a large tract, the 137 acres of fields is a significant and valuable habitat resource in northern Aroostook County.

Pollard Flats Wildlife Management Area. Photo from Google Earth.

Butler Island Wildlife Management Area. Photo from Google Earth.

Butler Island is a 295-acre WMA made up primarily of wetlands; however, it also boasts an 86-acre island, 24 acres of which is maintained as grassland. While the primary focus of this management area is for waterfowl and wetland species, maintaining the island field is also important for grassland birds and provides forage for geese, bear, deer, and other wildlife species using the upland/wetland/river habitat areas.

WHY FIRE?

On Pollard Flats, we have traditionally maintained the early successional grassland habitat by mowing ⅓ of the area (30-50 acres) on a rotation each year. This presents species composition and grassland quality on the landscape as a mosaic, beneficial to different bird species at different age classes. The disadvantage of this approach is that, over time, it can result in a thick layer of thatch/dead vegetation. As this ground litter builds up, it begins to affect grassland birds' nesting suitability, forage availability, and escape mobility. With fire, the flames remove the thick litter layer, release nutrients into the soil that can only be released through burning, rejuvenate plant growth, and help prevent the spread of woody vegetation.

On Butler Island, the fields were traditionally maintained by mowing every year or every other year. However, a shallow water crossing provides the only access for tractors, and high spring flows or flooding due to downstream beaver dams can sometimes make the island inaccessible for equipment. On the island, fire serves a dual purpose – improving grassland habitat and providing another way to maintain early successional grasses when mowing is not possible.

TRIAL BY FIRE: CHALLENGES AND EARLY RESULTS

Ideal conditions for prescribed fire are hard to come by in northern Maine, with our late springs and early falls. Humidity must be just right, winds calm, and vegetation not too green. Pollard Flats and Butler island, both of which are in the Aroostook River floodplain, present the added complication of spring flooding. Spring 2017 did not work out due to flooding, rain events, and quick green-up; but in fall 2017, the stars aligned, and we had a VERY short window of opportunity to conduct the burn.

Applying prescribed fire on Pollard Flats WMA. Photo by Amanda DeMusz.

On Pollard Flats WMA, we were able to burn 27 acres, some of which had been mowed in 2014 and some not since 2011. The fire effectively removed the litter layer and dormant grasses while also killing off emerging trees and young shrubs. We left adjacent fields unburned and mowed one adjacent field so that we could compare the effectiveness of the techniques.

Meanwhile, on Butler Island, we burned 10 of the 21 acres. Logistically, this area was a major challenge, and we commend the Forest Service on their hard work to get this done. We were successful in removing a thick litter layer and opening the area for a flush of fresh, high-quality spring growth. Later, in the spring of 2018, we had a brief window to conduct a burn on the remainder of the field.

LOOKING AHEAD

Moving forward, we will be monitoring both Butler Island and Pollard Flats for vegetation composition and grassland bird species. Having the side-by-side comparisons of mowed, fall burned, and spring burned areas will allow us to evaluate each technique and tailor our future management using the best and most efficient tools.

As a wildlife manager and biologist, I was excited to put this tool to use in northern Maine and look forward to using it in the future. The results of our efforts should provide quality grassland for game species (e.g., woodcock, waterfowl, bear, and deer) and non-game species (e.g., Bobolink, Savannah Sparrow, Killdeer, Meadowlark, Northern Harrier, and American Kestrel) and help maintain an ever-shrinking habitat type on the landscape. I am also grateful for the amazing interagency coordination with the Maine Forest Service to make this project, and future projects of this type, happen.

LANDS MANAGEMENT PROGRAM

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Developing Forest and Wildlife Habitat Management Prescriptions

Jeremy Clark and Daniel Hill

The Lands Management Program helps MDIFW biologists manage state-owned Wildlife Management Area (WMA) habitats and forests. One of our main responsibilities is to develop and employ silvicultural (tree growing) prescriptions and other forest management techniques that maintain or create the best possible wildlife habitats.

One way we can enhance wildlife populations to desired conditions (as defined by MDIFW goals and objectives) is by manipulating habitats to encourage, or discourage, certain species. Within woodland habitats, this is accomplished by managing certain tree species and conditions. Silviculture, the art and science of growing trees within a forest ecosystem, is a tool that we use to manipulate the trees, their density, and the light available to them on sites. This allows us to grow specific tree species and create suitable conditions for specific wildlife.

DIFFERENT SPECIES NEED DIFFERENT FOREST CONDITIONS

To complete their lifecycle, some species, including American woodcock, ruffed grouse, New England cottontail rabbit, and eastern towhee, require young forest habitat. Others, such as barred owl, northern goshawk, pileated woodpecker, American marten, and a variety of salamanders, require mature, late-successional forest types with predominantly closed-canopy structures.

Resource managers can hypothesize which wildlife species may be using various habitats by identifying existing forest cover types, land use history, and site conditions such as soil types, aspect, and topography. A silvicultural prescription identifies the current forest type and provides management recommendations (harvesting and/or vegetation control treatments) to enhance it for specific wildlife species.

THE PRESCRIPTION PROCESS

The prescription development process begins with an inventory of the existing forest resource. We record the number and location of each inventory plot, and review preliminary data on known populations of endangered, threatened, and special concern wildlife species for the compartment we're examining. We also contact Maine Natural Areas Program (MNAP) to determine whether any special habitats, features, or invasive plant locations have ever been identified on the site.

Next, we collect data on overstory tree species, diameter, height, product volumes, and overall tree health, along with understory species composition, wildlife habitat recommendations, and forest management recommendations. This gives us quantitative data of the forest stand's tree species composition and general health. From there, we can develop recommendations on how vegetation manipulation (such as tree removal) could create the desired habitat conditions in the forest stand.

Using this data, we then write a forest and wildlife habitat enhancement prescription, which includes an overview of the entire inventory area and addresses factors such as wildlife and natural areas, forestry, insects and disease, land use and water, access, historical or cultural significance of the site, engineering and surveying work needed or completed, and recreational opportunities. Each distinct forest type's present condition is broken out separately, and details such as regeneration notes, site quality, operability, history, remarks, wildlife recommendations, forest management recommendations, and a schedule of prescribed activities with corresponding years of treatment(s) are all discussed. Finally, the prescription identifies the desired future condition of the forest. This guides the process of designating and marking trees to be removed to achieve that condition.

COLLABORATION

In developing harvest prescriptions, our program collaborates with MDIFW regional biologists, assistant regional biologists, and species specialist staff in the Wildlife Research and Assessment Section (WRAS).

Together, we identify management treatments that will transition the forest into a desired future condition. Specifically, that means a condition that provides exceptional habitat for a given Wildlife Management Area (WMA)'s priority wildlife species.

Goals, objectives, and priorities vary regionally, and these differences guide the harvest prescriptions we develop for each area. For example, Region A in southern Maine may be interested in creating young forest habitat for the New England cottontail rabbit; whereas in Regions D and G in northern Maine, where New England cottontail does not exist, the top priorities may be to maintain Deer Wintering Areas (DWAs) and provide suitable softwood cover for snowshoe hare, and subsequently, Canada lynx populations.

Once we prepare a harvest prescription, MDIFW and MNAP staff review it. Once approved, we implement these prescriptions within WMAs, helping regional biologists statewide to meet their wildlife population goals.

TREATMENT PREPARATION AND IMPLEMENTATION

Our program frequently utilizes timber harvesting as a tool for achieving wildlife habitat objectives and population goals.

Once a prescription is approved, Program managers begin field operations. To prepare a site for harvest, we identify and flag property boundaries, landings, skid trails, sensitive areas, and buffers as necessary. This process allows the resource manager to decide which trees should be retained and which should be removed to meet MDIFW objectives. Next, we carefully mark trees for removal with paint and/or flagging, per the developed prescription for the harvest area. Managers also identify additional work requirements for the compartment, such as access improvement projects, and specify harvest equipment types that will best fulfill the comprehensive objectives.

Once a contractor begins work on site, resource managers frequently inspect the active operation. Our program oversees contractors to ensure their compliance with all laws and regulations, and their adherence to the prescription and any other MDIFW staff recommendations.

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