

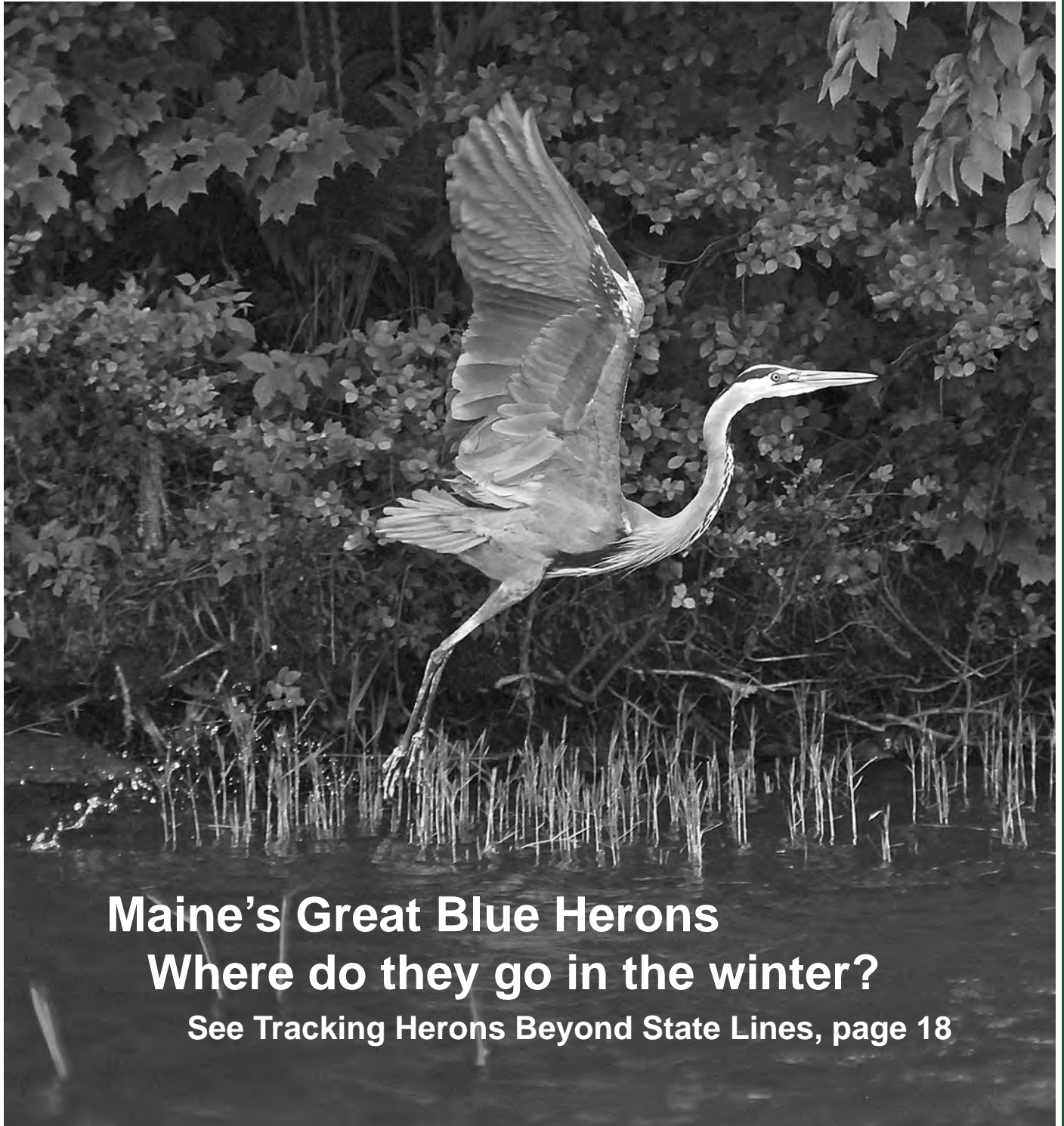
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WILDLIFE DIVISION RESEARCH & MANAGEMENT REPORT 2017



Maine's Great Blue Herons Where do they go in the winter?

See Tracking Herons Beyond State Lines, page 18

**MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
CHANDLER E. WOODCOCK, COMMISSIONER**

RESEARCH AND MANAGEMENT REPORT

Compiled and edited by Diana Harper

Cover Image: A great blue heron taking flight. (Photo by Gail Smith)



Fishing lead-free is better for our lakes and our loons.

Lead poisoning is the leading cause of death for adult **Common Loons in Maine** — a direct result of the ingestion of lost or discarded lead sinkers and lead-headed jigs.

**Protect our treasured loons.
Switch to lead-free fishing gear.**

fishleadfree.org



Maine's Fish Lead-Free Law: Maine has banned the use and sale of **lead sinkers 1 oz. or less.** The sale of bare **lead-headed jigs 2 1/2" long or less** will be banned in September 2016, followed by a ban on use in September 2017.



These studies are financed in part through Federal Aid in Wildlife Restoration Funds under Projects 88D and 87R and through the Endangered Species Conservation Act.

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



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WELCOME TO THE WILDLIFE DIVISION

“Preserve, Protect, and Enhance.”

These three words summarize our mission at the Maine Department of Inland Fisheries and Wildlife. They are written into state law, and they guide us in our daily work activities.

Yet it seems that only a minority of the state's 1.3 million residents truly understand all that we do. In order for us to effectively preserve, protect, and enhance Maine's wildlife, we must communicate our message to all our constituents. In the past several years, the Wildlife Division has accomplished much, including a new Big Game Management Plan, expansion and updates on our moose survivorship project, creating New England Cottontail habitat, updating the State Wildlife Action Plan, and launching new citizen science survey efforts for breeding birds and bumble bees. We have some amazing stories and fascinating information to share.

Over the past few years, we conducted a number of public surveys. We know a vast majority of Maine's citizen's support the conservation of wildlife, yet many of these same people are unaware of the programs we use to conserve these wildlife species. We also know that the majority (74%) of Maine residents do not understand how the Department is funded, with many residents believing the Department is funded entirely through general state tax dollars. The reality is that approximately 90% of the annual MDIFW budget comes from sportsman dollars.

In an effort to increase our outreach and education efforts, we have contracted with agencies that specialize in public communications, so you can expect a few new things from us in the coming months!

We've updated our website to make it more user-friendly. We have designed a series of campaigns to help raise awareness of the Department to audiences who are less familiar with our work. We are also preparing a series of campaigns designed specifically to convey the wide diversity of our projects and ways the public can be more engaged with MDIFW.

Finally, we will improve our communication with all our audiences. We will continue to write blogs, post updates on social media, and provide videos that highlight our staff and the phenomenal work they do.

We hope through these efforts that we can expand the public's knowledge about conservation and management of our wildlife resources, increase understanding of our unique funding mechanisms, and enhance the understanding of the role of hunting and trapping as wildlife management tools.

If we are successful, this will increase support for our programs and improve our ability to preserve, protect, and enhance Maine's diverse wildlife resources.

I am excited to have such a concerted effort to communicate our message and highlight the work that we do on behalf of all Maine citizens and wildlife.

Thank you for your support and appreciation of Maine's wildlife.

-- Judy Camuso
Wildlife Division Director

All in for the Maine Outdoors.

MAINE'S 2015 WILDLIFE ACTION PLAN

CHARTING THE NEXT 10 YEARS OF COLLABORATIVE WILDLIFE CONSERVATION

The Maine Department of Inland Fisheries and Wildlife (MDIFW) collaborated with over 100 state and federal agencies, tribes, non-profit organizations, species and habitat experts, and other conservation partners to create Maine's 2015 Wildlife Action Plan (the "Plan"). The Plan identifies 378 at-risk species ("Species of Greatest Conservation Need" or "SGCN") that need our attention in the next 10 years to prevent further population declines. Maine's Plan addresses the full array of wildlife and their habitats in Maine -- vertebrates and invertebrates in terrestrial and aquatic (freshwater, estuarine, and marine) habitats. It builds on a long history of public involvement and collaboration among conservation partners.



Maine's Wildlife Action Plan is non-regulatory and relies instead on partnerships to accomplish the 600-plus conservation actions identified to safeguard Maine's most vulnerable fish and wildlife. We are now almost two years into Plan implementation, and, with our partners, we are already accomplishing many priority conservation actions. Some of these successes are detailed in this Research and Management Report. Over the past year, MDIFW also began providing revised SGCN conservation and habitat information to interested towns, land trusts, landowners, and state and federal agencies for use in their own planning efforts and grant proposals.

In the coming year, we will be undertaking several efforts to make the Plan more accessible to our partners and the public. This fall, we will conduct an opinion survey to better understand the public's awareness of issues related to at-risk species, help prioritize conservation efforts, and inform our outreach strategies. We will launch a new Wildlife Action Plan webtool with which users can access the Plan database and produce customized reports and maps. We will be looking for your feedback as we deploy and refine this tool. We also hope to reconvene our conservation partners to discuss progress and next steps for the remaining years of Maine's 2015 Wildlife Action Plan.

Maine's 2015 Wildlife Action Plan is our primary tool for conserving at-risk species now, before they decline to a point where endangered species listing is necessary. The Plan is adaptive and comprehensive enough that almost everyone can find a conservation action that is relevant to their interests, location, or group's mission, while also making a real difference for Maine's most vulnerable fish and wildlife. For a copy of Maine's 2015 Wildlife Action Plan, or to become involved in its implementation, please visit: maine.gov/ifw/wildlife/reports/MWAP2015.html.

-- Amanda Shearin, Ph.D.
Habitat Outreach Coordinator

FUNDING WILDLIFE CONSERVATION

Most staff salaries, administrative costs, and operations of the Maine Department of Inland Fisheries and Wildlife's (MDIFW) Bureau of Resource Management are funded by federal aid cost-share programs based upon excise taxes on sporting equipment. The Pittman-Robertson (PR) Act, adopted in 1937, generates funds earmarked for management of mammals and birds. Maine's allocation in Fiscal Year (FY) 2017 exceeded \$6.4 million. The Dingell-Johnson (DJ) Act of 1950 initiated similar support for fisheries, and Maine's share this year exceeded \$3.2 million. Both PR and DJ Funds require 25% state matching dollars, which MDIFW derives solely from license revenues. The saying that "sportsmen are the original conservationists" certainly rings true for program funding. Buying a hunting or fishing license improves both state income and federal aid revenue. The latter is partly allocated by the number of licenses sold. Some individuals purchase these, even though they may not actively hunt or fish, when they realize that this is the core funding for state fish and wildlife agencies.

Some individuals purchase licenses, even though they may not actively hunt or fish, when they realize it is the core funding for state fish and wildlife agencies.

MDIFW also receives federal funding for the management of at-risk animals which have been designated a "Species of Greatest Conservation Need" (SGCN) in the State's Wildlife Action Plan (Plan). Maine submitted a revised Plan and SGCN update in 2015; see maine.gov/ifw/wildlife/reports/MWAP2015.html. State Wildlife Grants (SWGs) are appropriated annually to states by Congress in the federal budget. In FY 2017, Maine's share again totaled \$480,000. The funding formula reflects a state's area and the human population census. Like 12 other rural or small states, Maine receives a minimum 1% share. It's an important first step toward SGCN conservation, but this funding level represents an annual investment of only \$1,270 for each SGCN! Of course, MDIFW attempts to maximize effectiveness via partnerships, regional collaboration with other states, emphasis on strategies that benefit multiple SGCN, securing other grants, etc.

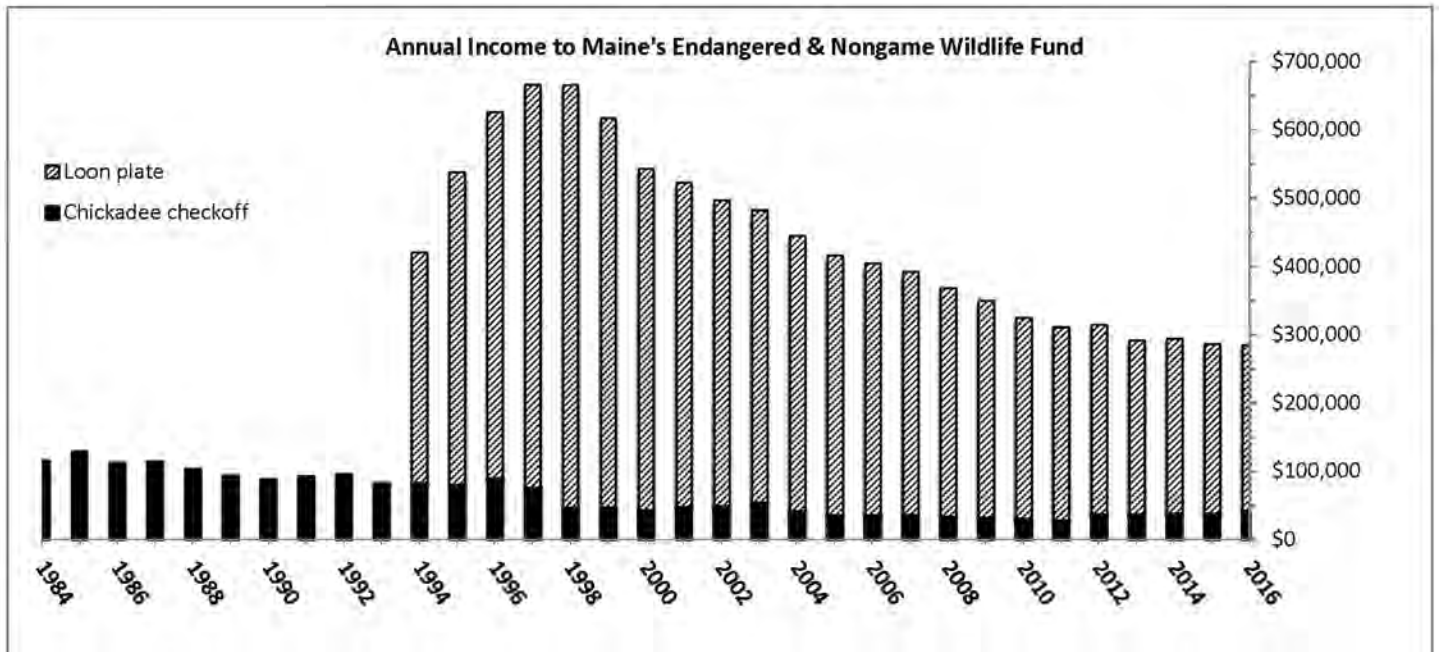
These funds are strategic for conservation of vulnerable species before further setbacks lead to protection via the Endangered Species Act (ESA). The certainty and scale of SWG funding fall far short of the need for comprehensive SGCN conservation. Congress is considering recommendations from a national "Blue Ribbon Panel" for stable, increased funds from an existing excise tax on energy production authorized by Congress but not currently appropriated. Energy sector leaders have endorsed the concept to fund proactive conservation of vulnerable SGCN. For more information, see teaming.com/blue-ribbon-panel-sustaining-americas-diverse-fish-wildlife-resources.



We gratefully acknowledge 43,249 purchases or renewals of a "Loon Plate" for vehicles last year.

Volunteer contributions to the Endangered and Nongame Wildlife Fund, via the tax-form “Chickadee Check-off” and purchases of “**Loon Plate**” **conservation registrations** for vehicles, provide state match to leverage SWG funds. Donations are deposited into a special, interest-bearing account from which money can only be spent for the conservation of Maine’s nongame wildlife -- including rare, threatened, or endangered species. Both revenues have declined by more than 50% (Figure 1) over the years, as other programs use similar funding strategies.

Figure 1. A history of income derived from the “Chickadee Check-off,” “Loon Plate,” and Maine Outdoor Heritage Funds to benefit wildlife programs.



If a 21st century model for funding fish and wildlife diversity is implemented nationally, Maine will be challenged to provide sufficient match to fully leverage increased federal aid. There are no easy solutions for long-term funding, but here’s one for the near future: if only 10% of individual Maine income tax returns include a \$5 minimum contribution to the “**Chickadee Check-off**” on Schedule CP, state funding would surpass the 1998 record. Certainly no one wants to add to their income tax liability, but this is one instance where a modest donation is noticeable and leverages 200% or more in federal aid dedicated to the program! We gratefully acknowledge 43,249 purchases or renewals of a “Loon Plate” for vehicles last year. The 40% proceeds to MDIFW represent >80% of total program funds through the years. Maine’s beautiful state parks earn 60% of that revenue source.

-- Charlie Todd
Endangered and Threatened Species Coordinator



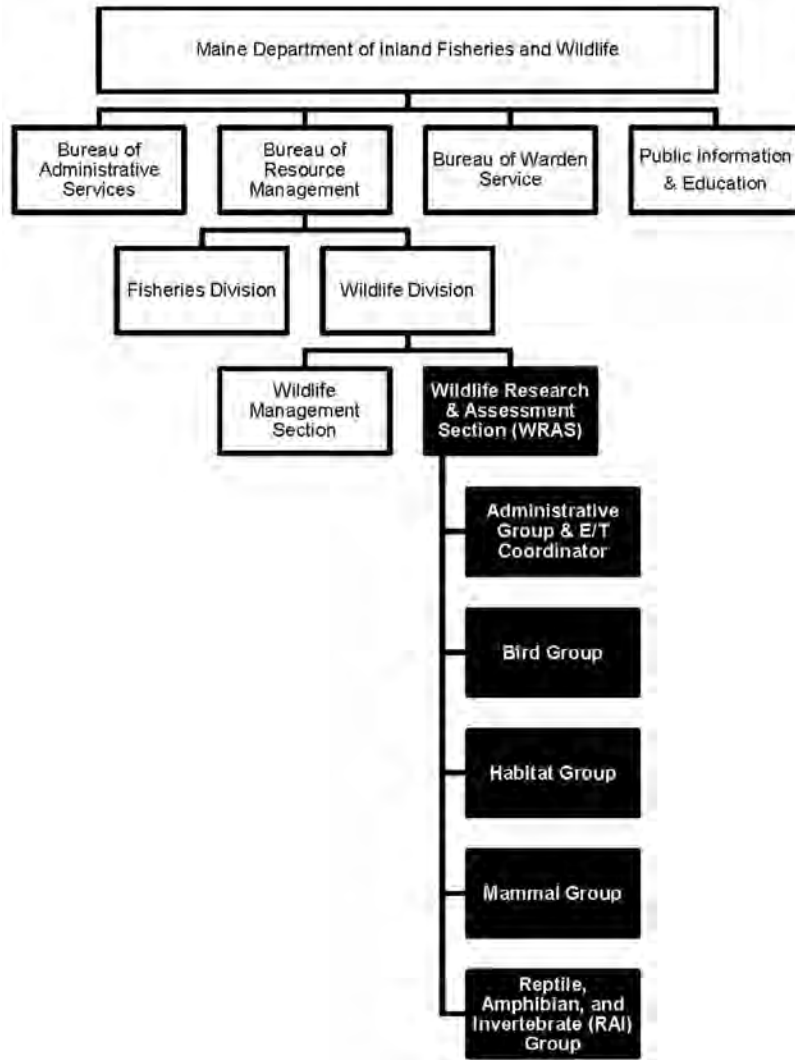
WILDLIFE RESEARCH AND ASSESSMENT SECTION:

A MDIFW SOURCE FOR SCIENTIFIC INFORMATION

The Wildlife Research and Assessment Section (WRAS) is tasked with assessing the status and trends of Maine’s wildlife populations and their habitats and managing them for long-term sustainability. While the regional biologists in the Wildlife Management Section are assigned to one of seven regions covering the state, and work on all species within their region, WRAS biologists work on a statewide or range-wide level on one species or a suite of species.

WRAS is located in Bangor and consists of an Administrative Group with an Endangered and Threatened Species Coordinator, Bird Group, Habitat Group, Mammal Group, and Reptile, Amphibian, and Invertebrate (RAI) Group. Biologists in each group have in-depth knowledge of their species and serve as the Department’s wildlife species specialists; they are often called upon to provide professional input to the public, the Wildlife Division, and, ultimately, the Commissioner, his Advisory Council, and the Legislature.

To fulfill the task of managing wildlife populations and their habitats, WRAS develops species-specific management plans, habitat conservation strategies, and criteria for listing endangered and threatened species and “species of greatest conservation need.” These management tools are derived from assessments, with public participation and through collaboration with conservation partners, for both game and non-game species. In the following pages, you’ll learn more about each group and individual within WRAS and some of the many research studies they’ve been conducting over the past year.



For an online version of this *Research and Management Report*, or for copies of past years, please visit our website at maine.gov/ifw/wildlife/reports/research_management.html.

-- Diana Harper

ENDANGERED AND THREATENED SPECIES CONSERVATION AND MANAGEMENT

Endangered and Threatened Species Conservation in Maine

Maine's Endangered Species Act (1975) opens with a clear declaration of purpose (12 M.R.S. §12801):

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

MDIFW is responsible for all terrestrial fauna, all animals living in inland waters, and all bird conservation in any habitat. The Department of Marine Resources is the lead state agency for other animals in coastal waters. Maine's Natural Areas Program (Department of Agriculture, Conservation and Forestry) is the authority for rare plant conservation. MDIFW worked with these agencies, other conservation partners, and stakeholders to update Maine's Wildlife Action Plan (Plan, 2015). The Plan (maine.gov/ifw/wildlife/reports/MWAP2015.html) designates 378 animals as "Species of Greatest

"Species of Greatest Conservation Need" are at-risk fauna that require some attention to avoid further jeopardy, which could eventually lead to endangerment and potential extirpation.

Conservation Need" (SGCN). These are at-risk fauna that require some attention to avoid further jeopardy, which could eventually lead to endangerment and potential extirpation. The Plan is the mechanism to secure State Wildlife Grants from the U.S. Fish and Wildlife Service, funds reserved for vulnerable animal species. Benefits to rare plants in Maine's Plan accrue when conservation strategies align with those for SGCN.

Wildlife action plans consider species vulnerability far in advance of thresholds normally used to consider listing a species as endangered or threatened (E/T). This is a better opportunity to avoid escalating risks, more costly solutions, and greater uncertainty of outcomes than strict reliance on listing species as E/T. Addressing SGCN conservation on regional (or broader) scales is a valuable strategy for species at-risk over vast areas beyond the scope of state jurisdictions.

Nevertheless, endangered species programs are high profile conservation efforts with widespread public support. Most have practical limitations based on funding levels. Let's consider some indicators of program performance in Maine:

- No species have been extirpated (lost from Maine) since being listed under the Maine Endangered Species Act (ESA).
- Among the 47 species listed prior to 2015, only three have been "up-listed" from threatened to endangered reflecting increased jeopardy to the species: Blanding's turtle, black-crowned night heron, and roseate tern.
- Among these 47 species previously listed, four have been "down-listed" based on improvements and diminished jeopardy: Clayton's copper (a butterfly), pygmy snaketail (a dragonfly), roaring brook mayfly, and bald eagle.
- One species has been "de-listed" and removed from the list of E/T species due to full recovery: bald eagle.
- One species was re-established to residency in the state following a 25-year absence of breeding activity, during which time it only visited Maine seasonally during migration: peregrine falcon.
- State funding options for E/T programs remain limited and the long-term trend in revenue continues to decline.

Most endangered species require decades to achieve a full recovery and self-sustaining populations. There are no simple solutions for the process. The timetable can be prolonged for many species facing special challenges:

- Drastic population declines take time for numbers and distribution to rebound. Millions of cave bats died from exposure to white-nose syndrome. Little brown bats, northern long-eared bats, and eastern small-footed bats will remain in jeopardy for many years, assuming we can safeguard the small number of survivors from other risks.

- The basic life history of some long-lived species is a liability if they experience increased adult mortality from human causes. Spotted turtles, Blanding's turtles, and box turtles all have this vulnerability, especially when new developments and roads fragment their habitat.
- Many E/T species occur at very low numbers, and some reach the limits of their geographic distribution in our State. Arctic terns and boreal snaketail dragonflies have strongholds north of their southernmost range limits in Maine, while grasshopper sparrows and black racers reach the extreme northern edge of their range in southern Maine. Wildlife biologists must be pragmatic when managing species at the edge of their distribution, while also remaining mindful that setbacks in the range of species can indicate escalating concerns range-wide and potential justification for federal E/T listing.
- Some E/T species are reliant on highly specialized habitats that are in sparse supply. Four such butterflies and moths (Edward's hairstreak, pine barrens zanclognatha, sleepy duskywing, and twilight moth) all depend on pitch pine - scrub oak barrens, a declining habitat vulnerable to residential and commercial development, agriculture, and gravel mining.
- Small, isolated populations are a major risk to species with low mobility, like the frigga fritillary butterfly (only one population) and New England cottontails.

Maine's E/T list, administered by MDIFW, currently includes 51 species. It was last updated in 2015.

Biologists periodically review guidelines for listing that are adopted in agency regulations, the status of species currently on the E/T list, as well as those designated as special concern. The latter category typically functions as a pool of candidate species for E/T listing. All listing changes undergo reviews from MDIFW, peer scientists, public input, and the MDIFW Advisory Council before a proposal advances to the Legislature. The process may require 18 months to complete. However, the checks and balances between MDIFW and the Legislature yield a list with the full endorsement of state government. Maine ESA listings have avoided wayward petitions and litigation prevalent in some E/T programs.

In a recent survey of Maine citizens, MDIFW programs for conservation of endangered and threatened species are overwhelmingly endorsed.

State endangered species programs are complimentary to (but typically do not duplicate) federal listings under the U.S. Endangered Species Act (ESA). ESA considers the status over "all or a significant portion of the species range." Unless a vertebrate population is isolated as a "distinct population segment," federal listings do not focus on variable status within individual states or regions. The U.S. Fish and Wildlife Service - Maine Field Office compiles federal listings under its jurisdiction; see [fws.gov/mainefieldoffice/Endangered_and_Threatened_Species.html](https://www.fws.gov/mainefieldoffice/Endangered_and_Threatened_Species.html). The National Oceanic and Atmospheric Administration – National Marine Fisheries Program has lead responsibility for E/T marine mammals, sea turtles, or fish in the Gulf of Maine (greateratlantic.fisheries.noaa.gov/protected/section7/listing/index.html).

In a recent survey of Maine citizens, MDIFW programs for conservation of E/T species are overwhelmingly endorsed. Unfortunately, that support has not translated into a stable funding source. Forty-two 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. If you are not making a donation via the "Chickadee Checkoff" on state income tax returns, purchasing or renewing a "Loon Plate" conservation registration for vehicle licenses, renewing a "Sportsman Plate" registration for vehicle licenses, or making direct contributions to the Maine Endangered and Nongame Wildlife Fund, then please consider supporting our efforts financially. State revenues are critical to our ability to leverage other funding sources and can ultimately limit the scope of our efforts.

This work is supported by the federal Pittman-Robertson program for wildlife restoration, federal State Wildlife Grants program 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.

-- Charlie Todd
Endangered and Threatened Species Coordinator

Taxa group (Class)		
Common Name	Scientific Name	Legal Status (year listed)
Birds (Class Aves)		
American Pipit	<i>Anthus rubescens</i>	Endangered (1997)
Arctic Tern	<i>Sterna paradisaea</i>	Threatened (1997)
Atlantic Puffin	<i>Fratercula arctica</i>	Threatened (1997)
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Recovered (2009) / Threatened (1996) / Endangered (1978)
Barrow's Goldeneye	<i>Bucephala islandica</i>	Threatened (2007)
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Endangered (2015) / Threatened (2007)
Black Tern	<i>Chlidonias niger</i>	Endangered (1997)
Common Moorhen	<i>Gallinula chloropus</i>	Threatened (2007)
Golden Eagle	<i>Aquila chrysaetos</i>	Endangered (1987)
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	Endangered (1987)
Great Cormorant	<i>Phalacrocorax carbo</i>	Threatened (2007)
Harlequin Duck	<i>Histrionicus histrionicus</i>	Threatened (1997)
Least Bittern	<i>Ixobrychus exilis</i>	Endangered (2007)
Least Tern	<i>Sternula antillarum</i>	Endangered (1984)
Peregrine Falcon	<i>Falco peregrinus</i>	Endangered (1975)
Piping Plover	<i>Charadrius melodus</i>	Endangered (1987)
Razorbill	<i>Alca torda</i>	Threatened (1997)
Roseate Tern	<i>Sterna dougallii</i>	Endangered (1997) / Threatened (1987)
Sedge Wren	<i>Cistothorus platensis</i>	Endangered (1987)
Short-eared Owl	<i>Asio flammeus</i>	Threatened (2007)
Upland Sandpiper	<i>Bartramia longicauda</i>	Threatened (1997)
Fish (Class Actinopterygii)		
Redfin Pickerel	<i>Esox americanus americanus</i>	Endangered (2007)
Swamp Darter	<i>Etheostoma fusiforme</i>	Threatened (1997)
Insects (Class Insecta)		
Boreal Snaketail	<i>Ophiogomphus colubrinus</i>	Threatened (2007)
Clayton's Copper	<i>Lycaena dorcas claytoni</i>	Threatened (2015) / Endangered (1997)
Cobblestone Tiger Beetle	<i>Cicindela marginipennis</i>	Endangered (2015)
Frigga Fritillary	<i>Boloria frigga</i>	Endangered (2015)
Edwards' Hairstreak	<i>Stayrium edwardsii</i>	Endangered (1997)
Hessel's Hairstreak	<i>Callophrys hesseli</i>	Endangered (1997)
Juniper Hairstreak	<i>Callophrys gryneus</i>	Endangered (2007)
Katahdin Arctic	<i>Oeneis polixenes katahdin</i>	Endangered (1997)
Pine Barrens Zanclognatha	<i>Zanclognatha martha</i>	Threatened (1997)
Purple Lesser Fritillary	<i>Boloria chariclea grandis</i>	Threatened (2007)
Rapids Clubtail	<i>Gomphus quadricolor</i>	Endangered (2007)
Ringed Boghaunter	<i>Williamsonia lintneri</i>	Threatened (2007)
Roaring Brook Mayfly	<i>Epeorus frisoni</i>	Threatened (2015) / Endangered (1997)
Sleepy Duskywing	<i>Erynnis brizo</i>	Threatened (2007)
Tomah Mayfly	<i>Lycia rachelae</i>	Threatened (1997)
Twilight Moth	<i>Erynnis brizo</i>	Threatened (2007)
Mammals (Class Mammalia)		
Eastern Small-footed Bat	<i>Myotis leibii</i>	Threatened (2015)
Little Brown Bat	<i>Myotis lucifugus</i>	Endangered (2015)
New England Cottontail	<i>Sylvilagus transitionalis</i>	Endangered (2007)
Northern Bog Lemming	<i>Synaptomys borealis</i>	Threatened (1987)
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Endangered (2015)
Molluscs (Class Bivalvia)		
Brook Floater	<i>Alasmidonta varicose</i>	Threatened (2007)
Tidewater Mucket	<i>Leptodea ochracea</i>	Threatened (1997)
Yellow Lampmussel	<i>Lampsilis cariosa</i>	Threatened (1997)
Reptiles (Class Reptilia)		
Black Racer	<i>Coluber constrictor</i>	Endangered (1987)
Blanding's Turtle	<i>Emydoidea blandingii</i>	Endangered (1997) / Threatened (1987)
Box Turtle	<i>Terrapene carolina</i>	Endangered (1987)
Spotted Turtle	<i>Clemmys guttata</i>	Threatened (1987)
Snails (Class Gastropoda)		
Six-whorled Vertigo	<i>Vertigo morseii</i>	Endangered (2015)

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.

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.

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.

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 Stakeholders' Group. Oversees GIS needs within the Habitat Group. Provides assistance to Department staff on a wide range of technical issues and data needs.

INFORMATION FOR HABITAT CONSERVATION AND MANAGEMENT

What We Do

Habitat Group creates and maintains data on wildlife observations and habitats. These data are used for regulatory reviews, oil spill response, species management, and conservation planning. Each of these uses requires different types of data. Regulatory maps are political/social compromises and are based on legal definitions. In the regulatory world, an area is either regulated or unregulated so the mapping is more black and white. In contrast, oil spill response, species management, and conservation planning consider all habitat in Maine but focus on relative values, which vary with environmental gradients, proximity to other habitats, disturbance, and other elements of the landscape. Habitat Group also develops custom applications to make this data available to Department staff. We provide a range of technical support, primarily with mapping and wildlife/habitat databases, but also with general network and server problems. Unlike other WRAS Groups that work on numerous, specific projects that may be relatively short in duration, much of the work Habitat Group does is ongoing maintenance of existing data sets and custom applications.

Citizen Science Web Application

The Department needs to track where priority wildlife species occur in Maine. Keeping these databases current is challenging, 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 Program recruits interested Mainers, who are skilled at identifying particular species, to participate in some of our wildlife monitoring programs. Some of these programs are multi-year survey efforts that may accumulate hundreds or thousands of species observations. This year, we are constructing a new web application, funded partly by a grant from the Maine Outdoor Heritage Fund, to promote citizen science and to publish the information that is being collected. It also will have a contact link for anyone who might be interested in participating. Previously, citizen scientists had to submit their data on paper. Besides showcasing our monitoring programs, this new web application will allow online data submissions. This will enable us to get new information into our wildlife databases more quickly and accurately, and it will make it easier for us to share that data with the public. We hope this will help generate more interest in wildlife, the Department, and our Citizen Science Program. The River Bird Program is described in the Bird Group section of this year's report.

Our Citizen Science Program recruits interested Mainers, who are skilled at identifying particular species, to participate in some of our wildlife monitoring programs.

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

Mapping Habitats for Aquatic Species

The Department maps observations of “Endangered, Threatened, and Special Concern” (ETSC) species, typically as a point (GPS coordinate) indicating where the individual or group was seen. Many of the Department’s business needs, however—such as landscape planning and conducting environmental reviews—are interested in where the habitats associated with those ETSC species occur. Mapping the habitats around each observation point is time-consuming. For terrestrial species, a simple circle drawn around each point is a reasonable approximation until the more detailed habitat mapping can be completed. For aquatic species, such as those associated with rivers and streams, however, a simple circle fails to capture most of the important habitat, while including too much upland area that is less important to those species. The Habitat Group has been steadily working to map these riparian habitats to more accurately depict the functional habitat. In the past year, we have been focusing on mussels, like the brook floater, and dragonflies and will continue to work to improve on mapping.

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

Oil Spill Response

As a state Natural Resource Trustee, MDIFW is obligated to respond to oil spills that affect wildlife or wildlife habitat. This year, we worked with the state’s wildlife rehabilitation contractor, Tri-State Bird Rescue, to provide annual training in oil spill response to MDIFW staff. As part of the training, we practiced setting up a stabilization center for oiled wildlife and built caging that could be used in an actual response. We began updating our oiled wildlife response plan and developing a plan to use the Maine Wildlife Park as our primary facility for rehabilitating oiled wildlife.

This work is supported by the Maine Coastal and Inland Surface Oil Clean-up Fund.



MDIFW staff learn about conducting a field exam of oiled wildlife in our annual oiled wildlife response training. The trainers are wearing Tyvek suits as part of the “personal protective equipment” (PPE) that all staff would wear during an actual response. The tall pens made from PVC pipe and netting could be used to hold oiled wildlife during the stabilization process. The gray “cribs” at the lower left have net bottoms – these would be used for seabirds, such as loons, that cannot sit well on a hard surface. (Photo by Tri-State Bird Rescue)

BIRD GROUP

Birds enrich our lives and reflect the quality and health of our environment. North America provides habitat for over 900 species of birds. The Maine Bird Records Committee considers 427 bird species (nearly half of all North American birds) to be positively documented within the state of Maine. Maine's diverse mosaic of differing habitats provide nesting space for 225 species of birds, and many more species that either migrate through or winter in Maine. Maine's landscape is used by at least 29 inland species that reach the northern limits of their breeding distribution in Maine and 29 species at their southern limits. In addition, many of Maine's island-nesting seabirds reach their southern breeding terminus on Maine's coastal islands. Several other 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 back into Maine following extirpation and are now carefully monitored and managed.

Maine is strategically located at a constriction point of the funnel in what is referred to as the Atlantic Flyway, a migratory path along eastern North America that begins in the eastern Canadian arctic and Maritimes and tapers down the east coast. The Atlantic Ocean has a channeling effect on these migratory movements as birds fly south in late summer and fall. In addition, Maine's vast coastline and more than 4,000 coastal islands provide important stopover areas for millions of migrating birds. This flyway includes some of the continent's most productive ecosystems and is home to about a third of the U.S. human population. Conserving birds and their habitats in Maine's portion of this important flyway is a monumental task.

Brad Allen, Wildlife Biologist and Bird Group Leader – Brad oversees group activities and budgets and continues to investigate the lives and times of the common eider, focusing currently on a collaborative study looking at duckling survival. 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 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 five years, she has also devoted a great deal of effort to heron surveys, heron research, and coordination of a volunteer heron monitoring program called HERON. Her other field-related duties include marsh bird surveys and research, black tern surveys, and inland seabird surveys.

Adrienne Leppard, Ph.D., Wildlife Biologist – Adrienne is the newest member of the Bird Group whose 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 coordinating 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 the 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, ducks, and Canada geese. He is Maine's representative on the Atlantic Flyway Council Technical Section.

Lindsay Tudor, Wildlife Biologist – 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.



Hooded Merganser (Photo by Sharon Fiedler)

BIRD GROUP VOLUNTEERS AND OTHERS

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, Rebecca Holberton, 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, Dave Hiltz, Chris West, Bill Hanson, Chris DeSorbo, Rick Gray, Wing Goodale, Lucas Savoy, Lauran Gilpatrick, Kevin Regan, Lesley Rowse, Joe Wiley, Margo Knight, Don Mairs, Ron Joseph, Patrick Keenan, Bill Johnson, Bill Sheehan; Susan Gallo and Laura Minich-Zitske; Don Reimer, Scott Kenniston, Libby Mojica, John Sewell, Sharon Fiedler, Brittany Currier, Ryan Robbins, Ken Janes, Doug Sutor, Michael Fahay, Jill Glover, Julie Johnston, Deanne Richmond, Houston Cady, Jeremy and Addison Polis, James Armstrong, Erik Blomberg, Samantha Davis, Ellie Mangelinckx, 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, many Heron Observation Network volunteers, many 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 staff.

BIRD CONSERVATION AND MANAGEMENT

Success Continues for Maine's Endangered Piping Plovers!

Piping plovers are small, sand-colored shorebirds that nest on sandy beaches and dunes along the Atlantic Coast from Newfoundland to South Carolina. Habitat loss, lack of undisturbed nest sites, and predation are the primary factors jeopardizing populations of piping plovers. With less than 2,000 nesting pairs on the Atlantic coast, the piping plover is federally-listed as threatened and is listed as endangered in Maine. Maine's population of piping plovers has been monitored annually since 1981.

With only 24 pairs of piping plovers returning to nest in 2008, and the realization that we were very close to losing this species from our state, a group consisting of government conservation agencies, municipal officials, landowners, and individuals from private organizations combined efforts to protect nesting piping plovers and to attempt to reverse the declining population trend. Maine Department of Inland Fisheries and Wildlife (MDIFW), Maine Audubon, Maine's Bureau of Parks and Lands, Rachel Carson National Wildlife Refuge (RCNWR), USDA APHIS Wildlife Services, The Nature Conservancy, and Bates College have a long-standing collaboration regarding piping plover management. The towns of Wells, Ogunquit, Old Orchard Beach, and Scarborough are also committed to managing their beaches using guidelines established with MDIFW that provide recreational opportunities for beachgoers and still protect piping plovers. These towns have included funds in their budgets to hire plover volunteer coordinators. Plover volunteer coordinators recruit and coordinate volunteers who monitor and protect plover nests and chicks during the nesting season.

Funding from U.S. Fish and Wildlife Service's (USFWS's) Landowner Incentive Program (LIP) and grants from Maine Outdoor Heritage Fund and National Fish and Wildlife Foundation provided increased efforts in law enforcement, predator management, and outreach at certain plover beaches. These efforts resulted in productivity rates that increased to the level needed to sustain and grow the population. Maine's piping plover population and distribution has steadily increased from 24 pairs nesting on 11 beaches in 2008 to 64 pairs nesting on 19 beaches in 2017. 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.

Until recently, there was very little information on where Atlantic coast nesting piping plovers spend their winter months. Indeed, we had virtually no information on where our Maine birds were wintering or if Maine nesting birds were hatched in Maine or if they were "from away". Thanks to banding efforts by researchers from Canada to the Bahamas, including biologists from the National Audubon Society, Canadian Wildlife Service, Virginia Tech Shorebird Program, Bahamas National Trust, and USFWS, the pieces of the puzzle are coming together. Banded piping plovers are sporting plastic leg flags that are color coded by banding location and, often, have an alpha-numeric code that identifies the individual bird. During 2015-2017, Maine's plover monitors have observed a few banded plovers nesting on Maine beaches. These observations include birds that were banded on the wintering grounds in the Bahamas and South Carolina. Later in the

season, observations included plovers migrating through Maine that were banded on Canadian beaches located in New Brunswick and Quebec's Magdalene Islands. The most surprising observation involved two banded plovers from the Great Lakes federally-endangered population that were spotted scoping out nesting beaches in Ogunquit, Kennebunk, and Phippsburg. Both birds were banded in Michigan, an entirely different subspecies!

MDIFW is asking for help from all beachgoers to protect these birds 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 it attracts nest predators such as skunks and raccoons.
- Call the Maine Warden Service to report harassment of birds. It's a federal offense to harm an endangered species. (See inside back cover of this report for Warden Service phone numbers.)
- IF you see a banded piping plover, please 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 by volunteer assistance, the federal Pittman-Robertson and State Wildlife Grants programs, USFWS Section 6 Funding, and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

-- Lindsay Tudor

International Shorebird Survey

The International Shorebird Survey (ISS), managed by Manomet Center for Conservation Sciences (Massachusetts) since 1974, enlists the services of 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.

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 are dispersed during the breeding season, but they 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, a set of more than 600 volunteers has completed over 91,000 census counts at 3,400 locations in 47 states, with additional counts from Canada (Atlantic Canada Shorebird Survey (ACSS)) and Central and South America.

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 Maine's 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 2016, MDIFW biologists, Maine Audubon plover biologists, and ISS volunteers surveyed 15 beaches located between Ogunquit and Georgetown and 15 mudflats located Downeast recording over 24,000 shorebirds. Several shorebird species were tallied, including semipalmated sandpiper, semipalmated plover, sanderling, black-bellied plover, whimbrel, and greater and lesser yellowlegs.



Sanderling (Photo by Colleen Bovaird)

For additional information, please contact Lindsay Tudor, MDIFW Wildlife Biologist, by email at lindsay.tudor@maine.gov.

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

-- Lindsay Tudor

The Maine River Bird Project – A Citizen Science Success

The Maine River Bird Project is dedicated to expanding awareness and improving species and habitat conservation within Maine's rivers. The mission is to improve understanding of rivers, river birds, and ecosystem changes through citizen science and collaborative research. The suite of birds that rely on rivers at some point in their life cycle is diverse and includes piscivores (fish eaters), such as the osprey, bald eagle, belted kingfisher, and double-crested cormorant; invertivores (insect eaters), such as the spotted sandpiper and swallow; and generalists, such as the ring-billed gull and American crow.

This group of river bird species is an effective ecological indicator of the full complexity of the riverine system because of the variation in their diet and feeding techniques. Linkages between river birds and river features, such as water flow, presence of dams, and landscape composition, not only inform our current understanding but also serve as a baseline to monitor ecosystem changes associated with river restoration and return of sea-run fishes (Maine hosts 12 fish species which require access between ocean and rivers to live and reproduce).

Initiated in 2008, the project encompasses completed, ongoing, and newly initiated objectives. Thus far, the project developed a new survey approach. Prior research has examined riparian territorial/breeding season passerines, waterfowl and waders, or a limited number of river bird species. A broader suite of species has been surveyed through bank transect and boat surveys; however, these methods likely are relatively intrusive to birds and logistically difficult to apply across extensive spatial and temporal scales (i.e., multiple seasons within a year and multiple years). Transect surveys present challenges due to lack of access to private lands and difficulties for bird surveyors to traverse rugged terrain. Boat surveys would also pose disturbance issues and would limit involvement to those with boating skills and access to suitable boats, and they may be constrained during high and low flow periods (i.e., dangerous or inadequate water for navigation). For example, flocks of winter diving ducks, such as common goldeneyes, would flush on the arrival of a boat and are only present on the river during the winter, when boat travel may be impossible.

The new river bird survey method overcomes these limitations because of its efficient approach. A surveyor stands at the same location along the river bank and visually (with some auditory detection) observes birds within a predefined boundary incorporating the river and shoreline (size of surveyed area varies by site). This logistically simple protocol allows for a broader pool of surveyors and survey sites; includes a wider breadth of species, as well as larger spatial and temporal scales; is cost effective; and minimizes disturbance to birds, thus better representing ecological conditions.

The project also documented how dams alter the transfer of nutrients from sea-run fishes to river birds and how bird abundance relates to river features. Analysis of feather and prey samples collected along the Penobscot River suggested that, prior to its removal, the lowermost dam on the Penobscot (Veazie) acted as a barrier to the delivery of nutrients from sea-run fishes to bald eagle and belted kingfisher nestlings upriver. We expect these nutrients will be detected in future sampling of nestlings upriver as sea-run fish populations rebound following the removal of the Veazie and Great Works dams.

Additionally, year-round river bird survey observations, collected by citizen scientists across 10 Maine rivers and 80 bankside survey sites, were combined with river feature data. The results of this analysis informed our current understanding of species-habitat relations and, with ongoing monitoring, will shed light on ecosystem changes associated with urbanization and river restoration.

The Maine River Bird Project will be one of several MDIFW citizen science projects highlighted on the new MDIFW Citizen Science Website. This will provide a platform to share local, regional, and statewide results, expand awareness, improve species and habitat conservation, and streamline logistics for expanded environmental monitoring at river sites identified through consultation with our partners. Project data management will be improved through an interactive website that will incorporate data entry, querying ability, analyses, and reporting.

Online data entry will facilitate expansion to additional river bird survey sites. New sites will allow for additional citizen scientists and conservation partner involvement, thus fostering improved river species and habitat conservation management. The interactive website data framework will benefit other MDIFW initiatives, and there is interest in the application of this approach as a new way to interface with the public as part of fisheries and wildlife conservation and management efforts.

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

-- Erynn Call

Tracking Maine's Great Blue Herons Beyond State Lines

Last spring, with the help of students, volunteers, and biologists with the non-profit organization, 1000 Herons, MDIFW tagged five adult great blue herons with GPS transmitters as part of an ongoing effort to better understand the state's great blue heron population. After a significant decline in the number of nesting pairs on Maine's coastal islands from the 1980s to 2007, MDIFW listed the great blue heron as a species of "special concern" and began a citizen science adopt-a-colony program called the Heron Observation Network (HERON). By marking and following individual adults over several years, MDIFW is learning new information regarding daily movements, habitat use, colony fidelity, migration routes, and wintering locations of Maine's herons.

The GPS transmitters were purchased with help from a grant from the Maine Outdoor Heritage Fund and represent the cutting edge of telemetry technology. GPS locations are transmitted via the cell phone network to an open source website (movebank.org). Being solar-powered, they are expected to provide years of data for each tagged heron. Fully-charged, the units collect 288 GPS points and 360 behavioral (accelerometry) tracings per 24-hour period. The data is available on movebank.org for the students, citizens, and conservationists of Maine to use in education and to help make conservation decisions.

During this first year of tracking, we learned a lot about the lives of these five individuals, including nesting locations, foraging locations, migration routes, and wintering locations. We first discovered that each tagged heron nested in a known colony tracked by MDIFW and HERON volunteers. They each had a distinct pattern of movement during nesting, with repeated visits to favorite foraging locations. After nesting, their foraging behavior changed. One heron moved to a completely new area 18-miles from her colony; others used similar areas as during nesting. For each tagged heron, the amount of area used after nesting was smaller because their energetic demands had diminished compared to when they were feeding their young.

Some of the most interesting and exciting information gained this first year was the timing of migration, the routes the herons traveled, the amount of time they traveled, and where they spent the winter. Due to feathers covering the transmitter's solar panel and, in some cases, poor cell phone coverage, some of the data was lost for varying lengths of time. Below is a synopsis for each tagged heron's fall migration, wintering location, and spring migration back to Maine:

- "Sedgely" is a male trapped and tagged in Orrington, adopted by Center Drive School in Orrington. His summer movements showed he nested in a known great blue heron colony in Bradley, 12 miles (straight-line distance) from where he was trapped. Sedgely was the first of our tagged herons to fly south for the winter, beginning his journey on September 1. He first stopped over at the Merrimack River estuary for 19 hours before flying nonstop for 29 hours to southern Georgia. He then flew to an agricultural area north of Lake Okeechobee in Florida. He remained there until March 30, when he departed on his northward journey back to Maine, arriving only 6 days later. He did not return to the same colony, rather he nested in the same colony as another GPS-tagged heron, "Snark."



Wintering locations of five GPS-tagged great blue herons (indicated by bird silhouettes) and migration paths (thick lines) of the four that returned to Maine this spring.

- “Snark” is another male trapped and tagged in Orrington, adopted by Haworth Academic Center in Bangor. His summer movements showed he nested in a known great blue heron colony in Brewer. Snark migrated sometime after September 22. We do not have a track of his migration south but he also ended up in Florida for the winter, in Vero Beach, 30 miles from Sedgely. He left Florida on the same day as Sedgely, March 30, but took two weeks to return to Maine. He returned to the same colony as last year.



Biologists getting ready to release Snark after attaching a GPS transmitter. (Photo by Alan Maccarone)

- “Cornelia” is a female trapped and tagged at the New Gloucester Fish Hatchery, adopted by the Gray-New Gloucester High School. Her summer movements showed she nested in a known great blue heron colony in Gray. Cornelia spent her post-breeding time in Brunswick and departed Maine on September 23. Unlike Sedgely, she stopped more frequently along her journey south. There was a period of time during which we did not receive data from her transmitter. In March, we discovered she had made it to the Bahamas and spent the winter there. She has since returned to and nested in the same colony as last year, exhibiting similar foraging patterns as last year.



Cornelia starting to take flight after release. (Photo by Joyce Love)

- “Nokomis” is a female trapped and tagged in Palmyra, adopted by Nokomis High School. Nokomis’ summer movements showed she nested in a known great blue heron colony in Newport, which is right behind the Nokomis High School baseball field. Nokomis’ transmitter temporarily stopped transmitting September 2. In October, we discovered she made it to Haiti and remained there the rest of the winter. She left Haiti on March 24 and arrived at the same colony as last year on April 13.
- “Mellow” is a female trapped and tagged on Orono Land Trust property, adopted by Old Town High School. Mellow’s summer movements showed she nested in a known great blue heron colony in Orono. Mellow was the last of the tagged herons to migrate south. While still in Maine, her transmitter temporarily stopped transmitting on October 13. As of November 5, she was in Puerto Padre, Cuba, and remained there through the winter. Unfortunately, we think something may have happened to her in Cuba. From March 7 to April 13, her locations were all clustered at a building and we have not received any data since.

Students and teachers from schools across the state played an important role in the field work leading up to the tagging of the five herons by finding foraging herons and baiting them to a trap site. Since then, students have also been tracking the tagged herons online and using the data generated by the solar-powered backpack transmitters in their classrooms. This project is ongoing, and MDIFW would like to get even more students involved in following the birds online and investigating the data further. They will not only learn something about great blue herons, but also make the connection that these birds rely on healthy wetlands, both in Maine and beyond. We are looking forward to following Sedgely, Snark, Cornelia, and Nokomis again this fall to see if they migrate south on the same dates, winter in the same places as last year, and return to Maine to nest again.

For more information on the Heron Tracking Project, including how to follow the great blue herons online and resources for educators interested in using the data in their classrooms, visit maine.gov/wordpress/ifw/heron/tracking-project.

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

Renewed Monitoring Efforts for a Declining Songbird

Stunted or re-generating spruce-fir dominated stands in or near shallow wetlands with scourges of mosquitos and black flies. That doesn't exactly make for the most comfortable working conditions for a field biologist, but that's precisely what rusty blackbirds (*Euphagus carolinus*) are looking for when they return to their breeding grounds across northern North America from their wintering grounds in the southeastern coastal plain of the United States.

Rusties, as they're affectionately called by birders and bird researchers, have experienced one of the steepest population declines of any North American songbird, declining more than 85% since the 1970s. Despite research efforts over the past decade, conservation biologists have yet to identify a "silver bullet" cause for the decline. It's likely cumulative effects from a number of stressors, from climate change related habitat loss leading to range shifts, acidification leading to declines of invertebrate prey on the breeding grounds, to the draining and conversion of wetland habitat on the wintering grounds. But, questions also still remain regarding certain periods of this species' annual life cycle. Specifically, there is a gap in our knowledge of fledgling survival. Researchers traditionally base success and breeding productivity of birds on whether young fledge from the nest or not. This, however, may not be giving us the complete picture.



Rusty Blackbird Nestling (Photo by Kiah Walker)

Carol Foss and the New Hampshire Audubon, in collaboration with the International Rusty Blackbird Working Group, have identified a population of rusties in northern New England and have been monitoring it over the past several years. Two years ago, they discovered bird blow flies parasitizing nestlings. It is currently unknown if these two species have a long evolutionary history or if this association is a more recent phenomenon resulting from increases in spring temperatures. Ultimate mechanism aside, blow fly parasitism has been shown in other species to compromise fledgling survival. So, in collaboration with NH Audubon, Maine Department of Inland Fisheries and Wildlife staff helped expand research efforts into Maine this year to try and better understand the potential impacts this parasite may be having on rusty blackbird survivorship.

With the help of Carol and her crew, we conducted presence/absence surveys at 43 sites throughout Oxford County. We confirmed occupied territories at 11 of those sites, and the crew monitored a total of 28 nests project-wide (five in Maine). To assess possible negative health impacts on nestlings from blow fly larvae, we collected a small amount of blood from nestlings and collected nests after young fledged. We are currently awaiting analysis of results from the 2017 data.

This is the first year of a 3-year project. Pending funding, we hope to expand research in the next two years to include radio-tagging and tracking of nestlings for 8-10 weeks post-fledging to obtain survival estimates, so stay tuned. In closing, we report that all five nests monitored in Maine this year successfully fledged young.

This work is supported by the federal Pittman-Robertson program, Wagner Forest Management, Ltd., New Hampshire Audubon, and the Maine Outdoor Heritage Fund.

-- Adrienne J. Leppold

Two Black Ducks

Beginning in September 2017, waterfowl hunters in the United States will be looking at a significant change in harvest management of American black ducks. For the first time in 34 years, duck hunters will be allowed to take two black ducks per day in their daily bag limit of six ducks for the entire 60-day hunting season.

Waterfowl hunters are used to the 1-bird bag limit for black ducks, since 1983, and to many there appears to have been no significant increase in the black duck population. Some waterfowl enthusiasts even suggest seeing fewer black ducks in recent years. To these individuals, any liberalization in black duck limits seems counterintuitive. The explanation is based in the population models that are the basis behind contemporary Adaptive Harvest Management and waterfowl hunting season recommendations.

Harvest management of the American black duck has historically been based on winter surveys conducted along the entire east coast. I've spent hundreds of hours in airplanes counting black ducks along the Maine coast in January. At the time, this survey was the best available information for managing black ducks. But these winter surveys have long been criticized for inconsistent coastal coverage and for generating incomplete counts of the population. To correct this, wildlife management agencies in the United States and Canada devoted considerable effort and resources towards developing population estimates for breeding black ducks across their range, which includes the entire state of Maine. Using combined analysis of all waterfowl breeding ground surveys, researchers estimated that the black duck population in 2011 to be over 900,000 birds. Further, the 2016 black duck population was believed to be up significantly (+13%) from 2015 and similar to the long-term average. So, it seems black duck populations have basically remained stable or are at least slightly improved recently. During this time period, black duck harvests have ranged from moderate to low. The black duck harvest for the 2015 season was a record low dating back to 1999 in both the U.S. and Canada, with harvest down about one-third from the previous 5-year mean.

During the summer of 2016, the U.S. Fish and Wildlife Service outlined the 2017-2018 optimal harvest policy for the American black duck and described work of the Black Duck Adaptive Harvest Management Working Group, a committee that recommends black duck hunting regulations for the U.S. and Canada based on the international harvest strategy for black ducks. The rationale for the two bird black duck bag limit comes from the outputs of their work and the population models they developed. If one puts faith in the models, recent analyses suggest managers select the moderate (2-bird), not restrictive (1-bird) hunting season package for the U.S. in 2017. This may be a perfect opportunity to demonstrate that we should take a small risk when the available science supports it. We should learn from this management action, and this should help us improve waterfowl management in the future.

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

-- Brad Allen



Black Ducks (Photo by Brad Allen)

Game Birds

Migratory Game Birds

MDIFW collaborates with the USFWS in monitoring migratory game bird populations and assessing harvest of these species. To monitor populations, several surveys are conducted throughout the year that target specific migratory bird species groups, such as sea ducks and dabbling ducks. Following each migratory bird hunting season, harvest is measured using: 1) the Harvest Information Program (HIP), with data on total estimated harvest, an estimate of the number of active hunters, and the estimated number of days afield; 2) the Wing-collection Survey, where hunters contribute one wing from each harvested bird, which serves as a measure of productivity from the past spring; and 3) analysis of band recoveries from numbered metal bands placed on birds prior to the fall hunting season to provide estimates of harvest rates and overall survivorship of a species.

American Woodcock

American woodcock populations are managed on the basis of two regions, referred to as the Eastern and Central Regions. These woodcock populations are basically located east and west of the Appalachian Mountains. Maine is one of the most important states for breeding woodcock within the Eastern Management Region.

Each spring, beginning in 1968, a coordinated survey called the Singing-ground Survey (SGS) is conducted in all states with woodcock populations. Each survey participant records the number of singing male woodcock they hear in the spring along specific routes distributed throughout Maine. Fifty-three routes were completed in Maine in the spring of 2016 by IFW staff, USFWS staff, and a number of volunteers. In 2016, the average number of males heard on Maine's SGS routes was 3.76. In 2015, the average number of males heard on Maine survey routes was 3.32. The 10-year Maine average is 3.76 males/route.

Woodcock hunting season

Based on data from HIP, approximately 2,100 woodcock hunters harvested an estimated 4,700 woodcock in Maine in 2015. This was a decrease in harvest by more than half compared to the previous year. The recruitment index of 1.3 immature (young of the year) to one adult female in the 2015 harvest was below the long-term average of 1.7 young/adult female (1963–2014) and explains, in part, the lower harvest. The recruitment index is a measure of the ratio of immature woodcock per adult female derived from the Wing-collection Survey described above. Maine hunters provided 936 woodcock wings from the 2015 hunting season for that survey.

Waterfowl

Waterfowl harvest metrics are also derived from the Harvest Information Program. Harvest estimates for the 2008 to 2015 waterfowl seasons are listed in the following table (Table 1).

Table 1. Maine Waterfowl Harvest 2008-2015.

Species	2008	2009	2010	2011	2012	2013	2014	2015
American Black Duck	4,683	5,364	3,377	2,133	3,300	3,500	2,300	807
Mallard	11,265	12,711	8,379	7,441	14,000	10,200	9,200	4,159
Green-winged Teal	7,872	4,923	3,189	2,042	2,300	4,600	1,500	1,242
Wood Duck	3,461	7,641	8,567	5,989	6,700	6,500	3,200	3,166
Ring-necked Duck	747	1,763	1,688	454	600	1,200	600	217
Common Goldeneye	2,307	1,469	313	318	600	700	500	497
Total (all regular ducks included)	30,335	33,871	39,100	31,500	39,900	36,000	21,600	12,119
Canada Goose	13,800	4,700	9,194	3,717	9,500	8,800	8,900	7,196
Sea Ducks								
Common Eider	11,143	4,355	4,505	6,400	5,200	3,100	1,000	917
Long-tailed Duck	4,305	656	2,321	2,695	NA	200	100	423
Scoter	4,052	890	1,092	674	3,200	1,800	900	141
Total Sea Duck Harvest	19,500	5,901	7,918	9,769	8,400	5,100	2,000	1,481
Total Waterfowl Harvest	63,635	44,472	56,212	44,986	57,800	49,900	32,500	20,796

Resident Game Birds

Wild turkeys and ruffed grouse are two species of game birds that spend their annual life cycle within the state of Maine. For this reason, all management authority and responsibility remains within MDIFW.

Wild Turkey

The spring wild turkey hunting season is the season of choice for the majority of turkey hunters. Over the last five years, participation in the spring turkey season has remained relatively stable, and the harvest success rate remains high at over 30%. The fall turkey season has been in place since 2002 and saw significant changes in 2013, with the opening of the season for most of the month of October to “shotguns allowable” hunting and to all day hunting in 2014. This is reflected in the increase in the fall harvest in 2013-2016 (Table 2). In addition to extending the fall season to the entire month of October in 2014, the spring season was open to all-day hunting for the first time. In the fall of 2016, the season was extended by one week into November.

Table 2. Wild Turkey Spring (2004-2016) and Fall (2004-2016) Registered Harvests.

Season	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Spring	4,839	6,236	5,931	5,984	6,348	6,043	6,077	5,445	6,079	6,553	5,750	4,852	5,725
Fall	204	157	198	1,843	685	712	1,205	667	958	2,182	1,814	2,718	2,749

Ruffed Grouse

Beginning in 1994, moose hunters have been asked to report the number of ruffed grouse they, and their party, see or harvest during the moose hunting season. Data are compiled by geographic region, and MDIFW calculates the number of grouse seen per 100 hours of moose hunting effort (Table 3). Based on survey results, the 2016 statewide average of 25 grouse seen per 100 hours of moose hunting decreased substantially, compared to 2015, and was on par with what other indices and data suggested.

Table 3. Grouse Seen or Harvested/100 hours of Moose Hunter Effort in Maine for the last 15 years (2002-2016).

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Northeast	23	35	27	11	26	37	31	48	47	59	44	30	59	46	31
Northwest	43	50	56	24	45	44	51	101	101	81	93	62	70	82	50
Eastern Lowlands	29	29	24	8	20	53	23	34	34	30	34	30	62	26	19
West & Mountains	25	26	30	13	25	44	19	36	36	32	50	38	40	28	23
Downeast	13	21	20	9	22	19	28	30	29	15	13	15	14	10	2*
Statewide	27	32	31	13	28	39	30	50	49	43	47	35	52	43	25

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

-- Kelsey Sullivan



American Woodcock (Photo by Sharon Fiedler)

MAMMAL GROUP

The Mammal Group is one of five groups in the Wildlife Research and Assessment Section (WRAS) at MDIFW's Bangor Office. We develop and oversee the monitoring and management programs for Maine's mammals, assist with permit reviews, and provide technical assistance to the general public and policy makers. 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 by responding to public information requests. Finally, the Mammal Group makes regulatory recommendations on hunting and trapping of mammals to the Wildlife Division Director. All regulatory recommendations, planning, and research programs are conducted in close cooperation with regional biologists in the Wildlife Management Section.

Wally Jakubas, Ph.D., Wildlife Biologist and Mammal Group Leader – Supervises Mammal Group personnel, oversees all group activities, helps design and implement research projects, writes and manages grant proposals and contracts, helps design and plan management programs, and facilitates the daily work of mammal group biologists. Wally is the Department's lead biologist for the state endangered New England cottontail and serves on the technical committee of the Rangewide New England Cottontail Conservation Initiative. He is an external member of the graduate faculties of the University of Maine and University of New Hampshire. Wally is the departmental spokesperson on New England cottontail, wolf, and cougar issues.

Randy Cross, Wildlife Biologist – Oversees field work for collecting reproductive, survival, and density information on black bears. Randy supervises field crews that handle hibernating bears, trap bears, and collar 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, participates in the development of bear management plans, and oversees the processing and aging of moose, deer, and bear teeth. Randy has worked for the Department's bear monitoring program for over 30 years.

Lee Kantar, Wildlife Biologist – Oversees Maine's moose management program. Lee's work includes conducting aerial moose surveys, collecting and analyzing biological information from moose, making hunting permit recommendations, serving as the Department's spokesperson on moose, and coordinating MDIFW's participation in the Northeast Wildlife Disease Cooperative. Lee is heading up Maine's portion of the moose survival study being done in cooperation with the University of New Hampshire and the wildlife departments of New Hampshire Fish and Game and Vermont Fish and Wildlife. The primary goal of this study is to determine which factors are affecting moose survival rates and the impact of these factors on moose population growth. Results from this study will be used to develop moose management strategies, estimate year-to-year changes in moose numbers, and determine moose permit allocations.

Cory Mosby, Wildlife Biologist – Oversees the management of furbearers and small mammals. He monitors furbearer populations, makes recommendations on Maine's trapping regulations, monitors the state's bat populations, conducts research on bats and small mammals, and serves as the departmental spokesperson for furbearer and small mammal issues. Cory is currently involved 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, a study on the use of talus slopes by bats for roosting and hibernation, and a study to develop new DNA survey techniques for northern bog lemmings.

Jennifer Vashon, Wildlife Biologist – Oversees the management of black bear and Canada lynx. Jen designs and implements surveys and monitoring plans for bears and lynx, participates in strategic planning, and analyzes biological data for these species. She is the departmental spokesperson on lynx and bear issues, and she has provided technical assistances to other states, the U.S. Fish and Wildlife Service, and other authorities on Canada lynx and black bears. Jen makes annual recommendations for harvesting black bears and provides technical support on nuisance bear issues. She also ensures that the Department meets its obligations under the federal Incidental Take Permit for Canada lynx, a federally-threatened species. Jen is one of the principal investigators on a new lynx genomics study being conducted in collaboration with the University of Massachusetts and the Smithsonian Institute.

Vacant, Deer Biologist – We hope to have a new deer biologist in place by August or September. The deer biologist oversees the deer management system, works closely with a team of regional biologists to make recommendations on the allocation of Any-deer permits, analyzes hunter harvest and biological data from deer, organizes MDIFW's monitoring efforts for chronic wasting disease, and serves as the departmental spokesperson on white-tailed deer issues. The new biologist will lead a large deer winter survival study that is already underway in Maine.



Mink (Photo by Paul Cyr)

MAMMAL GROUP CONTRACT WORKERS AND VOLUNTEERS

Each year, the Mammal Group depends on a number of dedicated, hard-working contractors and volunteers to help us accomplish all of our various projects and tasks. We deeply appreciate the efforts of these people and feel that they should be recognized as part of the team that manages Maine's wildlife. While all of our contractors and volunteers perform vital functions, we would like to recognize several individuals who are providing long-term support for our group.

2016-2017 Contract Workers & Volunteers – Bat Project: Jessie Paulson; **Bear Project:** Jake Feener, Mitch Jackman, William Brad Jones, Ethan Lamb, and Evan Whidden; **Deer Project:** Brittany Currier, Dan Hill, Josh Matijas, Jessie Paulson, Joe Roy, Anneliese Washakowski, Connor White, Holly Bates, Wendell Harvey, Wendell Harvey Jr., Sue Kelly, Jerry McLaughlin, and Eldon McLean; **Furbearer Project:** Priscilla Langlais, Kate O'Connor, and Mike Buyaskas; **Moose Project:** Sue Kelly, Daniel Vilasuso, Zachary Pulsifer, Andrew Jolin, and Diane Dunham; **New England Cottontail Project:** Bri Benvenuti and Katrina Amaral.

MAMMAL CONSERVATION AND MANAGEMENT

White-tailed Deer

2016 Deer Harvest

Season Dates and Structure

Maine offered five different structured hunting seasons (i.e., Expanded Archery, Regular Archery, General Firearms, and two Muzzleloader seasons), which provided hunters a total of 84 days to pursue white-tailed deer in 2016.

Doe Quotas and Any-Deer Permits

There were 45,755 doe permits distributed among 17 Wildlife Management Districts (WMDs) to meet the doe harvest objective of 5,297 adult does. Many hunters elect to not harvest a doe or not hunt. As such, MDIFW often applies an expansion factor to the number of any-deer permits (ADP) to meet doe harvest objectives. This expansion factor results in more permits being issued than does expected to be harvested.

The 2016 any-deer permit allocations ranged from zero in 12 WMDs (i.e., 1, 4, 5, 8-11, 14, 18, 19, 27, and 28) to 8,536 in WMD 21. The top five WMDs receiving the most any-deer permits per square mile were WMD 24 (29 permits/mi²), WMD 21 (18 permits/mi²), WMD 20 (15 permits/mi²), WMD 22 (8 permits/mi²), and WMD 23 (6 permits/mi²).

In 2016, Maine residents drew 29,245 permits, landowners (comprised of residents and non-residents) drew 6,353 permits, juniors (comprised of residents and non-residents) drew 6,366 permits, non-residents drew 1,828 permits, and Superpack permittees won 820 permits. Overall, 75,112 people applied for any-deer permits for the 2016 hunting season (70,390 residents, 9,251 landowners, 7,878 juniors, 4,704 non-residents, and 1,846 Superpack permittees (Superpack permittees were all counted as part of resident applicants)).



White-tailed Deer (Photo by Sharon Fiedler)

Statewide Statistics

Maine's deer hunters registered 23,512 deer during the 2016 hunting seasons (Table 4). Overall, 3,187 more deer were harvested in 2016 than in 2015, representing a 13.5% increase. Approximately 85% of the total deer harvest occurred during the 4-week firearms season. Youth day took place on Saturday, October 22, resulting in the harvest of 236 adult bucks and 423 antlerless deer. Overall, Maine's youth experienced a decrease in their deer harvest by approximately 22% over the 2015 hunting season.

Table 4. Statewide sex and age composition of the 2016 deer harvest in Maine by season type and week. Records were corrected and/or adjusted to account for registration errors.

Season	Sex/Age Class				Total Deer	Total Antlerless Deer	Percent by Season and Week		
	Adult		Fawn				Total	Adult Buck	Antlerless
	Buck	Doe	Buck	Doe					
Archery	760	674	161	141	1,736	976	7%	4%	15%
Expanded	520	507	130	110	1,267	747	5%	3%	12%
October	240	167	31	31	469	229	2%	1%	4%
Youth Day	236	266	88	69	659	423	3%	1%	7%
Regular Firearms	15,376	3,097	945	622	20,040	4,664	85%	91%	73%
Opening Saturday	1,588	399	147	84	2,218	630	9%	9%	10%
October 31 – November 5	3,503	772	227	153	4,655	1,152	20%	21%	18%
November 7-12	3,714	630	199	123	4,666	952	20%	22%	15%
November 14-19	3,255	494	159	102	4,010	755	17%	19%	12%
November 21-26	3,316	802	213	160	4,491	1,175	19%	20%	18%
Muzzleloader	614	224	52	43	933	319	4%	4%	5%
November 28 - December 3	329	68	21	13	431	102	2%	2%	2%
December 5-10	285	156	31	30	502	217	2%	2%	3%
Unknown					144				
Total	16,986	4,261	1,246	875	23,512	6,382	99%	100%	100%

The 2016 statewide harvest of 16,986 antlered bucks was a 14% increase from the 2015 hunting season, in which hunters registered 14,907 adult bucks (Table 5). On average, Maine hunters harvested bucks at a rate of 0.85 bucks per square mile during the 2016 hunting season. Excluding WMD 29, the top five buck-producing (per mi² basis) WMDs in 2016 were (in descending order) districts 24, 22, 21, 20, and 23. Department biologists estimate that, on average, approximately 48%, or approximately 7,155, of the harvested antlered bucks were 1½ year old deer, sporting their first set of antlers.

Overall, 6,382 antlerless deer were registered by hunters. Excluding WMD 29, the statewide total harvest of adult (yearling and older) does was 4,076 individuals, bringing the harvest well below the Department's recommended harvest of approximately 5,297 animals. The additional antlerless harvest was comprised of young of the year. Specifically, Maine hunters harvested 1,250 and 892 male and female fawns, respectively.

Biological Assessment

MDIFW sampled more than 6,431 white-tailed deer during the 2016 hunting season to assess the status and health of the state's deer populations. Some of the characteristics the Department tracks include yearling antler beam diameter, annual mortality, productivity, sex ratios, and breeding success.

The antler size of yearling bucks reflects the general health of bucks in a WMD. We use the diameter of yearling buck antlers to identify when white-tailed deer become overly abundant in an area. If deer become overabundant, they reduce the amount of forage available in an area. The limited availability of preferred foods can prevent deer from obtaining optimum nutrition and attaining optimum antler growth. Specifically, antler beam diameters within the range of 15.5 mm to 16.8 mm indicate a deer population is in balance with the availability of forage. If measurements are larger, there is room for the population to grow. Conversely, if the measurements are smaller, the animals have become too abundant in the WMD and the density of their population may need to be reduced.

In 2016, Maine's yearling bucks generally expressed overall good health with an average beam diameter of 17.4mm and range of 13.4 mm to 19.1 mm across the state. Most of Maine's deer populations could experience further growth without becoming a detriment to themselves.

Table 5. Sex and age composition and harvest numbers of the 2016 deer harvest in Maine by Wildlife Management District¹.

WMD	Total						Harvest Per 100 Adult Bucks		Harvest Per 100 Sq. Miles Habitat		
	Adult		Fawn		Antlerless	All	Adult	Antlerless	Adult	All	Adult
	Buck	Doe	Buck	Doe	Deer	Deer	Does		Bucks ²		Does
1	109	0	0	0	0	109	0	0	8	8	0
2	103	3	0	2	5	108	3	5	9	9	0
3	140	18	6	6	30	170	13	21	16	19	2
4	121	0	0	0	0	121	0	0	6	6	0
5	143	1	1	0	2	145	1	1	10	10	0
6	390	40	10	9	59	449	10	15	27	32	3
7	483	59	17	11	87	570	12	18	35	41	4
8	332	5	4	1	10	342	2	3	17	17	0
9	131	0	1	0	1	132	0	1	15	15	0
10	94	0	1	0	1	95	0	1	10	10	0
11	410	6	1	0	7	417	1	2	25	25	0
12	547	65	22	15	102	649	12	19	60	71	7
13	507	127	39	22	188	695	25	37	90	123	23
14	391	47	14	12	73	464	12	19	53	63	6
15	1,005	134	52	27	213	1,218	13	21	108	130	14
16	1,266	263	79	55	397	1,663	21	31	164	215	34
17	2,196	755	245	171	1,171	3,367	34	53	164	252	56
18	392	41	12	10	63	455	10	16	32	37	3
19	143	1	0	0	1	144	1	1	12	12	0
20	1,099	553	146	119	818	1,917	50	74	189	330	95
21	1,029	507	145	101	753	1,782	49	73	214	370	105
22	931	295	82	55	432	1,363	32	46	215	315	68
23	1,373	422	119	82	623	1,996	31	45	176	256	54
24	499	297	79	60	436	935	60	87	228	426	135
25	929	236	57	43	336	1,265	25	36	132	180	34
26	1,223	189	51	38	278	1,501	15	23	136	167	21
27	460	4	3	0	7	467	1	2	63	64	1
28	265	0	1	1	2	267	0	1	25	25	0
29	343	208	59	50	317	660	61	92	236	455	143
Unknown	16	8	4	2	46	10					
Statewide	17,070	4,284	1,250	892	6,412	23,512	25	38	59	82	15

¹Sex/age data were corrected for errors in the deer registrations

²Recorded BKI

Prospects for the 2017 Deer Season

In 2017, the Department will again offer five separate deer hunting seasons in Maine. The expanded archery season will open September 9 and run through December 9. This season is limited to WMDs 24 and 29, as well as 10 other locations primarily in residential-suburban areas with firearms discharge ordinances. Hunters with a valid archery license may purchase multiple antlerless permits for \$12.00 each and one buck permit for \$32.00. The purpose of the expanded archery season is to reduce human/deer related conflicts in areas with high human populations, while at the same time providing additional hunting opportunity. The expanded archery season targets urban areas that are difficult to access via the October archery and regular firearms hunting seasons. In expanded archery zones, deer populations can only be reduced if each hunter harvests a substantial number of deer. This requires access to huntable land, for the limited number of archers, and an unlimited availability of doe tags.

The regular (statewide) archery season will run from September 28 to October 27. Youth day will be Saturday, October 21, and is reserved for hunters between 10 and 15 years old who are accompanied by a licensed adult. The Department asks everyone to please remember that youth hunters are limited to bucks only in WMDs where any-deer permits have not been allocated. The 25-day regular firearms season opens for Maine residents on Saturday, October 28, and for nonresidents the following Monday. This season ends Saturday, November 25. Finally, the muzzleloader season will begin in all WMDs on November 27 but will end on December 2 (6 days) in WMDs 1 – 11, 14, 19, 27 and 28. Elsewhere, the muzzleloading season will continue to remain open from December 4 to 9. **Crossbow archery season will coincide with modern firearms and during the archery season for special situations. Please review your Maine State Hunting Regulations or contact your local game warden for questions about use of crossbows.**

Availability of any-deer permits among Maine's 29 WMDs is directly related to MDIFW's deer management objectives. The no doe harvest policy will continue in most eastern and northern WMDs, where the population objective is to increase deer densities. In contrast, does must be more heavily harvested to meet, or maintain, current populations objectives of 15 to 20 deer/mi² throughout much of central and southern Maine. Maine's deer density goals are publicly-derived and provide a compromise between the interests of hunting and viewing opportunities, while minimizing potential negative impacts to the public caused by deer (e.g., ornamental plant and crop damage and deer-car collisions).

To accomplish deer management objectives in 2017, we have set doe harvest quotas ranging from 0 to 1,013 animals among Maine's 29 WMDs. The 2016 statewide doe quota of 6,964 does is 24% above the doe harvest goal for the 2016 hunting season. A total of 66,050 any-deer permits will be issued statewide ranging from 0 permits (WMDs 1, 4, 5, 10, 11, 19, and 28) to 9,650 permits in WMD 20.

The allocation of any-deer permits, along with the archery and youth seasons, should result in the statewide harvest of roughly 6,964 adult does and an additional 3,343 fawns in 2016. Antlered buck harvests should approximate 17,453, which is approximately a 3% increase from the 2016 buck kill of 16,986 animals. If normal hunting conditions and hunter effort prevail, Maine's statewide deer harvest should be around 27,760.

Disease Monitoring in Maine's Deer and Moose

Chronic Wasting Disease

Disease Overview:

- CWD is a fatal brain disease of white-tailed deer, mule deer, caribou, moose, and elk. It is similar to mad cow disease which occurs in cattle.
- CWD occurs in wild deer populations in two provinces in Canada and 23 states in the U.S.
- CWD has not yet been recorded as being transmissible to people; however, a human variant of the disease does exist.
- CWD can persist in the environment outside of a host for many years. Recent research has shown that plants can uptake the disease agent and subsequently become a potential vector of CWD.
- Thus far, CWD has a 100% mortality rate in deer.

CWD Monitoring and Prevention in Maine:

- Maine has monitored white-tailed deer for CWD since 1999 and has screened over 9,000 wild deer. Thus far, Maine proudly remains CWD-free.
- MDIFW prohibits the transportation of unprocessed deer carcasses, and/or parts, into Maine from states and provinces that are not adjacent to our state.
- MDIFW will not translocate deer from other states into Maine.

MDIFW Recommends that Individuals:

- Contact their regional wildlife biologist or warden if an animal shows clinical signs of illness, such as loss of fear of humans, drooling, and excessive weight loss.
- Take precautionary steps, such as using latex gloves while processing the animal and sterilizing equipment following processing. These steps will help to reduce potential transmission of the disease to humans. **Again, thus far CWD has not been identified in a person.**
- Avoid consumption of the brain and spinal tissues.
- Refrain from feeding deer during the winter months, as high densities of deer within a small area can increase disease transmission.
- Do not use urine-based lures, as CWD has been shown to be spread via bodily fluids. To the best of our knowledge, commercial lures are not currently monitored for CWD.

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

-- Lee Kantar

Moose

2016 Moose Harvest

Season Dates and Structure

Maine moose hunters could hunt moose for six days by permit within the structure of a split season framework (September/October/November) during 2016. The September season ran from September 26 to October 1, while the October season ran from October 10 through October 15. For the seventh year, a third week of hunting was offered in the North Country (Wildlife Management Districts [WMDs] 1-4, and 19) from October 24 through October 29. The southern Maine moose hunt ran concurrently with the November deer season from October 31 to November 26 and opened for Maine residents on October 29.



Adult Bull Moose (Photo by Paul Cyr)

Moose Permits and Applicants

The annual allocation of moose permits is a function of WMD-specific management goals. Moose management goals are categorized as either recreational, compromise, or road safety. Permit levels changed in eight WMDs between 2015 and 2016, providing an overall decrease of 600 permits. This included decreased antlerless-only permits (AOPs) in WMDs 1-4 and 19 and decreased bull-only permits (BOP) in WMDs 3, 4, and 19. The number of moose permits allocated in 2016 was 2,140. Additional permits may be issued in a given year when permits are deferred one year due to permittee illness, armed service status, or similar situation.

During 2016, a total of 220 AOPs were allotted to five WMDs (1-4 and 19). The number of AOPs allocated in a given district is a reflection of a harvest level that will either grow, decline, or stabilize the district's moose population. Consequently, WMDs that can sustain only limited cow mortality are allocated relatively few AOPs. In contrast, WMDs that can support higher cow mortality and still meet management objectives, due to population size and structure, are allocated more permits. The southern Maine WMD moose hunt is a slight variation on this. Because of low moose densities in southern Maine, only AMPs are allocated. The season is extended to the length of the November deer season to increase the chances of a hunter harvesting a moose. The November time frame was chosen to honor recommendations by landowners who wanted the southern Maine moose season to open concurrently with the November firearms season for deer.

Permits were allocated to qualified applicants in a random computerized lottery. Overall, 54,893 people applied for a moose permit during 2016. This included 38,746 residents and 16,147 non-residents. Out of those applicant pools, 5% of the residents and 1.3% of the non-residents were selected for permits.

Statewide Statistics for 2016

Overall, 1,609 moose were registered during 2016 (Table 6). 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.

Bull Harvest

The 2016 statewide harvest of 1,396 antlered bulls during the Sept/Oct seasons was 206 bulls less than the 2015 harvest (1,602). Among the antlered bulls taken in 2016 (and aged by cementum annuli 1,203), 89 (7%) were 1½ year olds (yearlings) sporting their first set of antlers, while 191 were 2½ year olds (16%), and 198 were 3½ year olds (18%). Mature bulls, 4½ to 18½ year olds, comprised 60% of the bull harvest.

On average, breeding bulls lose approximately 15% of their body mass during the rut. Because of this, and the timing of the fall harvest, bull weights reflect a decrease in body mass from September to October. Average bull weights (yearling and older) in the 2016 harvest for September were 741 pounds versus 678 pounds (i.e., dressed weights) in the October harvest (a 8.5% decline). The heaviest bull weighed in at 1,061 dressed (no digestive tract, heart, lungs, or liver) and was killed in WMD 1 during the September season (7½ years old). The largest antler spread was 64.5 inches on a 9½ year old bull with 20 legal points. Among antlered bulls examined in the harvest, 12% of the bulls sported cervicorn antlers (antlers without a defined palm) and 35% of these animals were yearlings; 20% were mature bulls (>4 years old) including the oldest at 13½ years old.

Table 6. 2016 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.

WMD	Season	Permit Type	Number of Permits	2016 Registrations		WMD	Season	Permit Type	Number of Permits	2016 Registrations		
				Kill	Success Rates					Kill	Success Rates	
1	Sept.	BOP	150	127	85%	15	Nov.	AMP-B		3		
	Oct.	BOP	125	100	80%			AMP-C		2		
	2 nd Oct.	AOP	50	47	94%			WMD Subtotals	25	5	20%	
2	Sept.	BOP	100	86	86%	16	Nov.	AMP-B		6		
	Oct.	BOP	100	73	73%			AMP-C		1		
	2 nd Oct.	AOP	50	44	88%			WMD Subtotals	20	7	35%	
3	Sept.	BOP	75	71	95%	17	Oct.	BOP	20	6	30%	
	Oct.	BOP	60	58	97%			WMD Subtotals	20	6	30%	
	2 nd Oct.	AOP	50	46	92%			WMD Subtotals*	40	22	55%	
4	Sept.	BOP	125	103	82%	18	Oct.	BOP	40	22	55%	
	Oct.	BOP	75	56	75%			WMD Subtotals*	40	22	55%	
	2 nd Oct.	AOP	50	40	80%			Sept.	BOP	45	30	67%
5	Sept.	BOP	100	93	93%	19	Oct.	BOP	30	22	73%	
	Oct.	BOP	25	25	100%			2 nd Oct.	AOP	20	16	80%
	2 nd Oct.	AOP	50	40	80%			WMD Subtotals*	95	68	72%	
6	Sept.	BOP	100	86	86%	22	Nov.	AMP-B		0		
	Oct.	BOP	25	25	100%			AMP-C		0		
	2 nd Oct.	AOP	50	40	80%			WMD Subtotals	0	0	0%	
7	Sept.	BOP	100	86	86%	23	Nov.	AMP-B		0		
	Oct.	BOP	25	22	88%			AMP-C		2		
	2 nd Oct.	AOP	50	40	80%			WMD Subtotals	25	2	8%	
8	Sept.	BOP	100	86	86%	25	Nov.	AMP-B		3		
	Oct.	BOP	25	22	88%			AMP-C		2		
	2 nd Oct.	AOP	50	40	80%			WMD Subtotals	25	5	20%	
9	Sept.	BOP	100	93	93%	26	Nov.	AMP-B		0		
	Oct.	BOP	25	25	100%			AMP-C		1		
	2 nd Oct.	AOP	50	40	80%			WMD Subtotals	10	1	10%	
10	Sept.	BOP	100	86	86%	27	Oct.	BOP	10	4	40%	
	Oct.	BOP	25	22	88%			WMD Subtotals	10	4	40%	
	2 nd Oct.	AOP	50	40	80%			WMD Subtotals	20	14	70%	
11	Sept.	BOP	100	93	93%	28	Oct.	BOP	20	14	70%	
	Oct.	BOP	25	25	100%			WMD Subtotals	20	14	70%	
	2 nd Oct.	AOP	50	40	80%							
12	Sept.	BOP	25	20	80%	OVERALL WMD TOTALS						
	Oct.	BOP	25	21	84%	2,140	1,609	75%				
	2 nd Oct.	AOP	50	41	82%							
13	Sept.	BOP	25	20	80%							
	Oct.	BOP	25	21	84%							
	2 nd Oct.	AOP	50	41	82%							
14	Sept.	BOP	25	20	80%							
	Oct.	BOP	25	21	84%							
	2 nd Oct.	AOP	50	41	82%							

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 with 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.

Antlerless Harvest

The 2016 statewide harvest of adult (yearling and older) cows decreased from the 2015 harvest (156 vs. 335, respectively). Fewer antlerless-only permits were issued in 2016 in response to approaching publicly-derived population objectives in some management districts, with the bulk of the decrease occurring in WMD 4. This reduction in permits resulted in the decrease in the antlerless-only harvest. In addition to the 156 adult cows that were harvested, 15 calves (5 males and 10 females) were harvested for a total harvest of 172 antlerless moose for the 2016 season. This decrease included the antlerless moose taken as part of the 105 AMPs issued within the southern zones. The antlerless moose harvest in the southern zones was comprised of 12 bulls and 8 adult cows.

Moose Reproductive Data

Antlerless permits during the second October season, in WMDs 1-4 and 19, allowed us to collect reproductive data critical to assessing and monitoring moose population health and growth. In 2016, hunters removed and brought in 67 sets of moose ovaries for examination by biological staff. A cow's body weight and condition have a bearing on her potential to become pregnant and on the number of offspring she will produce. Pregnancy rates of cow moose with age and weight data was similar to 2015 at 92%. Typically, moose do not become pregnant until 2½ years old. Of the cow moose examined this year, 0% of yearlings and 92% of the mature cows (2½+ years) were pregnant.

Corpora lutea are identifiable structures within the ovaries that provide an indication of ovulation and potential pregnancy rates. Overall, there were 1.08 corpora lutea / cow for cows older than 3½ years. While this is an improvement from 2015 by 0.17, it remains an indication that moose in the northern portion of the state have relatively low reproductive rates (number of calves being born to a cow). A cow's reproductive rate is highly influenced by its nutritional plane. A cow's nutritional plane can be affected by the amount of available food in its environment or by diseases and parasites, such as the winter tick. We anticipate that additional sampling of female moose will provide a clearer picture of this relationship across northern Maine, as well as regionally.

Hunter Participation, Residency, and Success Rate

In 2016, 1,935 residents and 205 non-residents won permits to hunt moose. Most non-residents were successful in their hunt (84% success rate). Out-of-state hunters came from 35 states (as far away as Alaska/Hawaii). The majority (19%) of out-of-state hunters came up from Pennsylvania. Resident success rates were 74% and, when combined with the outstanding success by out-of-staters, the total success rate was 75% statewide. The higher success rate of out-of-state hunters, as compared to residents, may be attributed to the higher proportion of out-of-state hunters using registered Maine Guides for their hunt. Success rates over the last 10 years have been around 80%. Conditions for September and November were seasonable; however, multiple days in September and October were, yet again, unseasonably warm.

Changes for the 2017 Moose Season

In 2017, there will be four separate moose hunting periods in Maine. The September season will run from September 25 to September 30 in WMDs 1-6, 11 and 19; the October season will run from October 9 through October 14 and include 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 October 30 through November 25. Opening day for Mainers will be on Saturday, October 28. Lastly, WMDs 1-4 and 19 will have an additional moose hunt in October from October 23 through October 28. In total, Maine's moose hunt will offer 2,080 permits for 2017.

Comprehensive Moose Management in Maine

Beginning in the winter of 2010-11, MDIFW began conducting aerial surveys to estimate moose abundance and composition (bull, cow, and calf) across the core range of moose in Maine (roughly a line from Grafton Notch to Calais). Aerial survey data, 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 (i.e., size and composition) than ever before. Biologists and regulators (e.g., MDIFW Advisory Council) use these data to set moose permit levels to meet publicly-derived management goals. Moose viewing and moose hunting are two primary goals for moose that are equally weighed for management purposes.

Moose Adult Cow and Calf Survival Study

The size of Maine's moose population is not static and will fluctuate over time in response to many factors, including birth rates of calves and the survival of adults. In the winter of 2014 in western Maine (WMD 8), the Department began an adult female and calf survival study to monitor their survival rates over a minimum of five years and more closely examine sources of mortality. In 2016, a second study area in northern Maine (WMD 2) was added. Since 2014, we have captured 286 moose and fitted them with GPS collars. These collars enable us to track



Adult Cow Moose (Photo by Paul Cyr)

moose locations and movement over time, as well as receive text/email messages if the moose dies. We collect detailed health information from each moose that includes an assessment of blood parameters, parasite loads, body condition, and winter tick loads. Adult cows are observed each spring and summer to determine reproduction and survival of calves. This information is providing researchers with an in-depth and unprecedented look at moose health and the impact of parasites on survival and reproduction. This winter, an additional 70 calves will be fitted with GPS collars as part of this ongoing research. The study is in cooperation and collaboration with the University of New Hampshire, New Hampshire Fish and Game, and the University of Maine-Animal Health Lab.

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

-- Lee Kantar

Black Bear

Maine's black bear, an iconic symbol of Maine's forests, is one of Maine's wildlife success stories. Once relegated to no more than a nuisance, the black bear has risen in stature to one of Maine's most prized animals. Today, the expansive forest of northern, eastern, and western Maine supports one of the largest black bear populations in the Lower 48 States (Figure 2).

Maine's bear population is valued not only by hunters, but also others who enjoy watching wildlife and appreciate Maine's wildlife diversity. Unfortunately, when conflicts with people and bears occur, their value can diminish. MDIFW strives to balance biological and social needs by making management decisions based upon science gathered from monitoring Maine's bear population, bear harvest, and conflicts. Maine's black bear population is closely studied by Department biologists through one of the most extensive, longest running biological studies 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.

Since 2005, Maine's bear population has been increasing. Hunting is the Department's primary tool for managing this thriving bear population. To maintain bear populations at a healthy and socially-acceptable level, a variety of traditional hunting methods are offered in Maine. These include hunting with dogs, still-hunting/stalking, hunting with bait, and trapping. Hunters can also take a bear while hunting deer. Over 90% of the bears killed each year by hunters or trappers are taken with the aid of bait or dogs. Still-hunting/stalking accounts for less than 10% of the harvest. Even with these ample hunting opportunities, the odds that a hunter or trapper will take a bear remain challenging. Only 26% of hunters using bait or dogs and less than 20% of the trappers actually harvest a black bear. Hunters that use still-hunting or stalking techniques to harvest black bears have the lowest success rates (<3%), due, in large part, to Maine's dense forests.

Since 2005, the number of bears harvested each year has been below levels needed to stabilize the growth of the bear population. As a result, Maine's black bear population has increased from 23,000 black bears in 2004 to ~36,000 in 2015. 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 level of conflicts between bears and people is attributed, in part, to bears being more common where human densities are lowest. However, if Maine's bear population continues to grow, conflicts could rise as bears move into areas with higher human densities.

Maine's black bears are highly valued by outdoor enthusiasts and the general public. The Department understands that a healthy, well managed bear population provides opportunities for everyone to enjoy black bears without causing conflicts in backyards and neighborhoods to increase. With public input, biologists set management goals through the Department's strategic planning

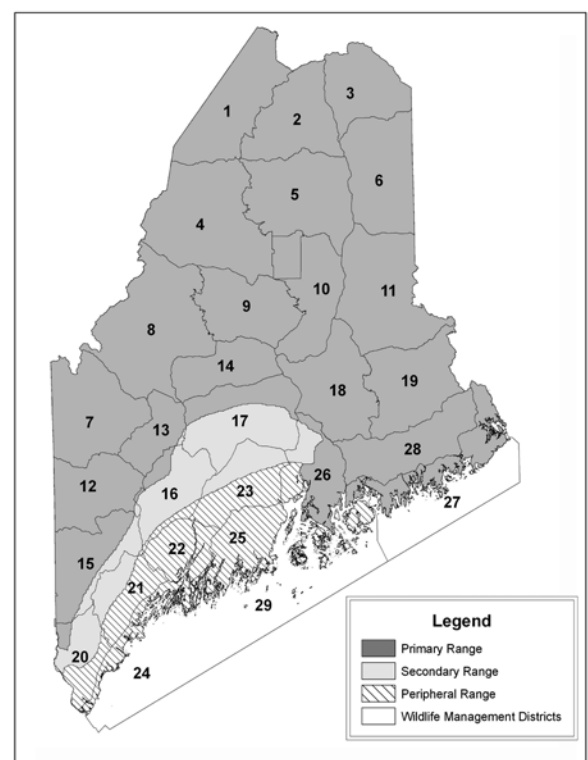


Figure 2. Maine black bear range.

process. Currently, an updated planning document for Maine's big game species (deer, moose, bear, and turkey) is being prepared to help guide management of Maine's big game over the next 10-year planning period. Public acceptance for an increasing bear population and management options to address a growing bear population will be carefully considered in this plan.

Living with Black Bears

The abundance of natural resources, including wildlife, is what makes life in Maine especially enjoyable. With more than 90% of Maine forested, Maine's bear population is one of the largest in the country. Although conflicts between people and bears are relatively uncommon, if you live in a community that is experiencing problems with bears, conflicts can be a great concern. The majority of conflicts between bears and people 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 bears search for limited food, 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, which reduces conflicts with people. However, when these natural foods are not abundant, bears are more likely to continue to search for food provided by people. The most common complaints we receive each spring involve bears feeding at bird feeders and on garbage. Although it may seem simple to move or destroy the offending bear, if you don't eliminate food and their odors, bears will likely continue to visit your backyard.

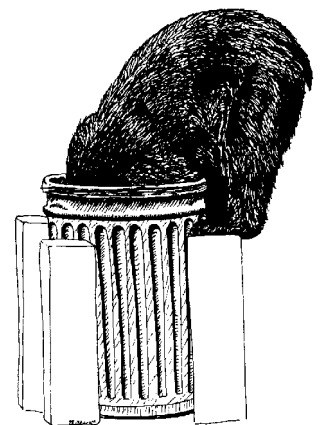
Many people expect the Department to move bears that are frequenting backyards, communities, and agricultural areas because it provides a quick fix to a problem. However, trapping and moving a bear is not always appropriate or effective. Bears that are trapped and transferred to a new area do not stay where they are released. Often these bears return to the area or create problems in new areas. In addition, moving bears puts them at greater risk of mortality, as they encounter more roads, other bears, and people. However, in some situations, it may be appropriate to move a bear to provide a temporary solution to a problem that has resulted in extensive property/livestock damage or poses a potential risk to human safety. Even when bears are trapped and transferred to new areas, efforts to remove or secure attractants to avoid future problems should be implemented.

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, neighborhood, or while recreating in Maine. Please check it out at maine.gov/ifw/wildlife/human/lww_information/bears.html.

To avoid enticing bears to your backyard, neighborhood, or farm, the best solution is to remove/secure common bear attractants every spring before you experience problems.

All of us can take a few simple steps each spring to reduce encounters with black bears.

- Bring your bird feeders in by April 1 and do not resume feeding birds until November.
- Store bird seed in a secure location and rake and remove waste seed from the ground.
- Keep your garbage secure in a building.
- Do not bring trash to the curb until the morning of pick-up.
- Keep dumpster lids closed and locked. If a dumpster is overflowing with garbage, call the disposal company and have the waste removed.
- Keep pet and livestock feed in a building or other secure enclosure.
- Clean or burn off outdoor grills to reduce food odors; if possible, store the grill in a building when not in use.
- Use electric fencing around bee hives and avoid setting hives close to forested edges.
- When possible, keep livestock and poultry indoors at night.



Remember, if your neighbors are not taking these steps as well, then bears may continue to frequent the area.

The 2016 Black Bear Hunting and Trapping Season

The Department'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, in turn, adjust regulations, as needed, to meet Maine's bear harvest objectives.

Currently, hunters are allowed to harvest bears during the fall using a variety of methods. Starting in 2015, the season opened one day early (the last Saturday in August) for youth hunters. In 2016, 27 youth hunters harvested a bear on youth day. The general hunting season for black bears opens the last Monday in August and closes the last Saturday in November. Hunters are allowed to hunt bears near natural food sources or by still-hunting throughout this three-month period. Hunting bears over bait is permitted for the first four weeks and with the use of dogs for a six-week period that overlaps the last two weeks of the bait season.

Trappers can harvest a bear in September or October. Trappers must use a cable foot restraint or cage-style trap. Since 2008, trappers are required to purchase a separate permit to trap a bear. Based on permit sales, interest in trapping a bear is on the rise, especially among residents. In 2016, 105 bears were taken in traps; the majority was harvested by residents (81%). The number of trappers purchasing a permit to trap bears reached a high point in 2014 with 676 permits sold. This high interest in bear trapping in 2014 was likely in response to a ballot initiative that, if passed, would have eliminated traps, bait, and dogs as legal harvest methods. In 2016, 668 trapping permits were purchased, 598 by residents and 70 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 has increased incrementally each year to 24 hunters by 2015. During the 2016 season, the trend reversed with only 15 hunters/trappers harvesting a second bear.

Although most bears in Maine are harvested by hunting over bait, since 2013, we have seen an increase in the proportion of bears harvested with the use of dogs. In 2016, 68% were taken over bait, 21% with dogs, 2% by deer hunters, 1% by still-hunting or stalking prior to deer season, and 4% in traps. The remaining 4% were taken by hunters that did not report their method of harvest (Table 7). 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.

Table 7. Number of bears harvested in Maine in 2016 by Wildlife Management District (WMD).

WMD	Method of Take						Total Harvest	Assisted by Archery ²	Assisted by Guide	Resident	Non-resident
	Hunting with Bait	While Deer Hunting	Hunting with Dogs	Spot and Stalk	Trapping	Unknown ¹					
1	131	0	19	0	2	6	158	14	122	45	113
2	84	0	33	1	3	4	125	8	107	12	113
3	119	0	7	1	10	6	143	14	108	47	97
4	179	0	15	1	2	7	204	17	142	69	137
5	113	0	44	1	4	18	180	18	150	29	152
6	144	3	16	8	5	1	177	28	108	62	115
7	98	4	30	0	8	3	143	15	77	52	91
8	161	2	54	1	16	7	241	17	159	107	135
9	68	1	22	2	1	3	97	10	60	32	65
10	88	1	14	0	1	10	114	16	85	34	81
11	138	3	65	1	10	8	225	20	162	48	177
12	87	6	55	2	13	9	172	21	52	106	66
13	17	2	19	0	2	1	41	0	22	24	17
14	40	0	33	0	3	4	80	3	52	40	40
15	35	13	27	1	1	6	83	9	12	68	15
16	2	0	0	1	3	2	8	1	0	8	0
17	26	3	18	0	1	8	56	3	22	36	20
18	111	1	23	1	6	2	144	15	86	61	83
19	87	1	58	1	0	6	153	12	127	23	130
20	3	6	2	0	0	2	13	0	0	13	0
21	2	3	0	0	0	0	5	0	0	4	1
22	0	0	0	0	0	0	0	0	0	0	0
23	2	3	0	0	0	0	5	1	1	5	0
24	0	0	0	0	0	0	0	0	0	0	0
25	1	0	1	1	0	1	4	0	0	4	0
26	38	3	1	4	5	2	53	3	7	49	4
27	45	6	6	1	5	0	63	4	27	38	25
28	116	2	33	3	4	6	164	17	114	65	99
29	0	0	0	0	0	0	0	0	0	0	0
Unreported	0	0	0	0	0	0	8	107	2	0	0
State Totals	1,935	63	595	31	105	122	2,859	373	1,804	1,081	1,776

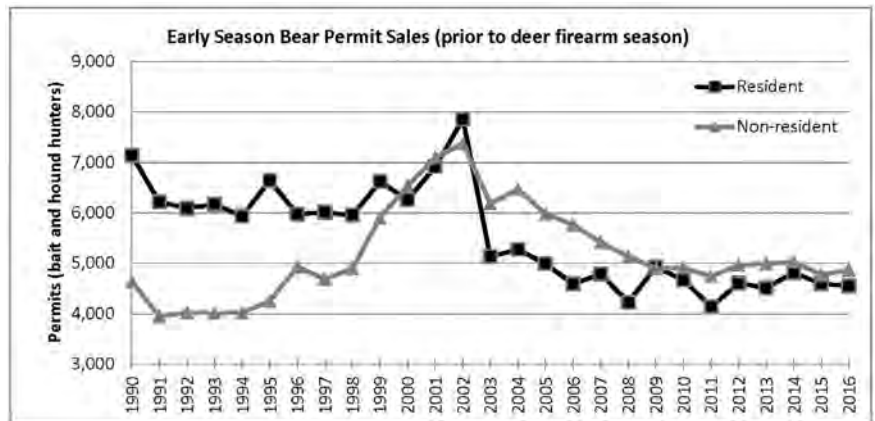
¹Unknown Method = Hunter did not report the method they used to harvest their bear.

²This includes 53 bears harvested with a crossbow.

Since 2005, Maine's annual bear harvest has been below the level needed to stabilize the bear population. Although harvest numbers tend to fluctuate from year to year, often with alternating high and low years, the bear harvest has averaged around 3,000 animals since 2005. During the 2016 season, Maine's bear harvest was slightly lower than average, with 2,859 bears registered at check stations, and broke the alternating trend of a lower harvest following a higher harvest. Although many factors may influence the black bear harvest rate, the abundance of natural foods during the baiting season is the primary factor affecting Maine's harvest rates. Weather, especially during the first two weeks of the baiting season, also impacts the final tally. A low availability of natural foods in the late summer and early fall increases a bear's interest in bait and overall activity. Conversely, harvest rates are lower when natural foods are abundant. Because the bait harvest comprises the greatest portion of the overall harvest, natural food levels can have the greatest impact on the final harvest figures. Abundant natural food availability also causes bears to forage later in the fall, increasing their vulnerability to harvest by deer hunters in November. Although natural foods were generally lower this year, the abundance of black berries during the start of the 2016 season likely influenced the lower bait harvest. Despite the large number of deer hunters (over 170,000), their harvest of bears comprise a small proportion of the annual harvest (1-10%), averaging less than 100 bears each fall. In 2016, 71 bears were harvested by deer hunters; 2 bears were harvested by deer hunters during the deer archery season and 61 by deer hunters during the November deer firearm season. The low availability of natural foods in late fall likely influenced this low harvest rate. In 2015, when natural foods were more abundant during deer season, 119 bears were harvested by deer hunters.

Although non-resident permit holders account for just over half of Maine's bear hunters, they continue to harvest close to 2/3 of the bears taken. While most non-resident hunters hire a guide, fewer resident bear hunters hire guides, which may account for the higher success rate of non-resident hunters (in 2016 resident success rate = 22% and non-resident success rate = 36% prior to the deer firearm season). In 2016, non-resident hunters harvested the majority of bears during the bait (67%) and hound seasons (65%). Hunting over bait is also the most popular method for resident bear hunters and accounted for 58% of the bears harvested by Maine residents. Although fewer bears are taken by deer hunters or trapping, Maine residents harvested the majority of bears taken by these two methods (97% and 77%, respectively) in 2016.

Non-resident hunters became more interested in hunting black bears in Maine following the closure of the spring bear hunt in Ontario in 1999. Their interest remained high until 2003, when a rise in permit fees lowered participation by both non-resident and resident hunters. This was especially true for residents. When the fee increased from \$5.00 to \$25.00, hunters that were actively hunting bears were more likely to purchase the permit than hunters that purchased a permit for the opportunity to take a bear while hunting other game. After this sharp decline in bear hunters in 2003, and a slight bump in bear hunting participation during the bear hunting referendum year (2004), bear hunter numbers have declined steadily until 2009 and have stabilized at around 11,000 hunters. The downward trend in participation rates was especially significant for non-resident hunters, since they have a higher success rate and, thus, have a greater influence on the final harvest level. It is likely that economics and increased opportunities to hunt bears in other states have influenced non-resident hunter participation. Over the next few years, we will explore options to increase hunting opportunities and promote bear hunting to increase hunter participation.



Starting in 2008, trappers and non-resident deer hunters are required to purchase a bear permit to harvest a bear by trap or during deer firearm 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 the age structure of Maine's bear population and trends in bear numbers. In 2016, 845 non-resident bear permits for deer season and 668 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

A Northern Species

Canada lynx, as their name implies, are found primarily in Canada but also in several northern states, where habitat and weather patterns are similar to their northern neighbor's (Figure 3). The region's boreal forest and winter snow pack are essential components for supporting lynx. Like snowshoe hare, lynx have large, well-furred feet that give them a competitive advantage in deep snow. Thus, lynx are able to thrive in the harsh winter conditions associated with northern latitudes. In Maine, lynx are found primarily in northern Maine's spruce/fir forest, where snow depth often remains above a foot for at least three months of the year.



Figure 3. Canada lynx range. (Photo by IUCN Red List)

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

Maine's lynx population has been growing since the 1990s in response to favorable habitat conditions that support an abundance of prey. Estimates suggest there are more than 1,000 adult lynx in northern Maine, and, when their offspring are included, their population may approach 2,000. Lynx are prey specialists, and their diet is composed primarily of snowshoe hare. Snowshoe hare are most abundant in young, dense spruce/fir forests. These dense forests provide both cover and food for hare. Hare can also be found in older forests, if the forest has a dense understory of trees. Lynx do well in forests following natural or human disturbance (e.g., wind damage or forest cutting) because it promotes the regrowth of the forest and the dense forest structure snowshoe hare need.

Over the last 15 years, people living in northern Maine, or recreating there, have been seeing lynx more regularly. Since lynx are naturally calm animals, and are generally ambivalent to the presence of people, lynx often remain in the area long enough for the viewer to snap a photograph 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?

With more than 90% of Maine's land area classified as forest, Maine is the most forested state in the continental U.S. and supports the greatest acreage of spruce/fir forest. Much of Maine's spruce/fir forest is found in northern Maine, where snow conditions are ideal for lynx and human development is low. Most of northern Maine is privately-owned and managed for forest products. The commercial harvest of spruce and fir has benefitted lynx by promoting regeneration of dense thickets of spruce and fir. In particular, a major insect outbreak in the 1980s impacted most of northern Maine's spruce and fir forest and extensive areas were cut to salvage dead or diseased trees. This combination of natural and human disturbance created a record high level of habitat for lynx and has allowed snowshoe hare and lynx populations to thrive.

Lynx Management in Maine

Lynx are a federally-threatened species and a state species of special concern. MDIFW's management efforts include monitoring lynx status and distribution, monitoring habitat conditions, maintaining closed hunting and trapping seasons, law enforcement to reduce illegal activities, implementing measures to minimize accidental take of lynx while trapping other species, and sharing information with private land managers so they can continue to provide habitat for lynx in Maine.

The Department began collecting baseline information on the status of lynx by conducting winter snow track surveys along the Maine/Quebec border in the 1990s. This effort was expanded to most of northern and western Maine during the next decade to document the distribution of lynx in the state. In 1999, a 12-year telemetry study, that involved capturing and radio collaring lynx in a four township area in northern Maine, was initiated. This study was instrumental in documenting the status of Maine's growing lynx population and providing habitat recommendations to private forest landowners. Biologists used this information to develop a species assessment and produce the first data-driven population estimate for Maine lynx in 2006.

With an increase of reliable observations of lynx and kittens in eastern and western Maine, the Department began updating lynx population estimates in 2015. This includes systematically resurveying more than 90 towns in northern, western, and eastern Maine during the winter months to identify areas with lynx based on detecting their tracks in the snow. Biologists also began a second telemetry study, in which lynx are being equipped with GPS collars to identify the habitats lynx are using across Maine. The GPS collars not only allow biologists to compare the types of habitats being used by collared lynx to previous telemetry studies, but also will enable biologists to locate lynx denning sites to estimate how many young are being born each year.



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. (Photo by C. Gail Smith)

Snow Track Surveys - Past vs. Present

Between 2003 and 2008, MDIFW biologists surveyed 91 towns in northern Maine and found lynx in 43 towns (47% were occupied by lynx). Preliminary results from the current survey effort suggest that the lynx are occupying a greater percentage of the available habitat in Maine (lynx were found in 37 of 42 [88%] towns surveyed to date). Current plans are to complete the survey effort this winter and determine both the statewide distribution of lynx and the percentage of towns in which they reside.

Telemetry Studies – Past vs. Present

Between 1999 and 2012, the Department captured 191 lynx near the Allagash Wilderness Waterway in northern Maine and monitored 85 of these lynx with either GPS or VHF collars. This study identified habitats and size of areas being used by lynx. Lynx spent most of their time in the regenerating spruce/fir clearcuts that supported some of the highest snowshoe hare densities in Maine. In these areas, a male shared an area with two to three female lynx, and most adult females produced kittens each year (litters ranged from one to five kittens). Lynx densities and the proportion of occupied areas, as determined by Department snow track surveys, were used to generate lynx population estimates for the state.

Since the fall of 2016, Department biologists have put GPS collars on eight lynx. Most of these lynx have been along the southern periphery of lynx range. All eight lynx have established home ranges, indicating that these areas support resident lynx. This spring, two female lynx, equipped with GPS collars, both produced a litter of two kittens. The Department plans to equip an additional 10 lynx with GPS collars during the fall of 2017 to obtain more information on habitat use and lynx productivity across the state. From this information, the Department should be able to determine which forest conditions continue to support lynx and update its population estimates. This information will be made available to forest managers and the general public.

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

-- Jennifer Vashon

Furbearers

Overview of Trapping Season

Trapping effort, as indicated by the number of active trappers or traps being set, appeared to be lower than normal this past year. The low harvest of furbearers this past trapping season (Table 8) is likely a reflection of this low trapping effort. Trapping effort was impacted by low fur prices and additional trapping regulations (e.g., exclusion devices statewide when setting body gripping traps on dry land, chain and swivel configurations for foothold traps). Although the overall trend was for fewer animals to be trapped, there was an upswing in the marten harvest compared to last year (Table 8). Upon discussion with the trapping community, it seems that more trappers have adopted the use of the exclusion devices for marten and have found that they work well for harvesting this species. The adoption of the same devices for fisher seems to be less positive, and the Department will continue to monitor how this tool affects the harvest of fisher.

Table 8. Annual harvest of Maine's furbearing species from the 2007 to the 2016 trapping and hunting seasons.

Species	16-17	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08
Beaver	3,267	4,953	3,578	7,841	9,063	15,769	6,976	10,765	9,119	6,357
Bobcat	190	236	126	124	205	239	305	281	407	410
Coyote	878	1,281	868	1,237	1,670	2,037	1,623	1,743	1,901	1,819
Fisher	329	302	653	617	1,242	925	1,207	1,078	1,456	993
Red fox	407	575	269	642	991	989	922	932	893	1,030
Grey fox	140	287	496	279	426	308	332	250	163	161
Marten	1,084	380	1,145	996	3,805	1,317	3,559	2,613	2,291	2,401
Mink	454	1,148	1,041	1,398	2,184	2,339	1,926	1,465	1,297	1,888
Otter	296	486	261	464	646	1,234	754	696	528	493

Furbearer Management

Last year, the Department started two projects to further strengthen its furbearer program. One 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 of these species. The second project involves monitoring populations of forest carnivores (with an emphasis on marten and fisher) using trail cameras. This project will provide population trends based on occupancy rates (i.e., the number of areas that have marten or fisher living in them vs. the number searched) over large areas of the state. Ultimately, the goal of the project is to develop a monitoring protocol using trail cameras that the Department will use to monitor fisher, marten, and, potentially, other furbearers into the future.

1. Overview of tooth submissions: Year One

The furbearer trapping and hunting season of 2016 marked the first year of mandatory submission of a tooth sample of any harvested bobcat, fisher, marten, and otter. This year, the Department collected nearly 1,200 tooth samples (63 bobcat, 234 fisher, 644 marten, and 255 otter) representing 33% of the bobcat, 71% of the fisher, 59% of the marten, and 86% of the otter harvest(s). The number of teeth that were turned into the Department was exceptional, considering the delay in publicizing information on the new rule and it being the first year of the program. Biologists expect that tooth submission rates will increase in the future once the trapping community becomes familiar with the requirements and submission routine.

Over the past few months, biologists and volunteers have cleaned and prepped tooth samples collected in 2016 for aging. Samples were shipped to a laboratory that specializes in tooth aging, and results will be sent back to the Department by the fall of 2017. The age and sex data collected from these samples will provide insight into how intensively these species are being harvested. Furthermore, 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.

2. Overview of Trail Camera Monitoring: Year One

In January 2017, a Ph.D. student, hired by the University of Maine and the Department, began field work in northern Maine on a marten/fisher study. The overarching goal of this project is to develop a monitoring protocol, which is independent of the trapping harvest, to track the statewide trends of marten and fisher populations. Developing such a project requires several steps, and this past winter was just the first season of a five-year study. The initial goal of the work conducted this winter was to identify the optimal survey design that balanced the time and effort needed to sample a site with the likelihood of detecting a marten and/or fisher. Once the survey design has been selected,



Figure 4. A sample of species detected during the 2017 winter camera trapping surveys (from L to R, top to bottom: American marten, fisher, coyote, snowshoe hare, red fox, and white-tailed deer).

large areas of the state will be sampled to investigate whether occupancy rates of forest carnivores change across the landscape, especially in relation to forest composition, access, and harvest pressure.

- **Year One Results**

Between January and March 2017, 160 trail cameras were placed at 32 independent sites (five cameras per site with spacing between cameras at either 100 or 150 meters). From these cameras, a total of 7,882 images were collected, representing 19 species of animals (Figure 4). Marten were observed at 75%, fisher at 50%, weasels at 53%, coyote at 50%, and red fox at 28% of the sites surveyed. Other species of interest were detected, but detection rates were lower and will be analyzed at a later date. Initial results indicate that three cameras baited with beaver meat and a skunk-based lure, placed 100 meters apart, provide the optimal balance between probability of detection and survey efficiency.

- **Next Steps**

Using the design identified from the winter of 2017 sampling efforts, the student and her technician will deploy cameras at 125 unique sites throughout Wildlife Management Districts 1-11, 14, 18, 19 and Baxter State Park between June and August 2017. The student will investigate whether detecting marten and fisher differ between summer and winter sampling periods and how forest composition influences occupancy rates. While the project is currently focusing on marten and fisher, data is being collected on all species recorded at these camera stations. Future research efforts will explore the value of this monitoring protocol for other species of forest carnivores, such as coyote, bobcat, weasel, fox, and prey items like snowshoe hare. Ultimately, by monitoring the occupancy rates of forest carnivores over large areas of the state, biologists will be able to track changes in carnivore populations over time.

Small Mammals

Northern Bog Lemming

The northern bog lemming (NBL) is a mouse-sized rodent commonly found in central Canada and Alaska but is found in Maine at four sites and is a state-threatened species. Sampling for the species is difficult. Conventional sampling methods used to capture small rodents (box traps, pitfalls, and snap traps) do not perform well for NBL. Furthermore, differentiating the much more numerous southern bog lemming from the NBL requires biologists to euthanize the specimen and examine its dentition. This combination of rareness and difficulty of sampling requires thinking outside the box to improve our understanding of the species range and habitat preference in Maine.

With this in mind, the Department has partnered with Dr. Zach Olson of the University of New England (UNE) to develop a survey technique for NBL using DNA samples collected from the environment. One readily available source for DNA samples in the environment is feces. When feces pass through an animal's digestive tract, small amounts of cellular material are shed from the 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, UNE was successful in developing a technique to differentiate NBL from other rodents based on their genetic code (Figure 5). 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. It is unknown if the site with no NBL samples was truly void of NBL or if they were just not identified during the sampling technique; biologists will look into this further during the 2017 sampling season.

Next Steps

The technique utilized in 2016 did work but was time consuming. This fall, biologists will be working on refining the current technique of sampling, via collecting fecal pellets, and investigating the feasibility of an environmental DNA (eDNA) technique, where DNA is extracted from water samples collected in habitat suspected of containing NBL, as an additional tool to sample for the species. With this eDNA approach, water samples are collected, often from a stream system, where it is suspected that a species of interest lives upstream of where the sampling occurs. Since DNA is in all components of an animal's body (tissue, hair, shed skin, etc.), these materials sluff off and are carried into aquatic systems. With this in mind, scientists are able to 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 sampling NBL, it would enable the Department to sample large swaths of the state quickly and efficiently. Assuming a more efficient fecal sampling protocol, and the eDNA technique is successfully developed during the fall of 2017, the Department plans on sampling throughout the state, and potentially neighboring states, in 2018 to identify other potential NBL locations. Please check back with future Research and Management Reports to see how the project progresses.

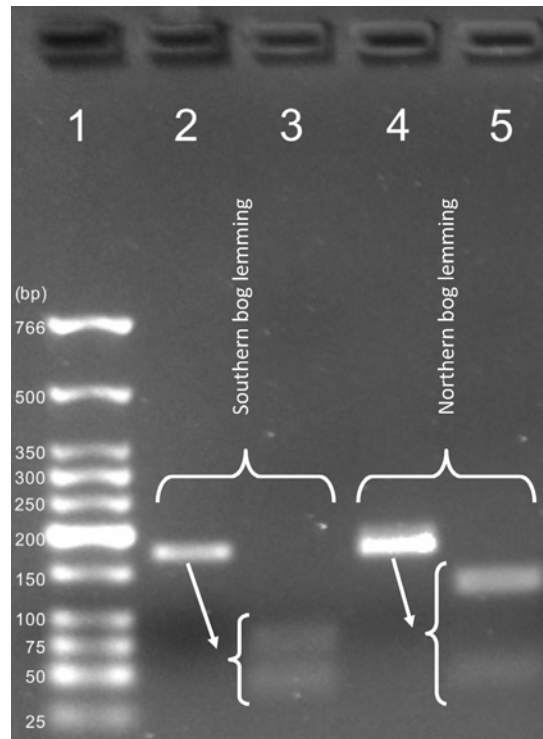


Figure 5. A gel image depicting the genetic sampling technique developed by Zach Olson of UNE identifying one sample as northern bog lemming and the other as a southern bog lemming, a closely related species.

Bats

The Department is continuing to develop our understanding of bat communities in the state. This includes developing both long term monitoring programs for the different species as well as identifying and addressing specific research needs. Monitoring projects that are currently in development include the bat colony counts and acoustic driving surveys. While we are still developing our research priorities for the state, we have provided updates on two of our monitoring programs below.

Maine Bat Colony Count

Last year, the Department sent out a request to report any known bat colonies living in people's homes, barns, and other structures. From this effort, we received approximately 350 online responses, of which nearly 150 warranted follow up based on the information provided. Of those 150 individuals, 70 were interested in providing us with a guano (bat poop) sample and a count of bats exiting the building at night. Fifty-two individuals returned a guano sample and some provided a count of bats exiting their building. Of those 52 guano samples, four were identified as being little brown bat, a state endangered species. The remaining 48 samples were from the more common big brown bat. With these sites identified, the Department is working to have individuals go back and count their colonies on an annual basis. With enough

participants counting bat numbers during the annual maternity season (June and July), biologists will be able to identify coarse trends in the population of Maine's big and little brown bats.

Driving Surveys

The summer of 2017 marked the first year the Department conducted driving surveys statewide using our newly acquired bat acoustic equipment. With a focus on migratory tree bats (hoary, silver-haired, and eastern red bat), these surveys drive a known route two times in a seven day period, starting 30 minutes after sunset. Since the vehicle drives faster than the bats fly as they forage in the canopy opening created by the road, biologists can develop a bats/mile by species. This data is collected during the same time frame each year (June and July); over time the Department will be able to identify coarse trends in the population of these species. This year's goal was to complete two survey routes for each of the seven regions of the state, totaling 14 total routes. With 12 of the 14 routes completed this year, the Department is off to a good start in this data collection and will continue efforts into the future.

This work was supported by the federal Pittman-Robertson and State Wildlife Grants programs and state revenues from sales of hunting and trapping licenses.

-- Cory Mosby

New England Cottontail Rabbit

About the Rabbit

The New England cottontail (NEC; *Sylvilagus transitionalis*), or cooney, was once a common rabbit in Maine and ranged from Belfast to Kittery. However, NEC populations declined markedly as old fields from abandoned farms reverted into mature forests and brushy habitat was developed into residential areas. The Department closed the hunting season on NEC in 2004 and listed the species as endangered in 2007. 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/Elliott (Figure 6).

The decline of NEC in Maine, and in other states in the Northeast, 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 to what NEC require in Maine. These include species such as the eastern towhee, American woodcock, and black racers. Dense shrubby habitat is rare in southern Maine and makes up less than 3% of the land base. Therefore, much of MDIFW's efforts, and that of its partners in NEC restoration, are targeted at creating or maintaining dense shrublands that will benefit other wildlife as well.

The New Challenge

Formerly, the four biggest challenges to NEC recovery in Maine were 1) little remaining shrubland habitat, 2) small population sizes, 3) low genetic diversity resulting from isolated NEC populations and low rabbit numbers (Figure 6), and 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. Maine was the only state in the northeast that did not have eastern cottontail rabbits (*Sylvilagus floridanus*). Eastern cottontails are similar in appearance to NECs, but they are not native to New England. Beginning around 1899, state wildlife agencies and hunting clubs introduced tens of thousands of eastern cottontails into states south of Maine. This was done primarily to provide more hunting opportunity. Eastern cottontails were introduced right 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 has better eyesight than the native NEC. This allows eastern cottontails to detect predators more readily than NEC and feed in areas further away from brushy cover than NEC (e.g., grassy lawns in suburbia). The end result is that eastern cottontails can have higher survival and reproductive rates than NEC and can gradually displace NEC when the two species occupy the same habitat. Rhode Island, for example, lost most of its NEC population and now primarily has eastern cottontails.

This summer, MDIFW and U.S. Fish and Wildlife Service (USFWS) biologists verified that eastern cottontails were now living on Badgers Island and in some parts of Kittery, Maine. These rabbits likely came from Portsmouth, New Hampshire, which has a large eastern cottontail population. Biologists have not determined how the rabbits crossed over into Maine or how far inland they have dispersed. The currents in the Piscataqua River are strong, and the river would be very difficult for a rabbit to swim across. Currently, biologists are live-trapping eastern cottontails on Badgers Island and on

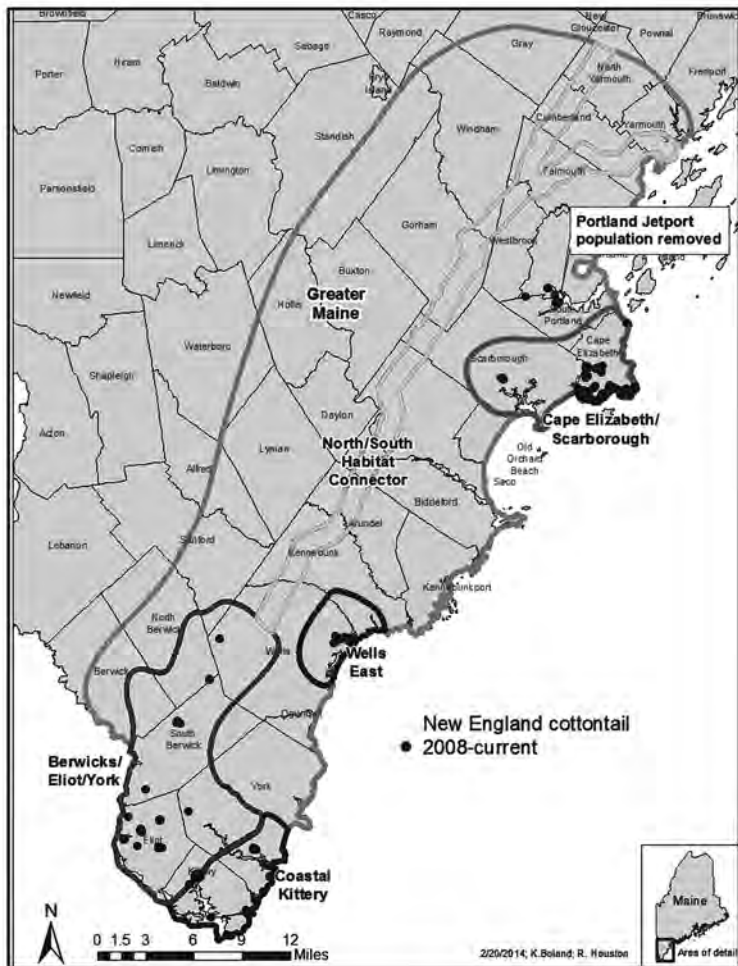


Figure 6. Maine's five focus areas and approximate locations of remaining New England Cottontail (NEC) populations.

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, which may be used by NEC as a travel corridor.

the mainland. New Hampshire Fish and Game is allowing MDIFW to release these rabbits back into New Hampshire. The goal of this trapping effort is to remove as many eastern cottontails as possible from Maine and prevent them from moving inland and threatening NEC populations. MDIFW will likely have a better idea of how far inland these rabbits have ventured this winter when biologists are able to conduct surveys for pellets and tracks on snow covered ground. If eastern cottontail rabbits have established themselves inland, MDIFW may have to consider alternative plans for habitat restoration and translocation efforts.

Habitat Restoration Efforts

MDIFW acknowledges the tremendous help it gets from its partners in the USFWS, Natural Resources Conservation Service (NRCS), and Wildlife Management Institute on habitat restoration projects. Most of the habitat restoration work in Maine occurs on private lands; therefore, the Department especially thanks the many willing landowners who have participated in NEC conservation efforts. In 2016, over 70 acres of habitat restoration work on private land was achieved by our partners in the NRCS, mostly through the implementation of Farm Bill conservation programs. Usually, the Maine New England Cottontail Restoration Coordinator facilitates most landowner outreach efforts. Despite this position being vacant for most of 2016, over 150 individuals participated in outreach events, including public presentations, walks and workshops at demonstration sites, targeted calls, personal site visits, and office visits. A new Restoration Coordinator was hired this spring – Jeff Tash. Look for outreach to landowners and the number of acres put under management agreements to increase in 2017!

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

-- Wally Jakubas

REPTILE, AMPHIBIAN, AND INVERTEBRATE GROUP

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, to name just a few. Coordinating research and conservation priorities for such a diverse suite of organisms is challenging! One of the Group's highest priorities is to address the conservation needs of the large number of reptiles, amphibians, and invertebrates currently listed as endangered, threatened, or special concern (>100 species). 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 have only recently been discovered in Maine by our biologists, including the cobblestone tiger beetle and the short-tailed swallowtail butterfly. The Reptile, Amphibian, and Invertebrate (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 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).

Phillip deMaynadier, Ph.D., Wildlife Biologist and RAI Group Leader – Phillip supervises 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) co-coordination of state atlasing efforts for butterflies, dragonflies, amphibians, and reptiles, 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 new federally-endangered species – the rusty patched bumble bee. Beth also helps coordinate the Department's vernal pool conservation efforts and provides 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, where he coordinates research and conservation efforts on several priority rare species. Derek is currently focused on assessing the distribution, status, and management needs of black racers, Blanding's, spotted, and wood turtles in Maine, coordinating Maine's efforts with that of several working groups in the Northeast on these species. Derek is also studying and guiding mitigation recommendations for 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 provided by the following professionals (in 2016-2017): Dr. Catherine Bevier, Kalyn Bickerman, Paul M. Brunelle, Dr. Ron Butler, Dr. Frank Drummond, Ken Hotopp, Chris Introne, Dr. Cynthia Loftin, Derek Moore, Dr. Michael Kinneson, Ethan Nedeau, Trevor Persons, Gannon Pratt, Dr. Leif Richardson, Samantha Beaulieu, Dr. Matthew Chatfield, David Putnam, Marcia Siebenmann, Dr. Reginald Webster, and Dr. Herb Wilson.

REPTILE, AMPHIBIAN, AND INVERTEBRATE CONSERVATION AND MANAGEMENT

Amphibians and Reptiles

Overview

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 a large number of species to reach their northeastern range limit in the state. Only one species, the mink frog, reaches the southern edge of its range in Maine (and northern New Hampshire and Vermont). There are 36 species of herpetofauna known from Maine, 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)

MDIFW continues to cooperate with an initiative entitled Partners in Amphibian and Reptile Conservation (PARC). Modeled partly after the successful Partners in Flight (PIF) bird conservation program, PARC's mission is to forge partnerships among diverse public and private organizations in an effort to stem recent declines of amphibian and reptile (herpetofauna) populations worldwide. MDIFW regularly participates in northeastern chapter PARC meetings, including the most recent 2017 annual meeting at Mountain Lake Biological Research Station in Virginia.

Some of Northeast PARC's projects, to date, have included: a) drafting model state herpetofauna regulations, b) compiling a list of regional species of conservation concern, c) publishing management recommendations for important habitats, d) developing fact sheets on emerging amphibian and reptile diseases, and e) designing guidelines for identifying Priority Amphibian and Reptile Conservation Areas (PARCAs).



Recognizing that habitat loss and fragmentation is the greatest threat to reptiles and amphibians worldwide, the PARCA project is an initiative to develop a network of focus areas in the U.S., designed specifically for the unique conservation needs of reptiles and amphibians. Areas are nominated using scientific criteria and expert review, drawing on the concepts of species rarity, richness, regional responsibility, and landscape integrity. PARCAs are a nonregulatory designation, 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, providing an additional, spatially explicit layer for 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 License Plate and Chickadee Check-off Funds.

-- Phillip deMaynadier and Derek Yorks

Maine Amphibian and Reptile Atlas Project (MARAP)

From 1986–1990, 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.

By 1998, considerable new data had been compiled, and there was increasing demand for updated information on the state's amphibians and reptiles. 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 the frogs and toads of Maine. Copies of the updated 1999 edition of *Maine Amphibians and Reptiles* can be ordered for \$19.95 from MDIFW's Information Center (207-287-8000) or from the online store found on the Department's website: mefishwildlife.com.

MDIFW continues this atlas work and maintains a comprehensive database on the distribution of Maine's 35 extant amphibian and reptile species (33 native and 2 exotic). Though most of this work is opportunistic, as of spring 2015, over 10,000 records from more than 1,100 volunteers have been logged. The results of the MARAP project have helped to improve our general understanding of reptile and amphibian biogeography statewide – for example, reptile species richness sharply decreases northward, while amphibian richness is similar across the state – and to inform periodic conservation status assessments of specific species (i.e., endangered, threatened, special concern, SGCN). There is much still to learn about the distribution and ecology of Maine's herpetofauna, and we encourage members of the public to share their photo-documented observations by submitting a MARAP reporting form, available on MDIFW's website in the Species Information section.

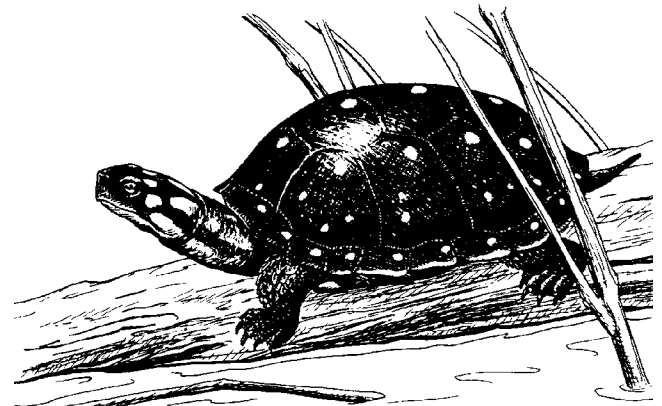
Please submit observations of any of the four state-listed reptiles -- Eastern box turtle (endangered), Blanding's turtle (endangered), spotted turtle (threatened), and black racer (endangered) – as soon as possible to MDIFW (derek.yorks@maine.gov or call 207-941-4475).

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

-- Derek Yorks and Phillip deMaynadier

Blanding's and Spotted Turtles

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 in length, have yellow spots on the head, tail, and legs and a somewhat flat, yellow-spotted shell. Both species are semi-aquatic, preferring small, shallow wetlands in southern Maine, 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.



Spotted Turtle (Drawing by Mark McCollough)

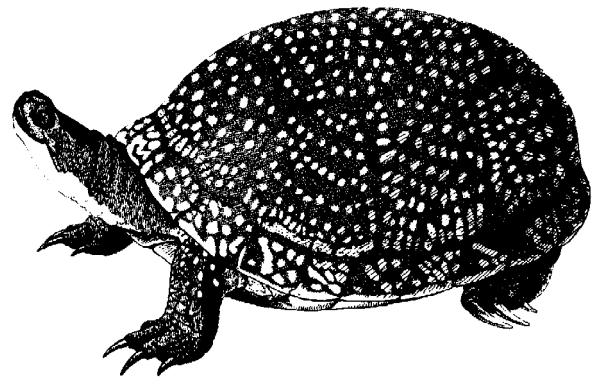
Despite the attention these turtles have received, habitat loss and fragmentation continue to threaten both species in Maine. As human population and development expands in southern and coastal Maine, road mortality becomes an ever increasing threat. The turtle's shell has provided sufficient protection 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 road-kill may be the greatest factor threatening the persistence of Blanding's and spotted turtles in Maine.

MDIFW is currently involved in four conservation projects benefitting Blanding's and spotted turtles in Maine:

- *Conservation of Blanding's Turtle in the Northeast:* MDIFW, along with four other northeastern states, was awarded a U.S. Fish and Wildlife Service Competitive State Wildlife Grant to implement conservation measures for Blanding's turtles. This is the second such award for collaborative conservation of the Blanding's turtle among northeastern states. This renewed effort focuses on implementing actions, identified in the 2014 Conservation Plan for Blanding's

Turtles in the Northeastern United States, that are intended to maintain and enhance functional Blanding's turtle populations with on the ground conservation actions and standardized population assessments. Actions include improvements to 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 efforts will continue through 2018.

- *Cautionary Road Signage Project (Turtle X-ing):* 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 (DOT), The Nature Conservancy, and local towns, temporary yellow warning signs are 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, thus helping to maximize the signs impact by reducing "sign fatigue" by local commuters. This signage project was one of the first of its kind among northeastern states and is now in its 12th year.
- *Wildlife Road Watch and MDIFW Rare Turtle Hotspot Surveys:* Partnering with Maine Audubon and Maine DOT, Wildlife Road Watch, a volunteer initiative to report wildlife-road interactions (both alive and dead), was launched in 2010. Additionally, in 2014, MDIFW began monitoring for road mortality at previously documented Blanding's and spotted turtle crossing and road-kill sites and potentially important road-crossing sites identified in a predictive GIS model. Data generated from these efforts will help in planning future wildlife road mitigation efforts (e.g., additional signage areas, critter crossings, exclusionary fencing). In addition to contributing incidental sightings, participants may also choose to adopt a road segment for repeated monitoring. For more information on the Wildlife Road Watch program, please visit: wildlifecrossing.net/maine.
- *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. Time-lapse cameras are being used at nesting areas to document nesting females, data that will help biologists to manage this critical resource effectively. 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.
- *Status of the Spotted Turtle at the Northern Edge of its Global Range:* The state-threatened spotted turtle reaches the northeastern terminus of its range in the Atlantic Coastal Plain of Maine. While its distribution in York County is well understood, it has also been reported occasionally over the past four decades from an additional 26 townships in 12 additional counties, reaching as far as central and mid-coast Maine. MDIFW is currently undertaking field surveys in an attempt to verify the presence of spotted turtles at a number of these locales and to determine if the previously reported turtles represent wild populations, possible released captives, or misidentifications of other turtle species. The spring seasons of 2015, 2016, and 2017 were an exciting first chapter in the search for spotted turtles at the edge of their range in Maine. Populations were documented in wetland habitats at a handful of sites in Sagadahoc, Lincoln, Knox, and Waldo counties, confirming that this rare turtle occurs (at least as isolated populations) across more of the state than previously known.



Blanding's Turtle (Drawing by Abigail Rorer)

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

Survey, Monitoring, and Population Assessment of Northern Black Racers in Southern Maine

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.

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 commonness 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. At present, Maine racer populations appear to be restricted to interior York County and southern Oxford County, where there are only about 10 modern documented sites.



Northern Black Racer (Photo by Derek Yorks)

In the spring of 2016, MDIFW biologists began a two-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. Currently, we are using VHF radio transmitters to track a total of eight individual racers located at two sites. This continues an effort begun in the 2016 season, when seven individual racers were tracked. In 2017, we initiated a monitoring program that uses repeated time-constrained transect surveys to assess populations. Data gathered on occupancy, abundance, and habitat use of northern black racers will guide future conservation of this rare and striking reptile.

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

-- Derek Yorks

Invertebrates

Overview

As is true globally, invertebrates dominate Maine's biota, both in terms of richness and biomass. In fact, Maine's non-marine invertebrate species 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 the conservation and management of invertebrates is to focus on those species and groups that are better-studied and 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. Some examples of recent survey, research, and conservation projects directed at these and other priority terrestrial and aquatic invertebrates are highlighted below.

The Maine Bumble Bees Atlas: Keeping Track of Native Pollinators

Bumble bees are one of our most valuable pollinators of both wild and cultivated flowering plants. Their early spring emergence and "buzz pollination" method are especially effective for many spring wildflowers and important Maine crops like apples, blueberries, cranberries, and tomatoes. Unfortunately, over the past 10-15 years, some species of native bumble bees have drastically declined throughout their ranges, and several have all but disappeared. 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 worldwide.

In order to get a better understanding of the diversity, distribution, and conservation status of Maine's native bumble bee fauna, MDIFW initiated the *Maine Bumble Bee Atlas* (MBBA) project in 2015. Designed as a five-year statewide survey, and coordinated by the Department in partnership with the University of Maine, MBBA enlists the aid of volunteer citizen scientists from all over the state to collect data on what species are present, where they occur, what habitats they use, and how abundant they are. During the project's first two years, over 160 volunteers were trained in a standardized survey protocol and provided field equipment to participate. This enthusiastic and productive group of citizen scientists then went to work and, by the end of the second field season, contributed more than 10,000 new bumble bee records! Their data showed that 13 of the 17 species historically known to occur in Maine (Table 9) were still present, and some species had decreased in relative abundance while others had increased.

Table 9. Bumble bees of Maine.

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

Four previously documented species have not yet been found during MBBA surveys: 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 in the coming years of the project. With three 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 and at the MBBA blog at maine.gov/worpress/bumblebeeatlas/.



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

-- Beth Swartz

Conservation Assessment of the Dragonflies and Damselflies of Maine and the Northeast

Insects in the Order Odonata, damselflies and dragonflies, are a conspicuous component of Maine's wildlife diversity, as well as valuable biological indicators of freshwater ecosystem integrity. Presently, 158 species have been documented in the state, comprising nearly 36% of the total North American fauna. Northeastern North America is recognized as a regional hotspot for odonate diversity, and several of Maine's species are of national and global conservation concern. To better understand the vulnerability of northeastern damselflies and dragonflies to historical and current threats, MDIFW recently completed a regional conservation assessment of Odonata and their habitats in cooperation with experts in New Hampshire (NH Audubon Society) and New York (NY Natural Heritage Program).

MDIFW and partners 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. Specifically, we calculated a single regional vulnerability rank (R-rank) reflecting each species' degree of relative extinction risk in the Northeast. The R-rank was calculated based on five factors -- 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) -- and ranged from R1 (most vulnerable) to R5 (least vulnerable). We combined this vulnerability rank with an analysis of the degree of endemism (% of the species' U.S. and Canada range within the Northeast) as a proxy for regional responsibility, thereby deriving a list of species of combined vulnerability and regional management responsibility. Overall, 18% of the northeastern region's odonate fauna is imperiled (R1 and R2), of which eight species are found in Maine, including two state-listed species: boreal snaketail (threatened) and ringed boghaunter (threatened). Among 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.



Boreal Snaketail (Photo by John Abbott)

This assessment can be used to inform the strategic allocation of limited state and federal conservation resources and to help foster collaboration across state lines to conserve regionally at-risk Odonata.

We anticipate this research will help guide and standardize conservation assessments of other invertebrate taxa. Finally, 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 has begun to organize, 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).

Contact Phillip deMaynadier (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.

Funding for this work comes from the federal State Wildlife Grants program, a Northeastern Regional Conservation Needs grant, and state revenues from the Loon License Plate and Chickadee Check-off Funds.

-- Phillip deMaynadier

The Maine Butterfly Survey: Keeping Track of Scaled Jewels

Juniper hairstreak, Clayton's copper, and spicebush swallowtail are just some of the state's rarest butterflies that are both colorful in name and on the wing. In an effort to improve our knowledge of these and other priority butterflies, MDIFW is actively studying the group during statewide regional surveys. Attractive and ecologically important, butterflies have garnered increasing attention from scientists and the general public as sentinels of habitat change. By documenting the distribution and status of the state's butterfly fauna, MDIFW hopes to improve its understanding of the group and prioritize conservation efforts towards the most vulnerable species.

In support of this goal, MDIFW received a grant from the Maine Outdoor Heritage Fund in 2002 to contract a professional lepidopterist, Dr. Reginald Webster from 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. Visit mbs.umf.maine.edu/Publications.htm to download a pdf copy of Maine's first baseline butterfly atlas.

Finally, 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 atlas projects, including the Maine Damselfly and Dragonfly Survey, data from the MBS was generated from >200 trained citizen scientists. The survey will help fill information gaps on distribution, abundance, flight seasons, and habitat relationships for one of the state's most popular and vulnerable insect groups. Significant scientific contributions from the project included: a) a comprehensive database of Maine butterflies comprised of approximately 34,500 records, b) a museum quality specimen and photo voucher collection, c) the addition of nine new state (and one national!) species records to the Maine butterfly list, d) a Maine butterfly website that includes a state checklist, data on volunteer survey effort, species distribution maps, flight period, and other survey results, and d) 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, to the office in preparation for the project's penultimate product – a published *Atlas of the Butterflies of Maine and the Maritimes*, in collaboration with the Atlantic Canada Conservation Data Centre. It is our hope that this publication will both summarize the scientific state of knowledge of the butterflies of Acadia and serve as an attractive and accessible outreach tool for introducing new members of the public to the fascinating world of butterflies and potentially other invertebrates.

Funding for this work comes from volunteer assistance, the federal State Wildlife Grants program, The Nature Conservancy, the Maine Outdoor Heritage Fund, and state revenues from the Loon License Plate and Chickadee Check-off Funds.

-- Phillip deMaynadier

Rare Mayflies

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. Often abundant, the nymphs are a major consumer of algae and decomposer of plant material and, in turn, provide a high quality food source for many more visible stream predators. Anglers have long recognized that a good mayfly stream is likely a good trout and salmon stream as well. 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.

While most of Maine's mayfly species are widely distributed and relatively common, some are much rarer. Maine currently lists two species of mayfly as threatened, both of which are also identified as Priority 1 Species of Greatest Conservation Need (SGCN) in Maine's 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 central and western Maine (Figure 7). 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 is a unique insect, once thought to be extinct. It was rediscovered in Tomah Stream (Washington Co.) in 1978 and has since been documented at 18 sites distributed across northern, eastern, and central Maine and at least one site in New York. The nymphal stage of the Tomah mayfly, unlike other species of mayfly, 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 from a limited number of sites.

In addition to these two 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 for future surveys, the Department has contracted mayfly expert Marcia Siebenmann to document all previous survey effort for Maine's state-listed and special concern mayfly species. Over 35 years of data are being entered into a database that will aid in tracking known occurrences and coordinating where to search for new populations of these uncommon insects.

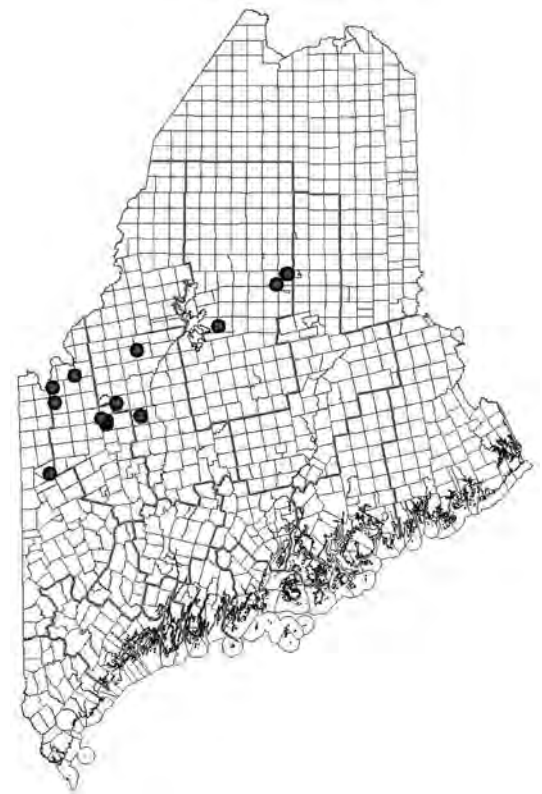


Figure 7. Distribution of Roaring Brook Mayfly in Maine.

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

-- Beth Swartz

Brook Floater

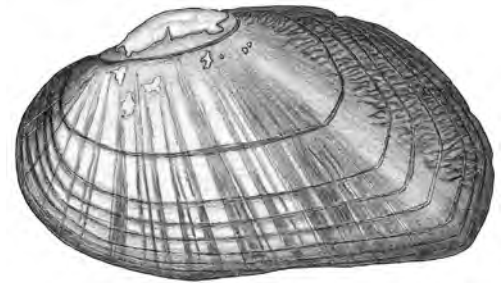
Maine is home to 10 species of freshwater mussels, three of which are listed as threatened under the Maine Endangered Species Act (Table 10).

Table 10. Freshwater mussels of Maine.

Common Name	Scientific Name	State Listing
Eastern Pearlshell	<i>Margaritifera margaritifera</i>	
Eastern Elliptio	<i>Elliptio complanata</i>	
Triangle Floater	<i>Alasmidonta undulata</i>	
Brook Floater	<i>Alasmidonta varicosa</i>	THREATENED
Eastern Floater	<i>Pyganodon cataracta</i>	
Alewife Floater	<i>Anodonta implicata</i>	
Creeper	<i>Strophitus undulatus</i>	
Yellow Lampmussel	<i>Lampsilis cariosa</i>	THREATENED
Eastern Lampmussel	<i>Lampsilis radiata radiata</i>	
Tidewater Mucket	<i>Leptodea ochracea</i>	THREATENED

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.

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 the species' requirement for clean, relatively undeveloped, and 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. During the past eight years, the Department has focused on intensively surveying all streams and rivers where the brook floater had been documented in the past. Many of these sites had not been visited for over 20 years, and little was known about the species' current status at each. MDIFW contracted Ethan Nedeau (Biodiversity, LLC), a mussel biologist with extensive experience studying brook floaters in the Northeast, to conduct the surveys. So far, Ethan has surveyed 25 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, have nearly extirpated the species in that river during the last decade. 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, Wesserunsett Stream, Marsh Stream, West Branch Union River, and the Passadumkeag River appear to have relatively large, healthy populations. At each site he surveys, Ethan documents the numbers and density of brook floaters, as well as habitat use and potential threats. In 2017, he will be surveying the Piscataquis and Pleasant (mainstem and East Branch) Rivers in Piscataquis County and the Mattawamkeag River (East Branch and West Branch) and Fish Stream in Aroostook County. All of this information will contribute to a regional assessment of the brook floater's conservation status -- a collaborative project between MDIFW and 12 other northeastern states -- as well as the federal status review.



Brook Floater (Drawing by Ethan Nedeau)

In 2016, MDIFW and several partnering states were awarded a Competitive State Wildlife Grant from the U.S. Fish and Wildlife Service to fund a rangewide conservation and restoration initiative for the brook floater. Developing long-term monitoring programs and conservation plans for a subset of our populations will be a focus for activities in 2017. 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 License Plate and Chickadee Check-off Funds.

-- Beth Swartz

Special Habitats for Reptiles, Amphibians, and Invertebrates

The Maine Legislature has declared it the policy of the state to conserve and manage all species of inland fish and wildlife. MDIFW takes this mandate seriously but is 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 the risk of extinction. However, the state does not have the capacity to manage all of its fish and wildlife resources on an individual species by species basis. Wildlife biologists have long recognized that a more efficient and lasting approach for sustaining the majority of Maine wildlife requires working at coarser scales, by identifying and conserving a diversity of 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 and diverse populations of all Maine wildlife. Below, we highlight some especially valuable habitats for Maine's reptiles, amphibians, invertebrates and other taxa.

Pollinator Habitat

Maine is home to a wide diversity of native insect pollinators, including many species of butterflies and moths (Order: Lepidoptera), bees (Hymenoptera), beetles (Coleoptera), and flies (Diptera). The ecosystem service that these pollinators provide is immeasurable, both to natural communities and human societies. Without them, many wildflowers, shrubs, and trees, as well as fruits, vegetables, and other food crops, would not get fertilized. Apples, peaches, blueberries, squash, and tomatoes are just some of the economically valuable crops in Maine that benefit from wild pollinators. Some species of Maine's native pollinating insects, such as the monarch butterfly and rusty patched bumble bee, have experienced significant declines throughout their ranges and are in danger of being extirpated. Habitat loss is often a factor in these declines, but creating habitat for pollinators is something we can all do to help. 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. Bumble bees, like many pollinators, are habitat generalists but require a diversity and abundance of flowering plants that bloom continuously from spring to fall. Some of the best habitats for pollinators are "weedy" un-mowed fields, roadsides, and right-of-ways. With full sun and little competition from woody vegetation, these areas are rich in both native and introduced flowering plants that are pollinator favorites: clovers, milkweeds, goldenrods, vetches, dogbanes, asters, thistles, fireweed, lupines, raspberries, and more. By allowing these areas to remain un-mowed until late fall, mowing every other year, or staggering your mowing so that a portion of the habitat remains un-mowed every season, you will be providing habitat for many species of pollinators all through the growing season – and with no extra work or expense involved!

Residential lawns and backyards can also provide excellent pollinator habitat. "Mow less" is a good rule to follow here as well. Try leaving an un-mowed border around the edges of your property or allowing a portion of the lawn to grow tall, so that wildflowers can mature and bloom. Instead of faithfully mowing the lawn every week, wait at least 2-3 weeks between cuttings. The clovers, violets, creeping ground-covers, and dandelions that bloom will provide an abundant source of nectar and pollen, especially in early spring when little else is in flower. Planting a pollinator garden is another way to create beneficial habitat for butterflies, bumble bees and other insect pollinators. Many common garden plants are especially attractive to native pollinators. Examples of favorites that are easily grown in Maine include bee balm, butterfly weed, sunflower, coneflower, thyme, mint, rhododendron, blueberry, and rose, but there are many more from which to choose!



Pollinator Habitat (Drawing by MDIFW)

In addition to mowing less and gardening with pollinators in mind, another important step in providing pollinator-friendly habitat is to avoid using herbicides and pesticides. Herbicides kill many of the flowering plants that provide food for pollinators. Insecticides can kill bees and other insect pollinators directly or affect their ability to forage, reproduce, or care for their colonies. There are often less harmful alternatives to consider before reaching for chemicals to manage plant diseases or insect pests around our homes and gardens.

Establishing and protecting pollinator habitat can help make a difference for native pollinators that may be in decline from habitat loss or stressed by other factors, such as disease, pesticides, or competition from introduced species. For more information about pollinator conservation and what you can do to help, visit the Xerces Society website 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.

-- Beth Swartz

Vernal Pools

Vernal pools come in myriad shapes, sizes, and settings, but nearly all are small, forested wetlands, whose depressions fill with water from spring snowmelt and rain and dry partly or completely by late summer. What makes these habitats so valuable for wildlife is a rich food base, fed by surrounding forest organic matter and a lack of fish. 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 -- spotted salamanders, blue-spotted salamanders, wood frogs, and fairy shrimp -- breed almost exclusively in vernal pools.

Just as the state's more traditionally recognized wildlife habitats, such 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 many more familiar species such as 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. The collective weight (or "biomass") of these unseen spring amphibian sentinels has been estimated to exceed that of all birds and mammals combined in some forests! 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.



Vernal Pool (Photo by Phillip deMaynadier)

Additionally, among Maine's dozens of wetland community types, few host as many rare and endangered species as do vernal pools, providing sustenance and shelter to the Blanding's turtle (endangered), spotted turtle (threatened), ribbon snake (special concern), ringed boghaunter dragonfly (threatened), and rare plants, including featherfoil (threatened) and sweet pepperbush (special concern). Some of these species could face extinction in Maine without the presence of high value vernal pools distributed throughout their range.

MDIFW cooperates with the Departments of Environmental Protection (DEP) and Conservation, municipalities, and landowners to conserve vernal pools. Workshops on vernal pool biology and conservation have been held throughout the state for landowners, land trusts, and land managers, and several publications designed to offer voluntary techniques for protecting vernal pools and their wildlife are available. 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 guide-books 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 (207-781-2330).

Finally, MDIFW and DEP developed a definition of Significant Vernal Pools -- the most recent Significant Wildlife Habitat under the state's Natural Resource Protection Act (NRPA), approved by the 120th Maine Legislature in 2006. 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 2,700 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 focus their management recommendations on conserving those vernal pools that are providing the greatest wildlife habitat values.

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

-- Phillip deMaynadier

Pitch Pine Woodlands and Barrens

Pitch pine woodlands and barrens are lightly forested upland areas with dry, acidic, 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.



Pine Pitch Woodlands and Barrens (Photo by Phillip deMaynadier)

Once viewed as unproductive wastelands, Maine's few remaining pine woodlands and barrens are now recognized as areas of exceptional wildlife value, providing habitat for a variety of highly specialized plants and animals. 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 other 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.

-- Phillip deMaynadier

Freshwater Marshes and Shrub Swamps

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 and abundant vegetation with high levels of biological production. Many of Maine's amphibians, reptiles, and invertebrates depend on these wetlands for all or some of their life cycle. Frogs, including leopard frogs (special concern), pickerel frogs, green frogs, bull frogs, mink frogs, gray tree frogs, and spring peepers, breed and often live in these habitats year-round. The mixture of lush herbaceous vegetation found above and below the water surface provides amphibians with shelter from predators, as well as food in the form of the vegetation itself or by supporting a plethora of invertebrate prey. A number of reptile species thrive in marshes and shrub swamps too. Spotted turtles (threatened), Blanding's turtles (endangered), painted turtles, and snapping turtles are found in these wetlands, as are ribbon snakes (special concern), garter snakes, and northern water snakes. Marshes and shrub swamps are also hugely important to a number of invertebrates, perhaps most conspicuously dragonflies and damselflies. Across Maine's forest-dominated landscape these wetlands are often focal points for wide-ranging wildlife in an area. Beyond reptiles, amphibians, and invertebrates, wading birds, waterfowl, beaver, muskrat, and even moose depend on these productive habitats.



Shrub Swamp (Photo by Phillip deMaynadier)

The 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 been informative in highlighting 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 that has been gathered from this project will help Maine biologists to understand what specific characteristics of marshes and shrub swamps are critical for the survival of this species in the state.

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

-- Derek Yorks

WILDLIFE MANAGEMENT SECTION

The Wildlife Management Section functions as the on-the-ground wildlife management work program within the Department and is organized into seven regional geographic districts throughout the state. In addition to these offices, the Wildlife Management Section also contains a Lands Management Program focused on habitat management throughout the state (with a primary focus on Wildlife Management Areas), as well as a wildlife biologist assigned to the Maine Department of Agriculture, Conservation and Forestry.

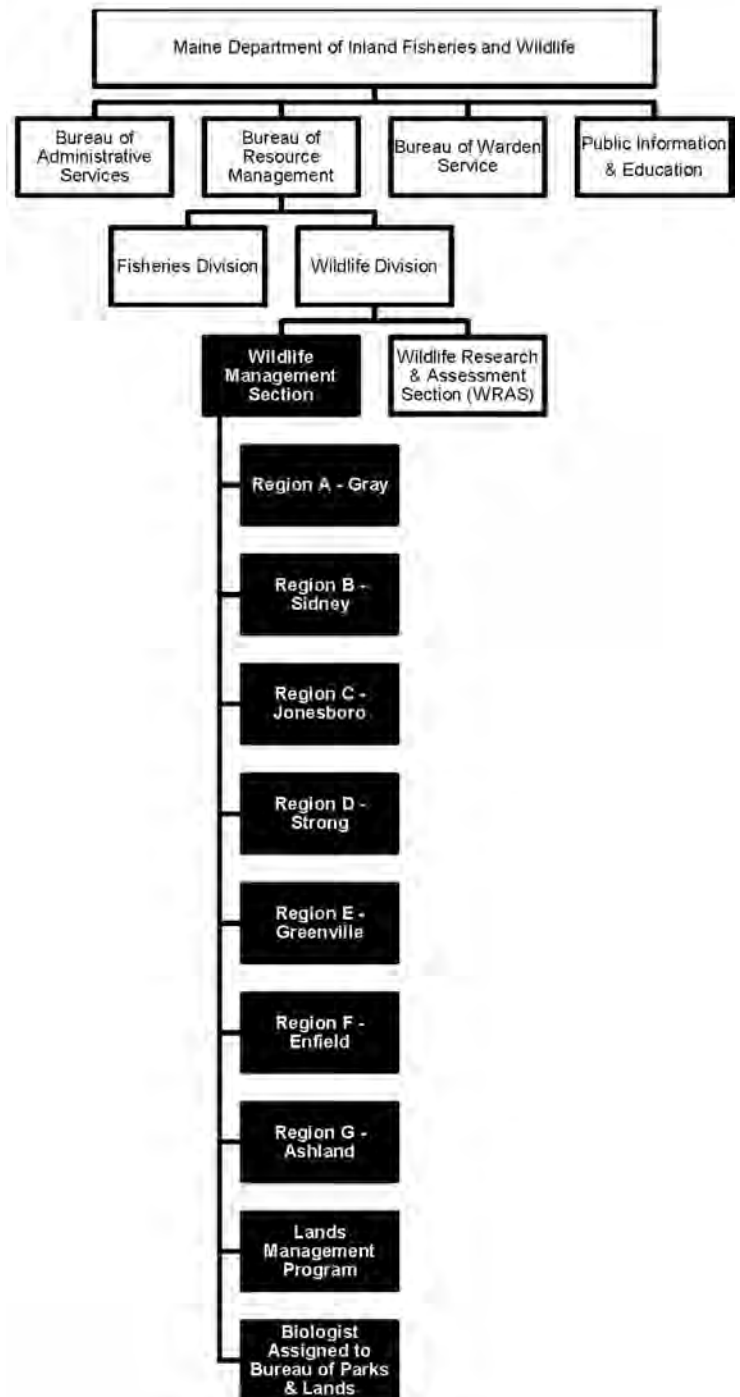
The seven regional wildlife offices are located in Gray, Sidney, Jonesboro, Strong, Greenville, Enfield, and Ashland. Each of the regional offices is located to allow for interactions with the public and to facilitate administrative oversight within the respective region.

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

Truly comprehensive in the scope of the work program, the Regional Wildlife Management Program touches on all aspects of the Department's approach to wildlife management. For most of the public, the regional wildlife biologists are the main point of contact for wildlife issues in the state, and they serve as an important conduit for information both coming into the Department and conveying information out to the public.

Over the past year and a half, the Wildlife Management Section has focused on providing information to the public about what regional wildlife biologists do – whether it is an important study, project, or activity they are working on or merely something they find interesting and think the public may find interesting as well. To help accomplish this, the regional wildlife biologists have been writing internet “blog” articles, which are posted on the Department's website. These blogs can be accessed in digital format via the Department's website at: maine.gov/ifw/aboutus/blogs.htm.

For this year's Research and Management Report, I wanted to select a sample of these blogs to showcase the important, interesting, and broad scope of activities the Wildlife Management Section touches on. There are many more articles posted online. I'd encourage you to read them when you have a moment. You'll find topics in the coming pages on Deer Wintering Area management, species surveys, or mortality studies conducted by the Department. I hope you find these articles as interesting as we do!



-- Ryan Robicheau

Wildlife Management Section Supervisor

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Biologists Track New England Cottontails in the Snow

Have you seen this rabbit? The New England cottontail is a state endangered species in Maine with an estimated population of less than 300. Each winter, biologists from MDIFW and our conservation partners conduct snow tracking surveys to monitor the sites known to have cottontails and to search for new occurrences. So, if you've spotted a cottontail, please let us know so we can survey the site to confirm their presence. Knowing exactly where cottontails occur is critical to our efforts to restore the species, so we'd greatly appreciate any reports.

New England cottontails and snowshoe hares are very similar in appearance through much of the year, but cottontails are generally smaller than hares (though overlap does occur), with shorter ears, legs, and feet. They have a wider appearing face, and often have a black spot on their forehead (though it's difficult to observe). Cottontail hind-foot tracks are oval shaped and 2¾ – 4" long; whereas hind-foot tracks for snowshoe hares are 3½ – 6" long and are more triangular (or snowshoe shaped). The two species are easily distinguished during winter because cottontails remain brown in color but snowshoe hares change to white. So, if you see a brown bunny in winter, please let us know!



New England Cottontail (Photo by Kelly Boland)

New England cottontails once ranged as far inland as Porter, Lewiston, and Augusta, and as far east as Belfast. But, they are now relegated to about 30 confirmed sites (within the last few years) south of Portland. In contrast, snowshoe hares occur statewide.

The primary factor causing the decline in the state's cottontail population is the loss of the dense shrubby thickets and young regenerating forest habitat due to natural growth into older forests, development, and other changes in land use. As part of our restoration efforts, we manage over 60 acres at Scarborough Marsh Wildlife Management Area for cottontails and other wildlife species (e.g., brown thrasher, American woodcock, prairie warbler) reliant on young forest habitat, and we are developing plans to manage additional acreage in Mt. Agamenticus Wildlife Management Area.

-- Cory Stearns

REGION B - SIDNEY

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A Hands-On Look at Maine's Deer Mortality Study

Regional wildlife biologists are frequently involved with a variety of tasks to support various wildlife work programs statewide, so imagine our excitement when we were asked to help live trap some deer! Wow, what a job assignment! Are you kidding me, I get to do that? In reality, it is a task that is easier said than done!

Region B (Sidney) wildlife biologists have been assisting the state's deer biologist in a long term deer mortality/survival study. This study has been going on for three years and is designed to give us valuable information on white-tailed deer that will later help inform wildlife policy.

We manage all wildlife species in Maine at the Wildlife Management District (WMD) level, and this particular effort is occurring in WMD 17, a transition district between the farm lands of central Maine and the spruce fir forest of northern Maine. We are trapping in the town of Canaan, on private property with landowner permission. We have monitored winter severity and the impacts on deer at this deer wintering area for more than three decades. We have visited this location once a week, every week, all winter long for more than 30 years. Since this area is a known Deer Wintering Area (DWA), it is a natural choice to try to live trap a few deer during the winter.

At the site, we are using a box type live trap with an aluminum frame, nylon netting, and a drop down door at the front of the trap. The deer's nose is what springs the trap as they consume the bait. We bait it frequently and only occasionally set the trap to increase success. For the study, it is important that we keep a certain number of deer "on the air" (collared) at all times, as mortalities must be replaced. Each successfully collared fawn is a step forward, as each individual deer gives us unique and valuable information. The radio collars are designed to be light but rugged. Rubber surgical bands allow for the growth in the neck diameter of the fawn as it ages, ensuring a proper fit and no harm to the deer. The radio collar sends out a mortality signal if it detects that the deer has died. We are then able to locate the signal, and subsequently the deer, to determine the cause of death.



A game camera image of deer at the trap. (Photo by MDIFW)

We are fortunate to have some first class people working on behalf of the wildlife resources of the state of Maine. Regional Wildlife Biologist Kendall Marden is invaluable to this effort, as he brings a skill set that is hard to duplicate. Our deer biologist is leading a great effort that will continue to provide important information about deer mortality and survival. Additionally, John Pratte and Zach Pulsifer contribute consistently in support of these and other wildlife work programs.

-- G. Keel Kemper

REGION C - JONESBORO

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Spring-time Thunder-Pumpers

Ever heard of a "Thunder-Pumper?" How about a "water-belcher?" I hadn't either until I did some online searching. These colloquialisms for a Maine marsh bird come pretty close to describing the spring courting call of the male American bittern.



American Bittern (Photo by Tom Schaeffer)

About a week ago, I was treated to a rare opportunity to view both a male and female bittern in a relatively open setting at my homestead, allowing me to capture some pictures and videos. The birds came so close to the house that, unfortunately, I had no chance to sneak outside undetected to record sound with the videos. Still, the ability to view up close what is normally a secretive bird and record the breeding plumage variations of the sexes was a treat.

The American bittern is a predatory, heron-like bird that's known for, in addition to its distinctive call, perfect camouflaged plumage that blends with tall marsh vegetation. Similarly, its staunch, vertical profile and slow-motion stalking behavior are characteristic. When alarmed or cautious, the birds will adopt a vertical posture elongating their neck and bill skyward. With their striated feather pattern, they blend in perfectly with surrounding vegetation, making it easy to paddle by and

not detect them unless they flush. When posed, they are even known to sway with the breeze to match the movement of surrounding vegetation. Very cool.

American bitterns are diligent, purposeful stalkers, extending their legs in slow motion with outstretched toes. Their diet includes fish, amphibians, reptiles, insects, and even small mammals. Like a heron, their sharp bill strikes quickly and with purpose. They can also be found foraging in seasonally flooded basins and wet meadows, which is why they were likely in my field. Due to all the spring rains, the ground, which contains a fair amount of clay, is saturated. The female was having no problem in finding prey, most of which appeared to be night crawlers.

In the original blog post (which can be accessed online at: maine.gov/ifw/aboutus/blogs.htm), videos of the encounter are provided. The videos are a bit grainy when viewed on a larger screen, but you can readily see some of the characteristics described above. The male is in the background and his breeding plumage consisting of white wing coverts and black feathering along the neck are apparent. A couple of the video clips show his exaggerated body motion when vocalizing. Also, note the slow-motion body and leg movements of the female while she hunts for prey. If you're not familiar, the vocalizations of the American bittern can be heard at: [allaboutbirds.org/guide/American Bittern/sounds](http://allaboutbirds.org/guide/American_Bittern/sounds).

-- Tom Schaeffer

REGION D - STRONG

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Tracking the Canada Lynx: A Field Report from the Eustis Area

Regional wildlife biologists in the northern half of Maine are in winter number three of a project to extensively survey selected townships for Canada lynx. So far this year, Assistant Regional Wildlife Biologist Bob Cordes and I have surveyed Mayfield Township, Tim Pond Township, Upper Cupsuptic Township, and Redington Township. Spring Lake Township was surveyed for us by the regional wildlife biologists from Region A, headquartered in Gray. On each of the surveys we documented one or two sets of lynx tracks.

Protocol requires that surveys be run during a 48-hour window, commencing 24 hours after the cessation of a snow storm or significant winds. Then, within that window, the survey of 55-80 kilometers (33-48 miles) has to be fully completed, or, if not, re-run another time. The essence of this restriction was to limit and standardize the amount of time animals could run around leaving tracks in fresh snow. Eliminating all tracks made before the survey helps in assessing numbers. We also took advantage of the opportunity to assess the abundance of snowshoe hare and bobcat, the former being the prime food source for lynx as well as the soup du jour for many other predators.

Conducting lynx surveys from a snowmobile is usually very enjoyable duty. Some days can be rough, however, if the survey window occurs when it is really cold. Having done day-long surveys at sub-zero temperatures makes us really appreciate our last survey a little over a week ago. Temperatures that day were around 30 degrees and sunny. Our survey covered the southern half of Coplin Plantation and the northern half of neighboring Redington Township. This area is immediately west of Sugarloaf Mountain. Bob and I were assisted on this day by District Game Warden



From left to right: Scott Stevens, Blaine Holding, Bob Cordes, and Chuck Hulse getting ready to start their lynx surveys. (Photo by MDIFW)

Scott Stevens and retired game warden Blaine Holding. Scott replaced Blaine in this district upon his retirement. With these two helping us, Bob and I had little need for our maps to navigate the backcountry.

In closing, doing wildlife track surveys immediately following a fresh snow paints a pretty good picture of what is happening around us. Snowshoe hare tracks are common, as are moose. Because we were not in any deer wintering areas, we saw no deer tracks. On almost every survey, we see pine marten and fisher and sometimes the smallest member of that family, weasels.

-- Chuck Hulse



Canada Lynx (Photo by MDIFW)

REGION E - GREENVILLE

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Moose Fatalities Can Take Many Different Forms in the Maine Woods

The Maine Department of Inland Fisheries and Wildlife (MDIFW) recently entered its fourth year of a moose mortality study in western Maine (west of Moosehead Lake). This study aims at improving our understanding of mortality factors, mortality rates, and calf survival and recruitment, just to name a few. To gain this understanding, moose are equipped with a radio collar that communicates information to wildlife biologists via satellites. Our findings, thus far, have been interesting and intriguing, and on December 18, 2016, that was especially the case.

Wildlife biologists were notified that a radio collar had not moved in 4.5 hours, which generally means that the animal wearing the radio collar is dead. Upon arrival, observers witnessed the evidence of a very natural, but unfortunate, mishap that otherwise would have gone unnoticed had this animal not been marked with a transmitter. Somehow, the year and a half old moose had lodged its front, left leg into the crotch of a yellow birch that was about 4½ feet high off the ground. The moose had apparently bucked up or reared up onto her back legs for one reason or another, accidentally slid that leg down into the crotch of the tree as she tried to land, and then got jammed at the hoof. The split in the tree's stem was just wide enough apart for the moose to get its leg into, but, since the end of a moose's leg is clubbed (because of the hoof, dewclaws, and all of the associated bones), this prevented the entire leg from coming out of the tree's crotch. The leg was not broken, but, when a necropsy was conducted, there were numerous internal indications of a lengthy struggle. In addition, there was a lot of missing bark (from struggling) along the side of the yellow birch tree where she was lying. The locations transmitted from the radio collar had also indicated that she had been in that spot for several days before expiring. There is numerous documentation of incidental mortality in moose across their range, but this is the first of this exact type that we have documented on the mortality study here in northern Maine.

-- Scott McLellan

REGION F - ENFIELD

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Katahdin Forest Management Helps Out Wintering Deer in Rockabema Deer Winter Area

Maine winters can be critical periods for wildlife survival. Fortunately, Maine's wildlife has developed adaptations and strategies to get them through long periods of cold temperatures and deep snow.

White-tailed deer have developed a strategy of seeking out mature, coniferous forests that contain trees at least 35 feet in height and provide dense canopy crown closures of 50 to 100%. These areas are composed primarily of cedar, hemlock, spruce and/or fir and provide increased daily mean temperatures, wind reduction, and reduced snow depths. Snow depths under dense coniferous cover can be up to 40% less than open areas or hardwoods.

The location of these forest types across the landscape is also an important consideration when deer are choosing a place to survive the winter months. Usually, these habitats or deer yards are at low elevations near bodies of water (lakes, rivers, streams or wetlands). Deer congregate in these deer yards or Deer Wintering Areas (DWAs) to share the energetic cost of creating and maintaining trails while accessing food and winter shelter, and to avoid predation. DWAs are used year after year, and use of these areas by deer is a learned behavior passed from doe to fawn.

MDIFW has been identifying and mapping DWAs since the 1950s and realizes the importance of protecting these unique habitats to achieve public-derived deer population goals. The Rockabema deer wintering area complex, owned and managed by Katahdin Forest Management (KFM), is a prime example of an area providing wintering habitat for generations of deer.

The Wildlife Division of MDIFW documented wintering deer along the Rockabema Stream area, south of Medway, as early as 1968. A deer wintering area aerial survey, conducted by the Enfield regional wildlife biologists in the winter on 1971-1972, indicated a large concentration of deer along Rockabema Stream in TAR7 WELS and the southwestern corner of Medway. An additional area containing wintering deer was identified along Medunkeunk Stream in T2R9 NWP in 1972. Subsequent aerial surveys documented deer use in these areas in 1976 and 1978.

The Rockabema Stream yard was formally adopted as a P-FW (wildlife protection district) by the Land Use Regulation Commission in 1979. A considerable amount of both aerial and ground surveys, conducted by wildlife biologists in the late '80's and early 90's, further indicated the initial areas of deer use had enlarged and merged into a large, deer wintering area complex. This high value area supported a conservative estimate of over 1,000 deer each winter at that time.



Overhead canopy in Rockabema DWA. (Photo by Allen Starr)

As early as 1981, KFM recognized areas in the southwestern portion of Medway, in conjunction with the previously zoned area in TAR7, as providing quality winter shelter for deer. Discussions between MDIFW and KFM about developing a management plan first occurred in 1981.

During the 1980s, both parties realized that the existing wintering area was much larger and more important than had been originally thought. Additional travel corridors and concentrations of deer were identified, and a collaborative plan was developed to maintain or improve deer wintering habitat over the long-term, while providing a sustained yield of forest products for the landowner. The wildlife goals of the plan are to manage the area to maintain and/or improve the carrying



A deer trail through Rockabema DWA. (Photo by Allen Starr)

capacity for over-wintering deer and to maintain at least 50% of the area in quality winter shelter at all times. This was the basis for the cooperative Rockabema Habitat Management Area Plan that is in place today.

The Rockabema Plan encompasses 6,216 acres in the towns of Medway, TAR7 WELS, and T2R9 NWP. It is comprised of six management units with connecting travel corridors. This is a signed, voluntary agreement between MDIFW and KFM that spans 15-year intervals. Enfield regional wildlife biologists conduct site visits with KFM foresters to discuss timber harvest plans and to review post-harvest results.

This cooperative agreement is a prime example that, with consideration given to winter shelter for deer and some effort put into planning, quality deer wintering habitat can be achieved with a sustained yield of forest products. Katahdin Forest Management should be recognized and commended for their commitment to providing long-term, deer wintering habitat on the lands they own and manage!

-- Allen Starr

REGION G - ASHLAND

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Butler Island Wildlife Management Area

Butler Island, located in Ashland, is a small Wildlife Management Area (WMA) of approximately 295 acres of Aroostook River floodplain and riparian area. The area is split into 2 compartments; the larger of the 2 compartments includes an 86 acre island referred to locally as Butler Island. Half of this island consists of grassland or reverting field, of which 15 acres is actively cultivated and managed for grassland plant species and habitat. The original parcel of land was purchased in 1989 (Compartment 1), with an additional 49 acres added in 1993 (Compartment 2). The WMA is surrounded by private land but foot access has been granted off the Goding Road, via a primitive gravel road which crosses an active rail line. Foot traffic only is allowed on the WMA due to sensitive wetland habitat. The WMA is also accessible by water on the Aroostook River.

Waterfowl and woodcock are the focus of management activities on this WMA. The area contains high quality wetland habitat for waterfowl, with approximately half of the area flooding during early spring snowmelt. While some pools will dry late summer, several will retain water throughout the year and provide valuable feeding grounds for young and migrating waterfowl and wading birds. The island is also an active woodcock area, with its combination of old field, patches of alders, and hydric soils meeting the needs of this unique upland game bird.

Hunting, trapping, and wildlife viewing are allowed on the management area. Besides waterfowl and woodcock, keep your eyes open for moose, deer, beaver, muskrat, marsh birds, and songbirds that utilize the management area. If you want to access the island by foot, be sure to bring waders or be prepared to get your feet wet! The crossing between the island and mainland can vary in depth dramatically depending on the time of year, but, at low water it is well worth it!



A water crossing to Butler Island. (Photo by Amanda DeMusz)

-- Amanda DeMusz

LANDS MANAGEMENT PROGRAM

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Habitat Improvement Work at Jamies Pond Concludes for the Season, Grouse and Deer Habitat Improved

Habitat work at Jamies Pond began in August of 2016 and is now concluding for the season in anticipation of spring breakup. The Department has created 14 grouse blocks, totaling approximately 18 acres, enhanced deer wintering area habitat, and performed a light selection harvest around mast bearing species, such as red oak, American beech, and apple trees, to provide more growing space for their crowns. As of the end of the winter of 2017, work covering approximately 75% of the 800 upland acres at Jamies Pond has been accomplished.

Jamies Pond Wildlife Management Area (WMA) is an 800-acre upland parcel surrounding a 100-acre cold water fishery in the towns of Farmingdale, Hallowell, and Manchester. Management of Jamies Pond is funded, in large part, through the Wildlife and Sport Fish Restoration (Pittman-Robertson) Act for the creation, enhancement, and maintenance of wildlife habitat. Access to the area is from both the Meadow Hill and Collins Roads in Manchester and from the Outlet Road in Hallowell.

Upland game bird management has been of increasing interest to the public in recent years, and the Jamies Pond WMA represented an opportunity to develop a greater early successional habitat component, preferred by grouse and woodcock, than currently exists. An early successional structure is short-lived in nature and is characterized by species which are intolerant of shade and grow rapidly. Patch openings, such as those created at Jamies Pond in this operation, mimic small-scale natural disturbance and result in a flush of young forest. Future entries will allow the Department to maintain the early successional component and the game and nongame species which benefit. Non-game bird species, which will benefit from habitat in patches, include thrushes (Swainson's, hermit, wood, and veerys), indigo bunting, towhee, northern harrier, and short-eared owl.

Deer wintering shelter is in good supply at Jamies Pond WMA. Lacking, however, is a source of food within the sheltering areas. Harvesting within and adjacent to over-wintering shelter is a key component of management for deer. The photo shows a good example of a dense stand of hemlock and spruce with nothing for deer to browse. A sparse red maple component (and other hardwood species) is harvested selectively, resulting in sprouts that will provide a source of browse when the snow becomes too deep to forage on the forest floor for mast, such as acorns and beech nuts. ("Mast" is simply a term for fruit and comes in a variety of forms both hard and soft.) Biologists recommend light, frequent entries for deer wintering area management to provide a continuous supply of browse.



There is good shelter in Jamies Pond DWA but nothing for the deer to eat. (Photo by Eric Hoar)

The summer of 2017 and the winter of 2018 will conclude the remainder of the currently scheduled work at Jamies Pond WMA. The Department anticipates concluding mast tree release work this summer and wrapping up management of deer wintering areas in the coming winter. Work is expected to resume in approximately 5-10 years for further grouse and woodcock management and again in 15-20 years, depending on the development of deer wintering area habitat. Please visit Jamies Pond and witness the changes in the coming years. One can expect to see (and certainly hear) an increase in the number of song bird species populating a more diverse vertical forest structure, the truncated tips of browsed young red maple and oak, and a more abundant population of grouse.

-- Eric Hoar

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Installing Better Stream Crossing Structures Benefits Fisheries and Wildlife

Landowners, both large and small, often need to create access or upgrade existing access to their lands. In order to limit impacts to habitat, landowners should try to avoid crossing streams, if possible. If a crossing over a stream is unavoidable, it makes sense to limit crossings to only areas where they are essential.

Stream crossings will use a variety of different structures, such as metal or plastic culverts, concrete box culverts, or bridges. However, not all of these are created equally. Of course, these structures need to be sized appropriately, to safely meet the anticipated flows expected in the river or stream, and minimize velocity, low flow, and other common barriers to fish passage. Ideally, stream crossings should be designed to span 1.2 times the bankfull width of the stream (e.g., a 10-foot wide stream would require a 12-foot wide crossing).

The best crossing structures also retain the natural stream bed, allowing the stream to function normally. This not only provides fish passage but also allows for all the other biological components of the stream ecosystem, such as amphibians, reptiles, invertebrates, and mammal passage within the watershed. Another important benefit of crossing structures that maintain the natural stream width is a significant reduction in beaver problems.



A box culvert. (Photo by MDIFW)

Undersized culverts are the least desirable for crossings of streams because of their relatively short life span and the constrictions culverts impose to the natural stream width. Undersized plastic culverts have the same drawback; in addition, their smooth inner surface increases water velocity significantly, creating a barrier to fish passage. However, a culvert sized to 1.2 times the bankfull width of the stream, properly embedded and backfilled with streambed-like material, can be a good, relatively inexpensive, solution for the landowner that is also fish-friendly. Alternatively, modular concrete arches, box bridges, and bridge deck panels, along with concrete footings and abutment blocks, are manufactured in several sizes suitable for most any situation. These structures are generally more expensive than culverts, but, based on a service life of +/- 80 years, concrete stream crossing structures are cost effective, fish and wildlife friendly, and easy to install. A North Anson, Maine company is currently manufacturing pre-cast concrete crossing structures that maintain the natural bed of the stream.

-- Joe Wiley
Wildlife Biologist (Retired)

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