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**MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE**  
Chandler E. Woodcock, Commissioner

## **Research & Management Report**



**Are Maine bumble bees in decline?**  
See Maine Bumble Bee Atlas, page 47

# 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](http://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.



## 2016 Research and Management Report

Cover Image: Northern Amber Bumble Bee (*Bombus borealis*) on a Tall, Red Clover (Photo by Alison C. Dibble)



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# TABLE OF CONTENTS

MAINE'S REVISED WILDLIFE ACTION PLAN: CHARTING THE NEXT 10 YEARS OF COLLABORATIVE WILDLIFE CONSERVATION.....	4
FUNDING WILDLIFE CONSERVATION .....	6
THE RESEARCH AND ASSESSMENT SECTION: A MDIFW SOURCE FOR SCIENTIFIC INFORMATION .....	7
ENDANGERED AND THREATENED SPECIES CONSERVATION .....	8
INFORMATION FOR HABITAT CONSERVATION AND MANAGEMENT.....	11
What We Do .....	11
Completed - Coastal/Tidal Wildlife Habitat .....	11
Ongoing Work - Assessing Freshwater Wetlands .....	11
Oil Spill Response .....	12
BIRD CONSERVATION AND MANAGEMENT.....	14
Piping Plovers.....	14
Semipalmated Sandpipers .....	15
Tracking Maine's Great Blue Herons - Online .....	16
Bald Eagles - Flying High but Still Some Turbulance in the Air.....	17
Monitoring Population Change in Maine's Non-game Breeding Bird Species.....	18
Common Eider Duckling Survival Study.....	19
Reduction in Sea Duck Hunting Opportunity Starting Fall, 2016.....	19
Game Birds.....	20
MAMMAL CONSERVATION AND MANAGEMENT .....	23
White-tailed Deer.....	23
Disease Monitoring in Maine's Deer and Moose .....	28
Moose.....	29
Black Bear .....	32
Canada Lynx .....	36
Furbearers .....	37
Small Mammals .....	39
New England Cottontail.....	39
Wolves.....	41
REPTILE, AMPHIBIAN, AND INVERTEBRATE CONSERVATION AND MANAGEMENT.....	43
Amphibians and Reptiles.....	43
Invertebrates.....	47
Special Habitats for Reptiles, Amphibians, and Invertebrates.....	51
FISH CONSERVATION AND MANAGEMENT .....	52
Northern Pike in Pushaw Lake: A Ten Year Update .....	52
Stream Temperature Monitoring.....	56
REGIONAL WILDLIFE MANAGEMENT.....	59
Region A - Gray .....	59
Region B - Sidney .....	59
Region C - Jonesboro .....	60
Region D - Strong .....	61
Region E - Greenville.....	62
Region F - Enfield .....	63
Region G - Ashland.....	63
Lands Management Program .....	64
Joe Wiley, Staff Biologist Assigned to Department of Agriculture, Conservation, and Forestry .....	65
REGIONAL FISHERIES MANAGEMENT .....	66
Survival and Movement of Fall-stocked Brown Trout in the Lower Saco River .....	66
Shawmut Telemetry Project: Investigations into a Once Renowned Brown Trout Fishery.....	67
Estimating Smelt Drift through Brassua Dam into the Moose River .....	68
Investigations into Interactions Between Rainbow Smelt and Lake Whitefish.....	69
Fish Production Report, 2015 .....	70
In Memoriam - Dave Boucher .....	70



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## **MAINE'S REVISED WILDLIFE ACTION PLAN CHARTING THE NEXT 10 YEARS OF COLLABORATIVE WILDLIFE CONSERVATION**

The Maine Department of Inland Fisheries and Wildlife (MDIFW), in collaboration with its conservation partners, recently completed revisions to Maine's 2015 Wildlife Action Plan. The U.S. Fish and Wildlife Service (USFWS) requires each state to create and revise their Wildlife Action Plans every 10 years in order to qualify for the State Wildlife Grant Program (SWG). The SWG Program was established by Congress in 2001 to help states develop and implement management programs that benefit all wildlife species and their habitats, including those species that are not hunted or fished. Beginning with the approval of Maine's first Wildlife Action Plan in 2005, an extensive breadth and diversity of conservation work has been conducted by MDIFW and its conservation partners, including technical assistance, monitoring, research, outreach and education, and habitat restoration for sensitive wildlife species across the state.

During 2014 and 2015, MDIFW collaborated with over 100 state and federal agencies, tribes, non-profit organizations, species and habitat experts, and other conservation partners to revise Maine's Wildlife Action Plan. The first step in this process (and the foundation of the Wildlife Action Plan) was to identify Maine's Species of Greatest Conservation Need (SGCN). Biologists from MDIFW and other state agencies, with cooperation from conservation partners and species experts, developed a suite of objective criteria for designating SGCN that is intended to be transparent and science-based, and recognizes that species conservation concerns can be identified at global, regional, and local scales. The primary themes for SGCN prioritization in the 2015 Wildlife Action Plan include risk of extirpation, population trends, endemism, and regional conservation concerns. Secondary themes for SGCN prioritization include climate change vulnerability, survey knowledge, and indigenous cultural significance. Maine's 2015 list of 378 SGCN are assigned to three species priority levels: Priority 1 (Highest; 58 SGCN), Priority 2 (High; 131 SGCN), and Priority 3 (Moderate; 189 SGCN), all of which are eligible for SWG assistance from USFWS. In comparison, Maine's 2005 list of SGCN totaled 213 species grouped into two priority levels. The 2015 process for reviewing and identifying Maine SGCN included both species deletions (33) and additions (198) to the 2005 list. The net increase in SGCN is driven primarily from: a) additional conservation science designation criteria, b) scrutiny of more invertebrate taxa, c) significantly greater attention to marine fauna in the Gulf of Maine, and d) more explicit recognition of climate change vulnerability. It is our hope that identifying a relatively comprehensive, prioritized suite of SGCN will help MDIFW and conservation partners implement meaningful conservation actions for some of Maine's most vulnerable and valued wildlife resources over the coming decade.

MDIFW and conservation partners also identified habitat associations for all SGCN and the biggest challenges ('stressors') facing these species and their habitats. For SGCN, we identified 'Habitat Shifting or Alteration' (mostly due to expected climate changes or sea level rise) and 'Lack of Knowledge' as stressors for the largest number of SGCN, affecting 108 and 109 species, respectively. Each of these stressors impacted more than one-third of all Priority 1 and Priority 2 SGCN, indicating that they are wide-spread issues that occur across taxonomic groups. For habitats that support SGCN, we identified 'Invasive Non-native/Alien Species/Diseases' and development (comprised of 'Roads and Railroads', and 'Housing and Urban Areas') as stressors to the largest number of habitats. Although all of these issues occur statewide and have the potential to impact virtually every habitat in Maine, their impacts on SGCN differ markedly depending on geography and the sensitivity of the individual species. We determined priority stressors for each SGCN and habitat by assessing stressor severity and actionability, among other characteristics.

In order to address the most severe and actionable stressors to SGCN and habitats, MDIFW and partners identified practical solutions ('conservation actions') to prevent further species declines over the ten year life of the plan. Maine's 2015 conservation actions consist of complimentary coarse- and fine-filter approaches that maximize limited conservation resources and can be adapted as needed to address emerging issues and information. Conservation actions are non-regulatory and are not intended to replace existing management strategies. However, they can be used to bolster existing, or inspire new, efforts. MDIFW and conservation partners identified a total of 319 conservation actions for SGCN. Of these, 201 were applied to individual SGCN, 91 were applied to guilds, and 27 were applied to one or more

taxonomic groups. Nine of these actions were assigned to all SGCN species. Conservation partners also identified 341 habitat conservation actions, involving 173 marine and coastal habitat actions, 59 freshwater aquatic habitat actions, and 109 terrestrial and freshwater wetland habitat actions. Given the volume and large scope of habitat conservation actions, we also developed several themes to organize these actions into discrete packages of related and often complementary actions that address common stressors or use similar techniques. Three universal 'super-themes' emerged across all habitats (Enhancing Connectivity, Invasive Species, and Mapping and Outreach), indicating that conservation actions in these themes may be more effective with coordinated efforts across habitats. We also identified 11 Programmatic Actions to help guide Plan implementation, outreach, funding, and tracking.

Currently, MDIFW is working with partners to develop new tools and outreach materials for accessing 2015 Wildlife Action Plan information. Already, we have decreased the plan's length from the 2005 version by 77% to help users quickly find the most pertinent information to their conservation efforts. Furthermore, all SGCN, habitat, stressor, and conservation action information is linked in a relational database, an idea proposed in the 2005 Wildlife Action Plan and successfully developed as part of the 2015 revision. Currently, conservation partners and the public can access this information in a series of concise reports for each SGCN, habitat, and stressor through links in the online version of the Wildlife Action Plan. We also have developed range maps for all SGCN at the township and watershed scales to assist partners engaged in all spatial scales of conservation. Over the next few years, MDIFW will continue working with partners to incorporate SGCN range information into existing wildlife habitat maps, develop web-based search tools and databases, and create and deliver outreach modules and workshops aimed at different user groups and geographic regions.

Maine's 2015 Wildlife Action 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. The 2015 Wildlife Action Plan is dynamic, responsive, and adaptive. Hence, Maine's Wildlife Action Plan serves as a solid foundation to help guide the next ten years of collaborative wildlife conservation.

For a copy of Maine's 2015 Wildlife Action Plan and additional information, please visit:  
<http://www.maine.gov/ifw/wildlife/reports/MWAP2015.html>

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

"The last word in ignorance is the man who says of an animal or plant, "What good is it?" If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering."  
— Aldo Leopold (Round River, 1953, published posthumously)

# FUNDING WILDLIFE CONSERVATION

Most staff salaries, administrative costs, and operations of the 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 FY 2016 exceeded \$5.8 million. The Dingell-Johnson (DJ) Act of 1950 initiated similar support for fisheries, and Maine's share this year exceeded \$3.6 million. Both PR and DJ Funds require 25% state matching dollars, which MDIFW derives from license revenues. The saying that "sportsmen are the original conservationists" certainly rings true for program funding.

MDIFW also receives federal funding for the management of any animal designated a "species of greatest conservation need" (SGCN) in the State's Wildlife Action Plan. Maine submitted a revised Plan and SGCN update last year; see <http://www.maine.gov/ifw/wildlife/reports/MWAP2015.html>. These State Wildlife Grants (SWG) are appropriated annually to states by Congress via the federal budget. In FY 2016, Maine's share of SWG funds totaled \$480,000. These funds are strategic to conservation of "at risk" species before further setbacks lead to reliance on protection via the Endangered Species Act. The certainty and scale of SWG funds fall far short of the need and limit proactive conservation. In the past year, a national "Blue Ribbon Panel" has made recommendations for stable, increased funds that include industry support for a portion of the excise tax on energy production authorized by Congress but currently inactive. For more information, see <http://teaming.com/blue-ribbon-panel-sustaining-americas-diverse-fish-wildlife-resources>.

Volunteer contributions to the Endangered and Nongame Wildlife Fund via the tax-form "Chickadee Check-off" and purchases of "Loon Plate" conservation registration 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 have started to use similar funding strategies.

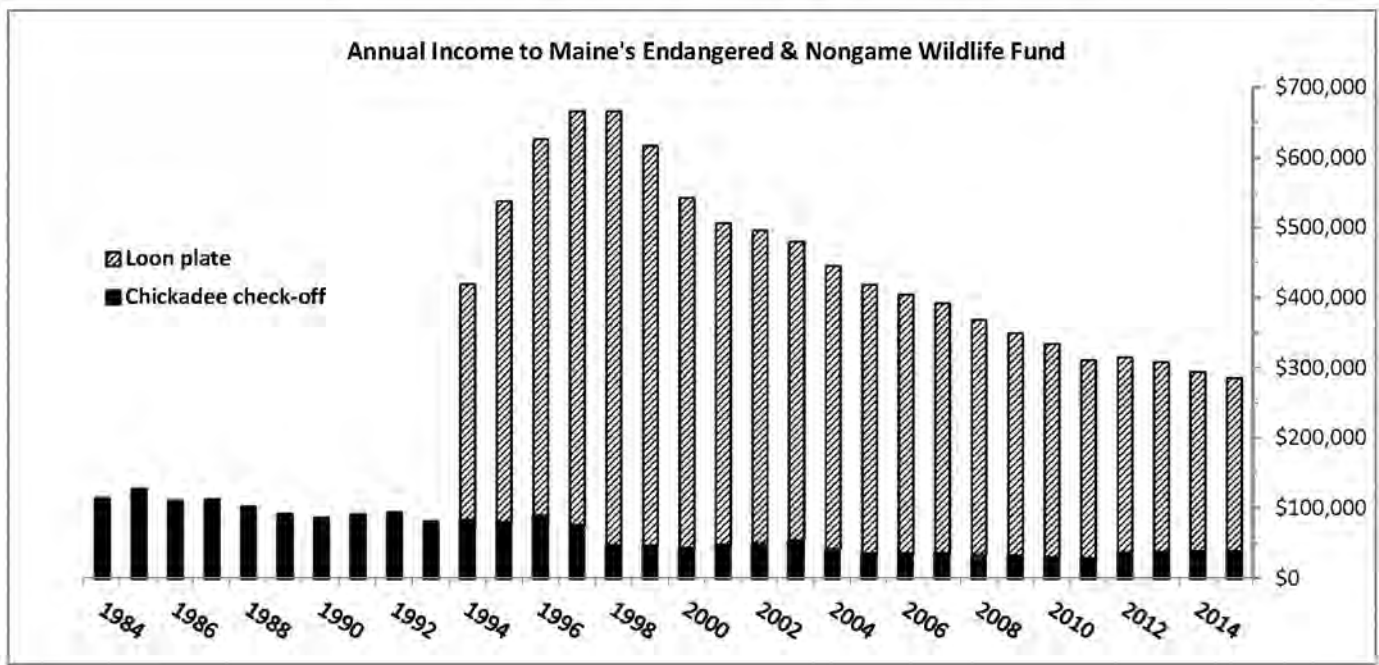


Figure 1. A history of income derived from the "Chickadee Check-off," Loon Plate, and Maine Outdoor Heritage Funds to benefit wildlife programs.

At a time when Maine citizens have just endorsed conservation of rare species and habitat conservation as among the most valued roles of MDIFW, we simply have to improve state funding. Our staff successfully acquire other grants and enroll citizen scientists to create new sources of match. Those efforts will continue, but the constant pursuit of funds handicaps our potential to implement adequate conservation for 378 SGCN now identified in Maine's Wildlife Action Plan. If a 21st century model for funding fish and wildlife diversity is implemented nationally, Maine will be challenged to provide sufficient match to qualify for its likely funding share. There are no easy solutions for long term funding, but here's one for the near future: if 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! We gratefully acknowledge >44,000 purchases or renewals of a "Loon Plate" for vehicles last year. The 40% proceeds to MDIFW represent >80% of total program funds.



## THE RESEARCH AND ASSESSMENT SECTION: A MDIFW SOURCE FOR SCIENTIFIC INFORMATION

Following the Department's reorganization of 2012, the current Research and Assessment Section (RAS) now consists of an Administrative Group with the Endangered and Threatened Species Coordinator, Bird Group, Habitat Group, Mammal Group, Reptile, Amphibian, and Invertebrate Group, and a Fish Group. We do our best to keep track of all of Maine's wildlife from moose to mayflies, as well as fishes that may be classified as commercial, sporting, or species of greatest conservation need (SGCN). The Regional Fish and Wildlife Biologists provide local expertise and boots-on-the-ground management, while the Bangor-based staff in RAS provide some additional technical expertise on all of the state's diverse fish and wildlife taxa. Much like the Section itself, this report that used to cater to Wildlife interests exclusively, now includes supporting information from Fisheries programs too.

As promised in last year's report introduction, MDIFW has been hosting public hearings and steering committee meetings to support and help guide 10-year species planning processes for various fisheries and big game, including black bear, white-tailed deer, moose, and wild turkey. Basically, we are identifying management concerns and priorities that have remained or have arisen since the last plan and are proposing strategies to deal with such issues.

We've hired a nationally-renowned fish and wildlife public survey firm to help us engage the public and identify attitudes, thoughts, and concerns on big game and fisheries management. They conducted random public surveys, closed-panel forum discussions, and open public hearings for big game and fisheries programs. They also conducted a public relations and marketing survey to help MDIFW with effective public communications, as well as marketing of ourselves, our fish and wildlife species and habitat conservation programs, and the resulting diverse and healthy fish and wildlife populations available for all people to enjoy in Maine. The first thing they did was try to get a better understanding of our publics' natural resource value system, and they found some interesting results.

Mainers appreciate clean water and healthy fish and wildlife habitats as much or more than anything else. When asked to gauge the importance of the services provided by MDIFW, "protecting and preserving fish and wildlife habitats" was ranked as #1 by public respondents. Species planning is one pillar underlying our mission of fish and wildlife conservation and wise use of those natural resources for current and future generations. But if they have no place to live, then why bother planning for something that has no natural life support system? Healthy habitats are a requirement for healthy populations of fish and wildlife. Habitat conservation is the other pillar underlying our mission and is the key to healthy fish and wildlife populations that can lead, as well, to healthy human lifestyles of outdoor use and enjoyment. We hope you have the opportunity to frequent the outdoors and experience Maine's diverse and abundant fish and wildlife resources that are public trust resources belonging to all of us.

There are a couple of programs that we use to help protect and preserve fish and wildlife habitats. The first line of defense is a good offense. We have a small team of staff who work with private conservation partners (landowners, land trusts, and towns) to identify areas of exceptionally high value habitats in their local area, so they can voluntarily conserve such habitats if it meets their local planning and land-use goals. We call this our habitat outreach program. The other program is Maine's environmental review system that is administered by the Department of Environmental Protection in organized towns and assisted by recommendations from MDIFW's biologists when priority fish and wildlife habitats are involved. Nearly all biologists participate in this program one way or another. This program is designed to accommodate new development in a manner that avoids and minimizes impacts to sensitive habitats for at-risk species. Mainers clearly value this service provided by their State, according to the recent public survey. Consider that this process helped lead to both federal and state delistings of the once endangered bald eagle in Maine. Now, we have over 600 bald eagle nests statewide, and the species is considered to be secure. Additionally, recent voluntary habitat management collaborations between Federal and State agencies and private landowners in southern Maine helped to prevent the listing of the New England cottontail rabbit under the federal Endangered Species Act in 2015.

The fisheries public survey provided some insights into what drives Mainers' fishing experiences. Top motivations for fishing were relaxation and time spent with family or friends, not the search for trophy fish. The top-rated factor when planning a fishing trip was "that the area offer solitude and pristine views of nature". Been there, and plan to go back.

Here's a quick mention that we have a new bird biologist on board, and there are rumors that we may undertake the development of a Maine Breeding Bird Atlas. This sounds like a pretty big project to me, and we'll probably be looking for some help. You can find extra copies of this annual report at Augusta headquarters, regional offices, at certain locations in the North Maine Woods of the Moosehead area, and on our website too: [http://www.maine.gov/ifw/wildlife/reports/research\\_management.html](http://www.maine.gov/ifw/wildlife/reports/research_management.html). Enjoy.

-- Shawn Haskell, Ph.D.  
*Supervisor, Research and Assessment Section*



## ENDANGERED AND THREATENED SPECIES CONSERVATION

### Maine's List of Endangered and Threatened Species

In the last year, new legislation expanded conservation tools afforded to animals listed as Endangered or Threatened (E/T) under the Maine Endangered Species Act. Most notably, the 2015 listing of three “cave” bats in the genus *Myotis* (Little Brown Bats, Northern Long-eared Bats, and Eastern Small-footed Bats) presented a new dilemma in Maine. Each of these bat species formerly lived across vast areas of the state, but finding remnant individuals is now a major challenge due both to the catastrophic declines among cave bats and their nocturnal lifestyle. Except for traditional cave hibernacula where they overwinter, it is quite difficult to predict occurrences of E/T bats. Foresters, loggers, and landowners in general were concerned about potential liability for incidental take while conducting normal activities.

MDIFW worked with stakeholders to refine a bill carried over from the first regular session of the 127th Maine Legislature. The measure was enacted as emergency legislation and became effective immediately when signed by the Governor as Public Law - Chapter 423 on April 1, 2016. Key changes include:

- Incidental take plans can be developed for specific activities if:
  - (1) risks are predictable in time and space;
  - (2) taking(s) are incidental to, and not the purpose of, carrying out an otherwise lawful activity;
  - (3) taking(s) do not impair the recovery of any E/T species;
  - (4) the individual and cumulative effects are prevented, minimized, and mitigated by a Plan developed by the responsible party; and
  - (5) the MDIFW Commissioner approves the Plan after seeking input from knowledgeable individuals or groups.
- In special instances, MDIFW will prepare an Incidental Take Plan for a widespread activity if:
  - (1) a reasonably identifiable group of participants is involved;
  - (2) the taking(s) are incidental to, and not the purpose of, carrying out an otherwise lawful activity;
  - (6) the taking(s) do not impair the recovery of any E/T species;
  - (3) the net impact is a finite, manageable risk for incidental take that can be monitored;
  - (4) at least one public hearing is held; and
  - (5) the MDIFW Commissioner seeks input to the Plan from knowledgeable individuals or groups.
- An exemption rule for broad activities is a new option if it:
  - (1) addresses a specific activity that is widespread in occurrence;
  - (2) does not have a reasonably identifiable group of participants;
  - (3) poses little or no risk for taking of any E/T species;
  - (4) the taking does not impair the recovery of any E/T species;
  - (5) at least one public hearing is held; and
  - (6) the MDIFW Commissioner seeks input to the Plan from knowledgeable individuals or groups.

Traditional recovery efforts for E/T species focus on habitat conservation, increasing population abundance, expanding distribution, etc. When a species is at extreme risk of disappearing entirely from Maine (= extirpation) or its entire range (= extinction), the loss of individuals can be critical. The sudden, dramatic death of millions of *Myotis* bats during the last decade from a pathogenic fungus is an unprecedented event that requires a sustained, coordinated response by wildlife agencies and their conservation partners. The legislative changes to Maine law, outlined above, enable an alignment of state and federal policies since the U.S. Fish and Wildlife Service listed the Northern Long-eared Bat as a Threatened species throughout its range in 2015. Short-term safeguards for at-risk bats are already being implemented, but other strategies may arise from research and monitoring. We invite your support for efforts that will take many years to remedy. Much like the successful 31-year effort to recover Bald Eagles in Maine, we know that restoring *Myotis* bats that produce only one offspring each year, normally, will take considerable time.

Maine's E/T List administered by MDIFW now includes 51 species. Biologists periodically review the status to recommend changes to the List for consideration by the Legislature. Most conservation efforts must be prolonged to affect changes.

Authority for state-listing of marine fauna (except birds) also is held by the State Legislature, based on input by the Maine Department of Marine Resources; see <http://legislature.maine.gov/legis/statutes/12/title12sec6975.html>. The Maine Natural Areas Program maintains an informational list of rare, threatened, and endangered plants in the State; see [http://www.state.me.us/dacf/mnap/features/rare\\_plants/plantlist.htm](http://www.state.me.us/dacf/mnap/features/rare_plants/plantlist.htm).

<b>Taxa group (class)</b>		
Common Name	Scientific Name	Legal Status (year listed)
<b>Birds (Class Aves)</b>		
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)
<b>Fish (Class Actinopterygii)</b>		
Redfin Pickerel	<i>Esox americanus americanus</i>	Endangered (2007)
Swamp Darter	<i>Etheostoma fusiforme</i>	Threatened (1997)
<b>Insects (Class Insecta)</b>		
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)
<b>Mammals (Class Mammalia)</b>		
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)
<b>Molluscs (Class Bivalvia)</b>		
Brook Floater	<i>Alasmidonta varicose</i>	Threatened (2007)
Tidewater Mucket	<i>Leptodea ochracea</i>	Threatened (1997)
Yellow Lampmussel	<i>Lampsilis cariosa</i>	Threatened (1997)
<b>Reptiles (Class Reptilia)</b>		
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)
<b>Snails (Class Gastropoda)</b>		
Six-whorled Vertigo	<i>Vertigo morseii</i>	Endangered (2015)

State endangered species programs are complementary to (but typically do not duplicate) federal listings under the U.S. Endangered Species Act (ESA). ESA considers the status of species over “all or a significant portion of the species’ range.” Unless a 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 [https://www.fws.gov/mainefieldoffice/Endangered and Threatened Species.html](https://www.fws.gov/mainefieldoffice/Endangered_and_Threatened_Species.html). Another federal agency, the National Oceanic and Atmospheric Administration – National Marine Fisheries Program has lead responsibility for marine mammals, sea turtles, and fish that are Endangered or Threatened in the Gulf of Maine; see <http://www.greateratlantic.fisheries.noaa.gov/protected/section7/listing/index.html>.

As E/T lists seem to inevitably grow over time, policies and conservation tools must adapt to new situations and solutions. The history of legislation related to Maine ESA demonstrates this pattern as well.

Maine ESA conservation tools	Year	Maine ESA list changes
Incidental take changes; new provision for broad exemption rules	2016	
	2015	additions: 3 mammals, 3 invertebrates; status changes: 1 bird “up-listed” to E 2 invertebrates “down-listed” to T
	2009	deletion: 1 bird removed from E/T list
	2007	additions: 1 mammal, 6 birds, 1 fish, 6 invertebrates; status changes: 1 invertebrate “down-listed” to T; deletion: 1 invertebrate removed from E/T list
Transfer marine fauna listings to Maine DMR	2003	
New prohibitions for incidental take	2001	
	1997	additions: 6 birds, 1 fish, 9 invertebrates; status changes: 1 bird, 1 reptile “up-listed” to E
End automatic listing of federal E/T species	1996	status changes: 1 bird “down-listed” to T
Legislature assumes final listing authority & new oversight of E/T transplants	1995	
Additional state funding = “Loon Plate” licenses	1994	
New provision for Essential Habitat designation	1989	
New prohibitions for baiting & harassment	1988	
	1987	additions: 1 mammal, 5 birds, 4 reptiles
Initial state funding = “Chickadee Checkoff”	1984	addition: 1 bird
Maine ESA enacted by the Legislature	1975	automatic inclusion of species listed by federal ESA

In a survey of Maine citizens last year, MDIFW programs for conservation of E/T species were overwhelmingly endorsed. Unfortunately, that support has not translated into a stable funding source. Forty-one years after passage of the Maine Endangered Species Act, the only state funds available to MDIFW to conduct these programs 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 we **do not** have your financial backing. MDIFW biologists often secure many alternative grants, but state revenues remain critical to our ability to leverage other funding sources and, ultimately, limit the scope of our efforts. Please consider supporting us!

*MDIFW personnel time is supported by federal aid funds from the Pittman–Robertson program for wildlife restoration and federal State Wildlife Grants for conservation of species “at risk”, as well as state revenues from the Loon License Plate and Chickadee Check-off fund.*

-- Charlie Todd  
Endangered and Threatened Species Coordinator

## 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.

**MaryEllen Wickett, Ph.D., Wildlife Biologist and 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 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** - Develops, maintains, and analyzes databases of wildlife observations and habitat. Provides assistance to other Division biologists to assess species' habitats on a statewide basis.

## 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 – they include only about half of the habitat in Maine and are based on legal definitions. In the regulatory world, an area is either regulated or unregulated so 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 these data available to Department staff and we provide a range of technical support, primarily with mapping and wildlife/habitat databases, but also with general network and server problems. Unlike other RAS Groups that work on numerous, specific projects that may be relatively short in duration, much of the work that Habitat Group does is ongoing maintenance of existing data sets and custom applications.

*This work is supported by federal State Wildlife Grants, the federal Pittman-Robertson Funds program, state revenues from the sales of hunting licenses, Loon Conservation Plate, and Chickadee Check-off Funds, and the Maine Coastal and Inland Surface Oil Clean-up Fund.*

### Completed Work - Coastal/Tidal Wildlife Habitat

Salt marshes, tidal flats, eelgrass beds, and mussel bars all provide important habitat for wildlife. These were originally mapped nearly 20 years ago using data that, by today's standards, was very coarse. For several years, Habitat Group has been working to make this information more current and accurate. This year, we completed that effort and published the new data. During the effort, we assessed nearly 9,000 km of shoreline (more than the distance from Bangor, Maine to Vancouver, British Columbia) and mapped over 20,000 acres of salt marsh and over 60,000 acres of tidal flats.

*This work is supported by federal Pittman-Robertson Funds program, sales of hunting licenses, and the Maine Coastal and Inland Surface Oil Clean-up Fund.*

### Ongoing Work - Assessing Freshwater Wetlands

Field verification of habitats mapped from aerial photos is an important part of making data as accurate as possible. The Department has mapped specific wetlands as "Inland Waterfowl/Wading Bird Habitat," a Significant Wildlife Habitat protected under Maine's Natural Resources Protection Act (NRPA). This mapping was done from high resolution aerial imagery. Each wetland was scored based on five criteria (wetland type, diversity, size, habitat interspersions, and percent open water) and rated as a "high," "moderate," or "low" value to inland waterfowl and wading birds. Those wetlands that scored a "moderate" or "high" value are considered Significant Wildlife Habitats under NRPA. In most cases, the aerial imagery depicts these wetlands, which usually are at least 5 acres in size, with more than enough detail to score them.

In some cases, though, a field visit to confirm the mapping is needed. Usually these field visits are conducted on a case-by-case basis, for example when a specific wetland might be affected by a project that is being reviewed. Last year, however, Habitat Group began working with the Department's Regional Biologists to conduct proactive field assessments of wetlands that rated near the "low"/"moderate" score cutoff. We surveyed approximately 100 of these "borderline" wetlands in southern Maine. In July 2015, we visited the remaining 30 in Region A. We began visiting wetlands in Region B in July 2016.

*This work is supported by federal State Wildlife Grants, the federal Pittman-Robertson Funds program, and state revenues from sales of hunting licenses, 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. We used the updated coastal habitat mapping described above to revise our ranking of priority habitat areas for protection during a spill response. This year, we initiated a contract with Tri-State Bird Rescue to assist Maine with our oiled wildlife training, response planning, and selecting potential oiled bird rehabilitation centers. We also conducted a field training exercise around Sears Island, during which MDIFW staff donned Personal Protective Equipment and searched for "oiled birds" (painted, stuffed animals). Field exercises are essential for preparing staff to respond to a real event. On June 28, a tanker in the Piscataqua River ran aground and breached its hull. Fortunately, the holding tanks were not damaged and no oil was released, but it was a very close call for what could have been a significant incident.

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



GIS Coordinator, Jason Czapiga, wearing Personal Protective Equipment (PPE) while finding "oiled animals" during the oil spill response training exercise. (Photo by Mark Latti)

## 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 423 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 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, 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 duckling survival study. Brad also coordinates Department interests in seabird research and management activities.

**Erynn Call, Ph.D., Wildlife Biologist** – Erynn focuses on the ecology and management of Maine's raptors. Her current research centers on rivers and river-associated birds, including bald eagles and ospreys. Ongoing and newly initiated state-wide river bird monitoring programs will offer a greater understanding of habitat relationships, presence and removal of dams, and the importance of sea-run fishes to raptors. Other work includes review and collaboration on various raptor research and monitoring efforts of industry, universities, federal agencies, and nonprofit organizations.

**Danielle D'Auria, Wildlife Biologist** – Danielle is the Department's species expert on 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 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 Leppold, 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 also an avian ecologist, who recently finished her doctorate degree at the University of Maine at Orono. She has over 15 years experience in field research, with most of it focused on songbirds.

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



Buffleheads (Photo by Sharon Fiedler)

**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 include coastal shorebirds and harlequin ducks.

## BIRD GROUP CONTRACT WORKERS, VOLUNTEERS, AND OTHERS

**Lisa Bates, Wildlife Management Institute (WMI) contractor** – Lisa splits her time between the Mammal Group and the Bird Group. When she is with the Bird Group, Lisa participates in various field activities, including Canada goose capture and banding, preseason waterfowl banding, and ruffed grouse capture and radio telemetry work.

**Matt O'Neal, WMI contractor** – Matt also splits his time between the Mammal Group and Bird Group. This year his field work activities with the Bird Group include: wading bird surveys, great blue heron colony site visits, Canada goose capture and banding, preseason waterfowl banding and ruffed grouse capture and radio tagging.

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 and Marc Payne, Avian Haven; Maine Warden Service pilots Jeff Beach, Charlie Later, and Jeff Spencer; Maine Forest Service pilots Chris Blackie, and Lincoln Mazzei; USFWS pilot/biologist Mark Koneff; Rich MacDonald, Colleen Bovaird, Donna Kausen, Rebecca Holberton, Sean Rune, Shannon Buckley, Kate Ruskin, Mo Correll, Kate O'Brien, Lauren Gilpatrick, Todd Jackson, Bill Carll, Courtney Hagenaaars, Tom Berube, Glen Mittelhauser, John Drury, Dave Hiltz, Chris West, Don McDougal, Jim Dyer, Bill Hanson, Chris DeSorbo, Rick Gray, Wing Goodale, Lucas Savoy, Kevin Regan, Bruce Connery, Lesley Rowse; Joe Wiley, Bureau of Parks and Lands; 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, Sara Williams, Brittany Currier, Ryan Robbins, Shannon Prescott, Ken Janes, Gordon Smith, Doug Suitor, Michael Fahay, Robin Robinson, Jill Glover, Julie Johnston, Deanne Richmond, Andrew Gibbs, Houston Cady, Jazmyn Atteberry, Jeremy and Addison Polis, James Armstrong, Andrew Slack, Joel Gilb, Erik Blomberg, Samantha Davis, Ellie Mangelinckx, Jaime Bray, Laird Townsend, Marek Plater, Dan Grenier, Douglas McMullin, Chris Stevens, Jr., Judy Stevens, The Nature Conservancy, Maine Coast Heritage Trust, many Heron Observation Network volunteers, many Maine River Bird Project volunteers, many private landowners who have granted us access to their property for surveys and monitoring, and IFW regional staff.

## BIRD CONSERVATION AND MANAGEMENT

### Piping Plovers

#### 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 municipal officials, landowners, government employees, and individuals from private organizations combined efforts to protect nesting piping plovers and 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 plover young. These towns have included funds in their budgets to hire plover volunteer coordinators. Plover volunteer coordinators recruit and coordinate additional 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 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 a 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 62 pairs nesting on 20 beaches in 2015. The 2015 nesting season produced 121 piping plover fledglings, the most fledged on Maine beaches since record-keeping began in 1981! This year, we currently have 71 pairs nesting on 20 beaches. Despite challenging high tides and subsequent flooding on certain beaches, 2016 promises to be another successful season for Maine's nesting plovers.

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. They resemble hawks and can keep birds away from 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.

*This work is supported by volunteer assistance, the federal State Wildlife Grants program, and Section 6 Funding, as well as state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.*

-- Lindsay Tudor

## **Semipalmated Sandpipers**

The semipalmated sandpiper is a small, abundant North American shorebird, drab in appearance, but capable of flying great distances, making migratory journeys from high Arctic breeding grounds in Canada to their South American wintering areas. These tiny sandpipers, weighing only 1.4 ounces, can rack up over 10,000 air miles during each spring and fall migration. Though they stop at specific coastal staging areas to refuel along their migratory routes, most "semis" are capable of flying 1,200 to 3,000 mile nonstop segments of their journey. During southward migration, Maine hosts thousands of semis, providing these weary travelers with the necessary fats and proteins to fuel the next leg of their journey, a nonstop 2,000-plus mile transoceanic flight to South America.

Recent surveys indicate that the eastern North American population of semipalmated sandpipers may have declined by as much as 50% over the past three decades. Habitat loss and habitat degradation along migratory routes, and in wintering areas located in South America, are believed to be major factors in this decline. Because the Gulf of Maine region is a major flyway for semipalmated sandpiper populations, the Maine coast plays a critical role in supporting these birds during migration. Understanding the movements of these individuals, as they migrate through the region, is paramount to identifying and preserving important stopover sites.

Until recently, tracking individuals across large distances was only feasible for large species that could carry a radio transmitter. However, recent development of tiny tracking devices called "nanotags," combined with automated receiver towers, allows for tracking local movements of shorebirds, as well as long distance, as researchers throughout the Atlantic coast install receiver towers.

In 2013 and 2014, MDIFW partnered with the University of Maine and the Maine Natural History Observatory to capture and place nanotags on semipalmated sandpipers that were feeding and roosting on coastal habitats located Downeast. Our objectives were to determine local movements related to shorebird foraging and roosting behaviors, information on length of stay by individual birds, and, combined with existing survey data, to determine population status of shorebirds using the Harrington - Addison staging areas. In 2014 and 2015, this study was expanded, in partnership with Rachel Carson National Wildlife Refuge (RCNWR) and Biodiversity Research Institute, to capture and place nanotags on semis using beach and saltmarsh habitats in Wells and Kennebunk. Knowledge of departure weights and condition indicators, along with knowledge of invertebrate concentrations and availability throughout the migration window, will be used to determine whether Maine staging sites are providing migrating shorebirds with resources needed for successful migration.

In the Downeast study, 72 transmitters were deployed on semipalmated sandpipers and subsequently detected by 2 automated towers. Adult birds weighed, on average, 5 grams more than juvenile birds. Also, young birds stayed longer, almost three weeks (17.5 days), on average, compared to adults (12.4 days). This additional 5-day stopover time may have been needed by young birds, on their first migration, to put on the energy reserves required to support nonstop flights to reach the wintering grounds. We confirmed that semipalmated sandpipers initiate their nonstop 3 to 5-day transoceanic flight directly from the Downeast study area to wintering grounds in South America.

In contrast, the average length of stay in Wells/Kennebunk was 16.5 days for adults. Juveniles were sporadic in departure dates, ranging over almost a month. Thirteen birds tagged at Wells were recorded at 16 different towers south of Maine and one bird, after staying for one week, ventured north toward Downeast Maine. Results from RCNWR suggest birds using beach and saltmarsh habitats in southern Maine may be staying longer to gain the fats needed to continue migration or need to increase local movements to find habitats with the resources they need. Certainly, birds using beach habitats surrounded by development are exposed to greater levels of human-related disturbance than shorebirds using relatively pristine habitats in rural Downeast Maine.



Beginning in 2015 and continuing through 2016, with support from Biodiversity Research Institute and Bureau of Parks and Lands, MDIFW and the University of Maine established a new study area in the mid-coast region located at Popham Beach State Park (Phippsburg). Thus far, we have captured and banded 76 shorebirds staging at Popham Beach State Park. Nanotags were placed on 30 semipalmated sandpipers (nine on juveniles and 21 on adults), four on juvenile sanderlings, and five on juvenile semipalmated plovers. One automated telemetry receiver tower was strategically located within the study area and five additional receiver towers, provided by Maine Coastal Island National Wildlife Refuge, were located on offshore islands in the mid-coast region, outside the study area.

Preliminary results from the mid-coast and southern study areas suggest birds similarly tagged at the southern and mid-coast sites that experience high human activity had longer stopover periods and were detected at multiple receiver stations south of Maine in New Hampshire, Massachusetts, and Rhode Island. Interestingly, some birds subsequently headed back north to Maine before they continued their migration to South America. Efforts in the mid-coast region will be continued in 2016 and it will be the final year of the shorebird telemetry study. We look forward to implementing management actions based on knowledge gained from this work that should benefit shorebirds that use our coastline during migration to rest and refuel.

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

-- Lindsay Tudor

### **Tracking Maine's Great Blue Herons – Online!**

This spring, MDIFW tagged 5 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. By marking and following individual adults over several years, MDIFW hopes to learn new information regarding daily movements, habitat use, colony fidelity, migration routes, and wintering locations of Maine's herons.

This year, students and teachers from several schools across the state played an important role in the field work, leading up to the tagging of the 5 herons. The students and teachers set and checked minnow traps, identified and measured the baitfish caught, and placed the baitfish into a bait bin in order to get a great blue heron to regularly feed from it. They also used game cameras to "watch" the bait bins when they could not be there themselves. After a heron became accustomed to feeding from the bait bin, MDIFW and researchers Dr. John Brzorad (Lenoir-Rhyne University) and Dr. Alan Maccarone (Friends University) set out an array of modified foothold traps near the bait bin to capture the heron so they could tag it with a GPS transmitter. The use of modified foothold traps has been perfected by Brzorad, and involves watching the

set traps from a blind until a heron steps into one of the traps. Once trapped, it is then quickly retrieved by the researchers for processing. The bird is kept calm with a hood over its eyes while researchers take measurements and a blood sample for sexing each bird, and attach the transmitter.



A Great Blue Heron with a GPS Transmitter (Photo by Brittany Marinelli)

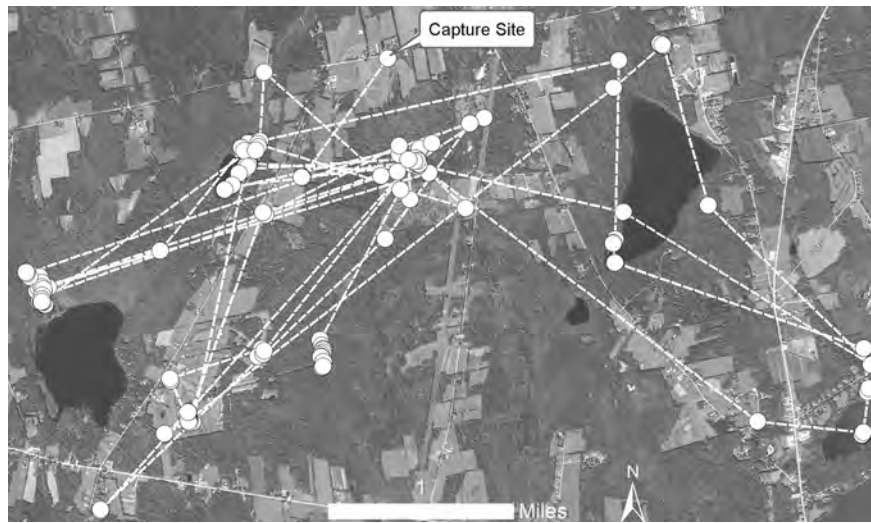
The transmitters were purchased with a grant from the Maine Outdoor Heritage Fund, represent the cutting edge of telemetry technology, and transmit GPS locations via the cell phone network to an open source website ([www.movebank.org](http://www.movebank.org)). The units also collect xyz accelerometry data on behavioral postures that quantifies time-energy budgets. 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 tracings per 24-hr period. The data are available on [www.movebank.org](http://www.movebank.org) for the students, citizens, and conservationists of Maine to use in education and to help make conservation decisions. Brzorad and Maccarone have been using these same style of transmitters since 2013 and have paired nearly 20 birds (great egrets and great blue herons) with school systems in five other states. In Maine, the students involved in this spring's field work ranged in level from grades 1-12 and were from the following schools: White Pine Programs in York, Harpswell Community School, Gray-New Gloucester High School, Nokomis High School in Newport, Old Town High School, Haworth Academic Center in Bangor, and Center

Drive School in Orrington. Thanks to their efforts, five great blue herons were trapped and tagged in Orrington, New Gloucester, Orono, and Palmyra. The 5 birds are:

- “Snark”, a male trapped in Orrington and adopted by Haworth Academic Center in Bangor. The students chose his name because they had recently read Lewis Carroll’s poem, “Hunting of the Snark.”
- “Sedgey” is a male trapped in Orrington and adopted by Center Drive School. “Sedgey” was named after the stream on which it was trapped: Sedgeunkedunk Stream.
- “Cornelia” is a female trapped at the New Gloucester Fish Hatchery, adopted by the Gray-New Gloucester High School. She had gotten into a fish rearing raceway at the hatchery, making her an easy capture with a long-handled net.
- “Pine Pond” is a female trapped at Pine Ponds on Orono Land Trust property and adopted by Old Town High School.
- “Nokomis” is a female trapped in Palmyra and adopted by Nokomis High School.

MDIFW hopes to get students from other towns in Maine following the five tagged great blue herons online and using the data generated by the solar-powered backpack transmitters in their classrooms. Data can be viewed online via an interactive map, and can be downloaded for use in Google Earth, Microsoft Excel, and ArcGIS. Students involved 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.

For more information on the Heron Tracking Project, including how to follow the great blue herons once they are tagged and resources for educators interested in using the data in their classrooms, visit <http://www.maine.gov/wordpress/ifwheron/>.



The first four days of movements by “Nokomis,” and adult great blue heron trapped in Palmyra and tagged with a GPS receiver.

*This work is supported by the Maine Outdoor Heritage Fund, the Maine Birder Band Fund, and Volunteers.*

*-- Danielle D’Auria*

## **Bald Eagles – Flying High but Still Some Turbulence in the Air**

Since their listing as an endangered species in 1973, bald eagles have made a tremendous recovery, both nationally and within Maine. While they are no longer listed as a threatened or endangered species, eagles are still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Act. In Maine, eagle nests are monitored statewide every five years. As of the last survey conducted in 2013, we know the number of nesting pairs is 20x what it was in 1970, increasing from 31 to over 600 pairs.

Bald eagle annual population growth has been steady at about 7% for the past 25 years and does not seem to be slowing down. This success story can be attributed to the Federal ban on the use of the pesticide DDT in 1972, as well as the dedication of MDIFW and landowners to protecting nesting habitat at over 470 nest territories from alteration or disturbance. Recent river restoration efforts and the return of sea run fishes, such as blueback herring and alewives, to Maine’s waters also helps by serving as a critical source of concentrated, highly nutritious prey.

Eagles still face threats that may not affect their population growth, but result in disheartening outcomes for this charismatic species. In addition to fish prey, eagles also rely on carrion. Scavenging can put them in harm’s way either



Bald Eagle (Photo by Sharon Fiedler)

through vehicle collisions associated with eating road kill or by misguided efforts by people to “help” by placing piles of animal carcasses on their property too close to roadways.

Big game carcasses can contain fragments of lead ammunition that break apart and become distributed in the flesh of the animal, well beyond the bullet entry site. Even a tiny piece of lead, about the diameter of a #2 pencil, has the potential to kill 3 to 5 eagles if ingested. Even if an eagle is not completely debilitated, they still may become disoriented, which could lead to a life threatening injury. Caregivers at Avian Haven, a wildlife rehabilitation center in Freedom, are able to measure lead levels in the blood and, when warranted, they will attempt to treat lead poisoned eagles. To learn more visit: <http://www.avianhaven.org/> and <http://www.huntingwithnonlead.org/>.

MDIFW is also working with a University of Maine master’s student to assimilate Maine bald eagle mortality data from the 1970s to the present. Through this work, we hope to gain a better understanding of trends in mortality over time and how different

sources of mortality vary by season or between juvenile (< 5 years old) and adult eagles. This work will help us address threats and improve conservation and management to ensure this species continues to thrive into the future.

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

-- Erynn Call

## **Monitoring Population Change in Maine’s Non-game Breeding Bird Species**

Spring and early summer in Maine is the time of year when flowers come into bloom, trees leaf out, the days get longer (and hopefully warmer), the mud dries up (if we’re lucky), and the robins, among other chorus members, begin to sing outside our bedroom windows, at 4:00 IN THE MORNING! Even I, an ornithologist and bird lover, will admit there are days I roll over grumpily after being awakened an hour or two before my alarm was set to go off! But, believe it or not, this is also the time when individuals across the country, myself included, hit the roads to collect data on these morning songsters. For just over a 5-week period, largely spanning the month of June in Maine, you might see an individual standing along-side the road at dawn, clipboard and binoculars in hand, on your morning commute.

There are a couple main theories as to why birds choose the early morning hours for singing. The climatic conditions, primarily calm, clear air, provide for the most consistent and clear song. Early morning songsters are primarily males in the bird world, so a clear, consistent song is important for staking claim to a territory and identifying yourself to your mate. Yes, despite often sounding the same to our ears, each individual bird has a unique, recognizable song just like our voice. Further, it is thought that early morning song provides proof about how strong you are. Singing is a time and energy-expensive activity for a bird. So, boasting a tune after a long night, before you’ve warmed up and had a good breakfast, speaks to your strength as a competitor and mate. But, why are *biologists and birders* also getting up that early to count these songsters?

For game bird species like waterfowl, American woodcock, and wild turkeys, populations are traditionally monitored through species-specific population surveys and harvest information. For example, woodcock are monitored via a springtime singing-ground survey and harvests are tracked by the Harvest Information Program. For non-game species, however, populations are generally less well understood. So, in 1966 the North American Breeding Bird Survey (BBS) was initiated to help track the status and trends of North American bird populations in general. Because these are road-based surveys conducted at fixed points along a pre-defined route, there are still regions and species not well monitored by the BBS. Nocturnal species, secretive marsh birds, and birds occurring in very remote areas, especially in the northern U.S. and Canada, are not well represented. But, despite its shortcomings, the BBS remains one of the largest-scale and longest-term monitoring programs for North American birds. Routes are assigned all over the country and throughout Canada. Maine has 75. Each route is 24.5 miles long. The surveys begin one half hour before sunrise and continue for about 5 hours; counts take place every half mile and last for 3 minutes. All birds seen and heard within that time are recorded.

BBS data have contributed to identifying watch-list species and Species of Greatest Conservation Need (SGCN), as reported in the Maine 2015 State Wildlife Action Plan and the 2016 State of North America’s Birds report. These data

are integral in focusing research and management attention on neotropical migrants, such as warblers and thrushes, and calling attention to range-wide declines of grassland nesting birds, like the grasshopper sparrow. Recently, results of these surveys have highlighted significant declines in the numbers of aerial foraging species in Maine, such as tree swallows, barn swallows, least flycatchers, and wood-pewees, among others.

The birds we see in our backyards, fields, forests, and over the ocean have much to tell us about the health of the environment we share. Every year, thousands of citizen scientists contribute data from across the U.S. to help biologists track bird populations. MDIFW staff has contributed to the BBS database for more than 20 years. A number of volunteer counters in the state also help by surveying each year. Unfortunately, 70% of the routes in Maine remain under-sampled. If you can identify birds in Maine by sight and sound, please consider adopting a route. For more information on the North American BBS, or to check out species' population trend estimates for the state, or to find a vacant route, please visit <https://www.pwrc.usgs.gov/bbs/index.cfm>.



Common Yellowthroat (Photo by George Gentry)

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

*-- Adrienne J. Leppold*

### **Common Eider Duckling Survival Study**

The Gulf of Maine is changing, and wildlife species that breed, nest, raise young and winter there have faced considerable change in recent years. This was no more evident than in 2012 when ocean temperatures rose an incredible two degrees, setting the wheels in motion for significant changes in complex marine food webs. Common eider populations, too, must adapt to a significantly altered food web, as numerous studies report widespread losses of the once-abundant blue mussel populations, the eiders preferred food item. Maine nesting eider populations, while still abundant, have declined as much as 50% over the last 25 years. Recent analyses indicate that annual production is not sufficient to offset the annual mortality levels, and this has resulted in a population decline. In previous investigations, we have found that while adult survival rates for adult males and adult females remain relatively high, changes in recruitment of young eiders into the population may be a major contributing factor in the population decline. It is believed that extremely low rates of duckling survival are the greatest limiting factor affecting the population growth and stability of common eiders in the Gulf of Maine.

American common eiders are a USFWS Focal Species, and a high priority of the Sea Duck Joint Venture (SDJV). This work serves to evaluate a priority management action identified in the draft Common Eider Focal Species Plan, and links management actions to the draft Atlantic Flyway Gull Management Plan. Improving our understanding of the survival rates of common eider ducklings has been identified as one of the highest priorities in the recent report to the SDJV. Specifically, our goal is to evaluate the effectiveness of gull control as a management tool for increasing common eider duckling survival. For this reason, beginning in the spring of 2016, we began a duckling survival study with U.S. Fish and Wildlife Service, Biodiversity Research Institute, U.S.G.S. Patuxent Wildlife Research Station, and U.S.D.A. Wildlife Services.

In early May, our field team visited one common eider nesting colony in Casco Bay, Maine. The timing of our visit was designed to safely capture hen eiders prior to the onset of egg-laying and nesting activities. We used a floating mist net technique to capture hen eiders paired with mates adjacent to their nesting island. Healthy hen eiders were weighed, measured, banded, and uniquely marked with plastic nasal discs and an external radio transmitter; we marked a total of 50 hens. We have begun conducting weekly boat-based surveys, using radio telemetry tracking equipment and nasal disc re-observations in order to locate each individual hen and determine the presence or absence of ducklings. I'll report on duckling survival in the near future, so please stay tuned.

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

*-- Brad Allen*

## Reduction in Sea Duck Hunting Opportunity Starting Fall, 2016

Sea ducks are long-lived birds that have fairly low reproductive rates compared with other ducks, which suggests that population abundance of these species may be sensitive to factors that influence adult survival (e.g., harvest). The population status of many sea duck species are poorly understood relative to other North American waterfowl, because they breed in remote areas that are not covered well by current surveys. The U.S. Fish and Wildlife Service's obligation is to ensure that populations of migratory birds remain sustainable. While the total sport harvest of sea ducks in the Atlantic Flyway is low relative to other waterfowl species, some believed that reductions in harvest levels were needed to help stabilize those populations, following a recent assessment of the harvest potential for sea ducks. The Service and Atlantic Flyway States have identified steps for reducing the harvest of sea ducks, and a reduction in season length and bag limits are expected to achieve an approximate harvest reduction of 25%. Please refer to your state's waterfowl hunting regulations before you participate in the 2016 sea duck hunting season!



A marked common eider hen (Photo by Chris Dwyer, USFWS)

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

-- 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-seven routes were completed in Maine in the spring of 2015 by MDIFW staff, USFWS staff, and a number of volunteers. The long-term trend of the number of males heard per route (1968 to 2015) indicates an overall decline in American woodcock numbers across their range. This long-term decline is believed to be caused by an overall loss in woodcock habitat. In 2015, the average number of males heard on Maine's SGS routes was 3.24. The previous year's number for Maine was 3.58. The 10-year Maine average is 3.69 males/route.

### *Woodcock hunting season*

Based on data from HIP, approximately 2,300 woodcock hunters harvested an estimated 10,400 woodcock in Maine in 2014. This was an increase in harvest compared to the previous year. The recruitment index of 1.8 immature (young of the year) to one adult female in the 2014 harvest was close to the long-term average of 1.7 young/adult female (1963–2013) and suggestive of good production in 2014. 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 1,132 woodcock wings from the 2014 hunting season for that survey.

## Waterfowl

Waterfowl harvest metrics are also derived from the Harvest Information Program. Harvest estimates for the 2007 to 2014 waterfowl seasons are listed in the following table (Table 1).

**Table 1. Maine Waterfowl Harvest 2007-2014.**

Species	2007	2008	2009	2010	2011	2012	2013	2014
American Black Duck	5,000	4,683	5,364	3,377	2,133	3,300	3,500	2,300
Mallard	12,700	11,265	12,711	8,379	7,441	14,000	10,200	9,200
Green-Winged Teal	6,100	7,872	4,923	3,189	2,042	2,300	4,600	1,500
Wood Duck	5,400	3,461	7,641	8,567	5,989	6,700	6,500	3,200
Ring-necked Duck	300	747	1,763	1,688	454	600	1,200	600
Common Goldeneye	1,600	2,307	1,469	313	318	600	700	500
Total (all regular ducks included)	31,100	30,335	33,871	39,100	31,500	39,900	36,000	21,600
Canada Goose	9,100	13,800	4,700	9,194	3,717	9,500	8,800	8,900
Sea Ducks								
Common Eider	13,100	11,143	4,355	4,505	6,400	5,200	3,100	1,000
Long-tailed Duck	1,000	4,305	656	2,321	2,695	NA	200	100
Scoter	1,700	4,052	890	1,092	674	3,200	1,800	900
Total Sea Duck Harvest	15,800	19,500	5,901	7,918	9,769	8,400	5,100	2,000
Total Waterfowl Harvest	56,000	63,635	44,472	56,212	44,986	57,800	49,900	32,500

## 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 remain within MDIFW.

## Wild Turkey

The spring wild turkey hunting season is the season of choice for the majority of turkey hunters. Over the last 5 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, 2014 and 2015 (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.

**Table 2. Wild Turkey Spring (2003-2015) and Fall (2003-2015) Registered Harvests.**

Season	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Spring	3,994	4,839	6,236	5,931	5,984	6,348	6,043	6,077	5,445	6,079	6,553	5,750	4,852
Fall	246	204	157	198	1,843	685	712	1,205	667	958	2,182	1,814	2,718

## 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 2015 statewide average of 43 grouse seen per 100 hours of moose hunting decreased compared to last year but was higher than the 2013 statewide average of 35.

**Table 3. Grouse Seen or Harvested/100 hours of Moose Hunter Effort in Maine for the last 15 years (2001-2015).**

Location	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Northeast	53	23	35	27	11	26	37	31	48	47	59	44	30	59	46
Northwest	55	43	50	56	24	45	44	51	101	101	81	93	62	70	82
Eastern Lowlands	55	29	29	24	8	20	53	23	34	34	30	34	30	62	26
West & Mountains	30	25	26	30	13	25	44	19	36	36	32	50	38	40	28
Downeast	-	13	21	20	9	22	19	28	30	29	15	13	15	14	10
Statewide	48	27	32	31	13	28	39	30	50	49	43	47	35	52	43

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

-- Kelsey Sullivan

## MAMMAL GROUP

The Mammal Group is one of five groups in the Research and Assessment Section (RAS) in the Bangor Office. We help develop and oversee the implementation of all management systems for Maine's mammals, monitor populations using a variety of techniques, assist with permit reviews, and provide technical assistance to the public and policy makers. We address public and departmental informational needs by conducting applied research, strategic planning, public outreach, and by responding to public information requests. Finally, the Mammal Group makes recommendations on changes to hunting and trapping rules to the Wildlife Division Director. These rule changes are made in close cooperation with regional biologists in the Wildlife Management Section, and after analyzing and applying biological data to our management systems.

**Wally Jakubas, Ph.D., Mammal Group Leader** – Supervises Mammal Group personnel, oversees all group activities, writes grant proposals, manages contracts, and helps facilitate the work of Mammal Group biologists. Wally is the Department's lead biologist for the state endangered New England cottontail and serves on the technical and executive committees of the Rangeland New England Cottontail Initiative. He actively participates in Mammal Group research projects and 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** – Supervises field crews in radiocollaring bears and collecting biological information, compiles these data, and writes reports for the Department's long-term (40-years) bear monitoring program. Randy also oversees the processing and aging of moose, deer, and bear teeth, and gives numerous talks to the public. Randy is a highly experienced field biologist who has worked for the Department's bear monitoring program for over 30 years. During Randy's tenure, he has shared his enthusiasm and knowledge of bears and bear management with many students, legislators, and members of the general public.

**Lee Kantar, Wildlife Biologist** – Oversees the management of Maine's moose population – the largest moose population in any state south of the Canadian border. Lee's work includes developing and conducting aerial surveys, collecting biological data, leading a team of biologists in making annual recommendations on moose hunting permits, serving as Departmental spokesperson on moose issues, and serving as IFW's liaison to the Northeast Wildlife Disease Cooperative. Lee is heading up a moose survival study in Maine in which GPS collars are deployed to track the movements and behavior of moose. The primary goal of this study is to identify the factors that limit the growth of Maine's moose population. This includes evaluating the impact winter ticks and other parasites have on moose survival rates. Results from this study will help IFW estimate year-to-year changes in moose numbers and set allocations of moose permits.

**Cory Mosby, Wildlife Biologist** – Cory oversees the management of furbearers and small mammals for IFW. He reviews and proposes changes to Maine's trapping regulations, monitors the state's bat populations, provides technical assistance for permit reviews concerning bats and other small mammals, responds to lynx incidental captures, writes grant proposals, and serves as Departmental spokesperson on furbearer and small mammal issues. Cory will be one of the principal investigators on a marten occupancy study that will start winter 2017. This study is being conducted in collaboration with Dr. Mortelliti, University of Maine, and will be used to develop new methods for monitoring the status of Maine's marten populations.

**Kyle Ravana, Wildlife Biologist** – Oversees the management of Maine's white-tailed deer population. Kyle works closely with a team of regional biologists in making annual recommendations on the allocation of Any-deer permits, collects biological data on deer, assists in conducting deer population surveys, organizes IFW's monitoring efforts for chronic wasting disease, and serves as the Departmental spokesperson on white-tailed deer issues. Kyle is conducting a major winter survival study on white-tailed deer, to determine how winter severity affects deer survival rates. IFW's winter severity index is arguably the most important index for predicting year-to-year changes in deer numbers.

**Jennifer Vashon, Wildlife Biologist** – Oversees the management of black bear and lynx and is the Departmental spokesperson on lynx and bear issues. Jen designs and implements surveys and monitoring efforts for bears and lynx, analyzes biological data, and writes grant proposals, annual reports, and planning documents. 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 federal 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.

## 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.

**Lisa Bates, Wildlife Management Institute (WMI) contractor** – Lisa is an integral member of the bear field crew. She helps with all aspects of bear den work including chemically immobilizing bears in their winter dens. In the spring, she traps and puts radiocollars on bears, and in the summer, she assists the Bird Group with their field studies.

**Kelly Boland, USFWS temporary appointment** – Kelly is the New England Cottontail Restoration Coordinator for Maine. Kelly's position is funded, in part, by IFW and by a grant from the National Fish & Wildlife Foundation. She works with various conservation partners to recruit landowners interested in habitat management for New England cottontail, heads up the Maine Lands Management Team, participates in the Outreach Technical Committee for the Rangewide Conservation Initiative, and provides technical support to IFW. Kelly works out of the Rachel Carson National Wildlife Refuge office.

**Andrew Johnson, WMI contractor** – Andrew works with the Natural Resources Conservation Service (NRCS) in Scarborough Maine to recruit and assist landowners in managing their property for New England cottontail under the Environmental Quality Incentives Program. Andrew's position is currently funded by IFW with support from NRCS and WMI.

**Josh Matijas, WMI contractor** – Josh leads capture crews on the deer survival study in the winter, and in the summer assists Cory with capturing bats, detecting bats using acoustic recorders, and analyzing acoustic recordings.

**Matt O'Neal, WMI contractor** – Matt provides field and logistical support for the Moose Survival Study; including performing necropsies, working on the capture team, and making moose / calf observations. Matt also responds to lynx incidental captures, assists with the collection of biological data from deer, and assists the Bird Group with their studies in the summer.

**2015-16 Contract Workers & Volunteers – Bat Project:** Katelin Craven and Christopher Heilakka; **Bear Project:** Jake Feener, Mitch Jackman, Brad Jones, Ethan Lamb, Mitchell Paisker, Alyssa Vitale, and Evan Whidden; **Deer Project:** Holly Bates, Faith Carney, Brittany Currier, Wendell Harvey, Sue Kelly, Ethan Lamb, William Miedema, Jerry McLaughlin, Eldon McLean, Alyssa Vitale, Daniell Hill, Megan Leach, and Anneliese Washakowski; **Lynx Project:** Katelin Craven and Alyssa Vitale; **Moose Project:** Tenley Bennett, Joel Carvell, Joanna Ennis, Josh Haines, Dave Hentosh, Sue Kelly, Megan Lowlor, Jennifer Majkowski, Brook Miller, Zach Smith, Daniel Vilasuso, Alyssa Vitale, and Monica Robinson; **New England cottontail:** Dave Tibbetts and Katherine Trickey.

## MAMMAL CONSERVATION AND MANAGEMENT

### White-tailed Deer

#### 2015 Deer Harvest

#### **2015 Season Dates and Structure**

Maine offered 5 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 2015.

#### **2015 Doe Quotas, Any-Deer Permits, and Applicants**

28,770 doe permits were distributed among 15 Wildlife Management Districts (WMDs) to meet the doe harvest objective of 3,274 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 to meet doe harvest objectives. This results in more permits being issued than does expected to be harvested.

The 2015 Any-deer Permit allocations ranged from zero in 14 WMDs (i.e., 1, 2, 4, 5, 7-11, 13, 14, 18, 19, 27, and 28), to 6,350 in WMD 21. The top 5 WMDs receiving the most Any-deer Permits per square mile were WMD 24 (19 permits/mi<sup>2</sup>), WMD 21 (13 permits/mi<sup>2</sup>), WMD 20 (9 permits/mi<sup>2</sup>), WMD 22 (4 permits/mi<sup>2</sup>), and WMD 23 (3 permits/mi<sup>2</sup>).



Overall, 65,742 people applied for Any-deer Permits for the 2015 hunting season (61,746 residents, 8,250 landowners (comprised of residents and non-residents), 6447 juniors (comprised of residents and non-residents), 3,996 nonresidents, and 1,672 Superpack; (Superpack were all counted as part of resident applicants). Maine residents drew the most permits (18,145 permits; 63%), followed by landowners ([comprised of residents and non-residents] 4683 permits; 16.1%), juniors ([comprised of residents and non-residents] 4611 permits; 16%), nonresidents (996 permits; 3.5%), and Superpack permittees (398 permits; 1.4%).

**2015 Statewide Statistics**

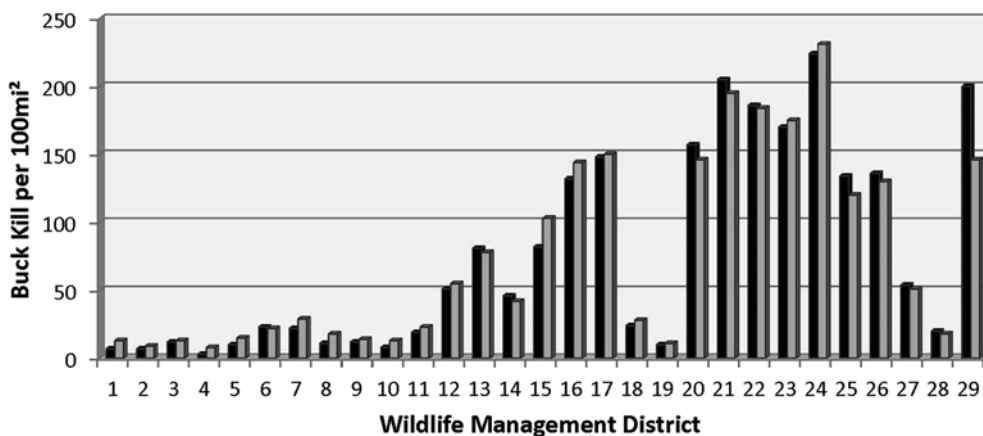
Maine’s deer hunters registered 20,325 deer during the 2015 hunting seasons (Table 4). Overall, 2,165 fewer deer were harvested in 2015 than in 2014, representing a 9% decrease.

**Table 4. Statewide sex and age composition of the 2015 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	932	839	171	216	2,158	1,226	11%	6%	23%
Expanded	568	623	133	170	1,494	926	7%	4%	17%
October	364	216	38	46	664	300	3%	2%	6%
Youth Day	306	336	102	101	845	539	4%	2%	10%
Regular Firearms	13,128	2,293	630	525	16,576	3,448	82%	88%	64%
Opening Saturday	1,399	381	97	84	1,961	562	10%	9%	10%
November 2-7	2,302	503	131	121	3,057	755	15%	15%	14%
November 9-14	2,841	427	129	109	3,506	665	17%	19%	12%
November 16-21	3,042	338	108	68	3,556	514	17%	20%	9%
November 23-28	3,544	644	165	143	4,496	952	22%	24%	18%
Muzzleloader	541	147	29	29	746	205	4%	4%	4%
November 30 - December 5	324	57	15	13	409	85	2%	2%	2%
December 7-12	217	90	14	16	337	120	2%	1%	2%
Unknown					20				
<b>Total</b>	<b>14,907</b>	<b>3,615</b>	<b>932</b>	<b>871</b>	<b>20,325</b>	<b>5,418</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**2015 Buck Harvest**

The 2015 statewide harvest of 14,907 antlered bucks was a 6% decrease from the 2014 hunting season, in which hunters registered 15,986 adult bucks (Table 5). On average, Maine hunters harvested bucks at a rate of 0.75 bucks per square mile during the 2015 hunting season. Excluding WMD 29, the top 5 buck-producing (per mi<sup>2</sup> basis) WMDs in 2015 were (in descending order), districts 24, 21, 22, 23, and 20 (Figure 2). 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.



**Figure 2. The 2015 buck-kill-index (BKI) was generally on par with the long-term average BKI in Maine.** MDIFW uses the BKI (i.e., the bucks killed per 100 mi<sup>2</sup> in a Wildlife Management District [WMD]) to assess white-tailed deer population trends within the state. An increase in the BKI may indicate an increase in the abundance of deer in a WMD.

**Table 5. Sex and age composition and harvest numbers of the 2015 deer harvest in Maine by Wildlife Management District<sup>1</sup>.**

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 <sup>2</sup>		Does
1	94	0	0	0	0	94	0	0	7	7	0
2	85	3	0	0	3	88	4	4	7	8	0
3	107	23	4	3	30	137	21	28	12	16	3
4	58	1	0	0	1	59	2	2	3	3	0
5	151	2	0	0	2	153	1	1	10	10	0
6	322	76	15	10	101	423	24	31	23	30	5
7	307	4	3	0	7	314	1	2	22	23	0
8	218	4	4	0	8	226	2	4	11	12	0
9	108	1	0	1	2	110	1	2	12	12	0
10	79	0	0	0	0	79	0	0	8	8	0
11	320	10	3	2	15	335	3	5	19	20	1
12	470	24	12	6	42	512	5	9	51	56	3
13	455	22	9	4	35	490	5	8	81	87	4
14	335	32	10	10	52	387	10	16	46	53	4
15	768	175	59	45	279	1,047	23	36	82	112	19
16	1,022	228	75	60	363	1,385	22	36	132	179	30
17	1,982	469	134	123	726	2,708	24	37	148	202	35
18	296	38	10	8	56	352	13	19	24	29	3
19	119	0	0	0	0	119	0	0	10	10	0
20	913	479	106	111	696	1,609	52	76	157	277	83
21	988	520	123	127	770	1,758	53	78	205	365	108
22	807	247	54	62	363	1,170	31	45	186	270	57
23	1,331	322	94	72	488	1,819	24	37	170	233	41
24	491	325	73	80	478	969	66	97	224	442	148
25	942	252	46	54	352	1,294	27	37	134	184	36
26	1,225	195	54	48	297	1,522	16	24	136	169	22
27	397	3	2	1	6	403	1	2	54	55	0
28	219	1	1	0	2	221	0	1	20	20	0
29	290	164	36	42	242	532	57	83	200	366	113
Unknown	7	0	1	2		10					
Statewide	14,906	3,620	928	871	5,416	20,325	24	36	52	71	13

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

<sup>2</sup>Recorded BKI

### 2015 Antlerless Deer Harvest

Overall, 5,416 antlerless deer were registered by hunters. Excluding WMD 29, the statewide total harvest of adult (yearling and older) does was 3,456 individuals, bringing the harvest to within 5% of the Department's recommended harvest of approximately 3,274 animals. The additional antlerless harvest was comprised of young of the year. Specifically, Maine hunters harvested 928 and 871 male and female fawns, respectively (Table 5).

### 2015 Harvest by Season and Week

Approximately 88% of the total deer harvest occurred during the 4-week firearms season (Table 4). Youth day took place on Saturday, October 26<sup>th</sup>, resulting in the harvest of 306 adult bucks, and 539 antlerless deer. Overall, Maine's youth experienced an increase in their deer harvest by approximately 4% over the 2014 hunting season.

### 2015 Harvest by Hunter Residency

Residents tagged approximately 93.4% (18,975 deer) of the total harvest (Table 6). Among seasons, the proportion of the harvest registered by Maine residents was highest for youth day (97.8%), followed by muzzleloader (97.2%), archery (96.4%), and firearms (92.6%). Regional differences occurred in the distribution of the harvest by residents and visitors to Maine (Table 7). In the more populous central and southern WMDs, most successful deer hunters were generally Maine residents (Table 8).

### 2015 Biological Assessment

MDIFW sampled more than 5,800 white-tailed deer, during the 2015 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.

**Table 6. 2015 statewide deer registrations in Maine by season type and residence.**

Season and Week	Residents	Nonresidents	Unknown	Total	Percent by Residents
Archery	2,080	78	3	2,158	96.4%
Expanded	1,451	43	2	1,494	97.1%
October	629	35	1	664	94.7%
Youth Day	826	19	1	845	97.8%
Regular Firearms	15,344	1,232	7	16,576	92.6%
Opening Saturday	1,958	3		1,961	99.8%
November 2-7	2,789	268	1	3,057	91.2%
November 9-14	3,192	314	3	3,506	91.0%
November 16-21	3,207	349	2	3,556	90.2%
November 23-28	4,198	298	1	4,496	93.4%
Muzzleloader	725	21		746	97.2%
November 30 - December 5	390	19		409	95.4%
December 7-12	335	2		337	99.4%
<b>Total</b>	<b>18,975</b>	<b>1,350</b>	<b>11</b>	<b>20,325</b>	<b>93.4%</b>

**Table 7. Deer registrations by hunter residence and county of kill in Maine during the 2015 hunting season.**

County of Kill	Residents	Resident Transient <sup>1</sup>	Nonresidents	Unknown	Total	Percent by Residents
Androscoggin	876	364	15	7	1,262	69.4%
Aroostook	735	85	124	11	955	77.0%
Cumberland	1,449	502	39	6	1,996	72.6%
Franklin	461	101	88	1	651	70.8%
Hancock	841	117	38	0	996	84.4%
Kennebec	1,301	541	26	13	1,881	69.2%
Knox	640	99	31	1	771	83.0%
Lincoln	498	191	8	0	697	71.4%
Oxford	805	195	156	1	1,157	69.6%
Penobscot	1,897	488	160	7	2,552	74.3%
Piscataquis	418	71	175	6	670	62.4%
Sagadahoc	485	164	8	1	658	73.7%
Somerset	1,273	237	207	2	1,719	74.1%
Waldo	924	117	96	1	1,138	81.2%
Washington	569	69	43	3	684	83.2%
York	2,068	332	125	2	2,527	81.8%
Unknown				11	11	
<b>Statewide</b>	<b>15,240</b>	<b>3,673</b>	<b>1,339</b>	<b>73</b>	<b>20,325</b>	<b>75.0%</b>

<sup>1</sup>Resident transients are residents of the State of Maine who harvested a deer in a WMD in which they do not reside within.

The antler size of yearling bucks may reflect 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 may 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 likely in balance with the availability of forage. If measurements are larger, then 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 2015, Maine's yearling bucks generally expressed overall good health with an average beam diameter of 17.1 mm, and range of 16.8 mm to 18.9 mm across the state. Most of Maine's deer populations could experience further growth without becoming a detriment to themselves (Figure 3).

MDIFW also tracks the productivity of does to assess their health. Like yearling antler beam diameter, monitoring the number of fawns a doe produces provides a measure of when the female segment of the population may be experiencing nutritional restriction. Healthy yearling and adult does will, on average, have approximately 1.5 fawns per doe. Maine's does have, on average, 1.61 fawns, which translates to at least 55% of the does producing twins. As such, Maine's doe populations have high levels of productivity, and are likely in good health.

In addition to health, having an understanding of survival and mortality, and sex ratios and breeding success are essential to ensuring that hunters do not over-harvest Maine's deer populations.

Past research has shown that the percentage of yearling bucks within the adult buck harvest can be used as an estimate of all-cause annual mortality for male white-tailed deer. In 2015, on average, 48% of the male harvest was comprised of

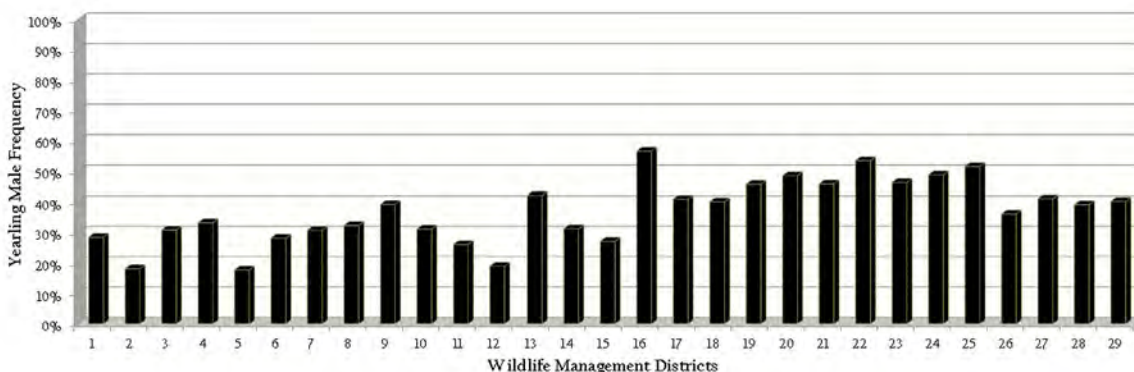
**Table 8. 2015 deer registrations by Wildlife Management District (WMD) in Maine and hunter residence.**

WMD	Residents		Transients <sup>1</sup>		Nonresidents		Unknown	Total
	Number	Percent	Number	Percent	Number	Percent		
1	5	14.7%	1	3%	28	82%		34
2	31	42.5%	21	29%	21	29%		73
3	95	56.2%	68	40%	6	4%		169
4	1		0		14			15
5	19	28.8%	7	11%	40	61%		66
6	331	71.0%	112	24%	22	5%	1	466
7	89	39.2%	27	12%	111	49%		227
8	33	26.0%	18	14%	76	60%		127
9	27	39.1%	16	23%	26	38%		69
10	40	28.2%	85	60%	17	12%		142
11	160	55.7%	79	28%	48	17%		287
12	332	67.8%	115	23%	43	9%		490
13	286	65.1%	109	25%	43	10%	1	439
14	133	48.4%	49	18%	93	34%		275
15	738	67.6%	278	25%	76	7%		1092
16	1061	70.3%	422	28%	24	2%	2	1509
17	1916	79.1%	311	13%	196	8%		2423
18	240	52.7%	189	42%	26	6%		455
19	65	61.9%	19	18%	21	20%		105
20	1294	76.1%	308	18%	99	6%		1701
21	1277	70.2%	514	28%	28	2%	1	1820
22	948	66.2%	468	33%	14	1%	2	1432
23	1258	71.9%	379	22%	111	6%	1	1749
24	604	53.4%	503	44%	24	2%		1131
25	1115	82.2%	211	16%	30	2%		1356
26	1215	73.1%	395	24%	52	3%	1	1663
27	335	72.5%	117	25%	10	2%		462
28	125	57.6%	84	39%	8	4%		217
29	261	78.9%	46	14%	23	7%	1	331
Unknown								0
Statewide	14,034	58%	4,951	25%	1,330	17%	10	20,325

<sup>1</sup>Resident transients are residents of the State of Maine whom harvest a deer from a WMD in which they do not reside.

yearling bucks. The relatively low percentage of yearling males in Maine’s buck harvest indicates that the state’s buck population experiences a relatively low mortality rate and should have a healthy age structure. Note that the percentages we report and use for management purposes are seven year averages. This helps to prevent extreme changes in management action, which can occur when variability in a measure is high from one year to the next. Please note that the percentage of yearling bucks in the harvest does not translate to hunters having removed 48% of a population’s yearlings. The percentage of yearling bucks in the harvest has no population implication beyond that of an estimate of mortality.

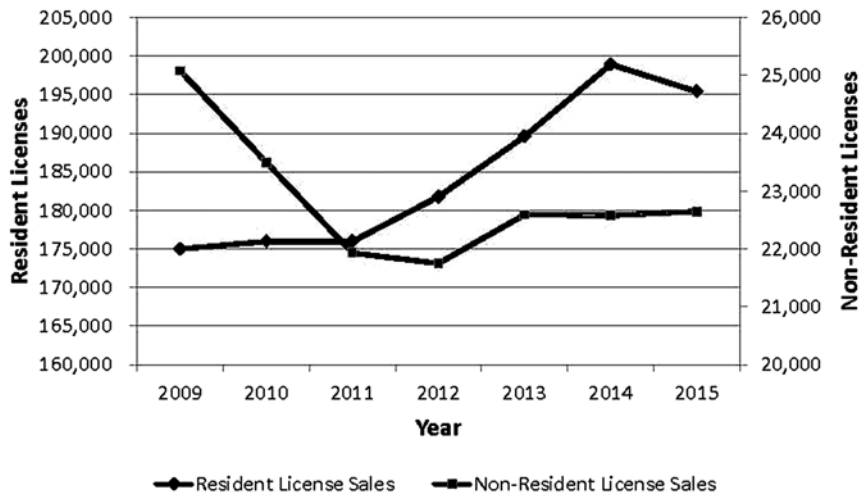
The combination of data on sex ratio and breeding success allows Department staff to ensure that the state’s deer populations remain in balance and viable. White-tailed deer sex ratios, in Maine, average 1.9 does per buck and range from 1.31 to 2.78 does per buck. Skewed sex ratios may impact population viability when approximately five does per buck has been reached. It is at this point that breeding success may begin to flounder. As of now Maine’s slightly skewed sex ratios have not been detrimental to breeding success. On average, Maine experiences a breeding success rate of approximately 88.7%. MDIFW works to maintain sex ratios skewed to the does, as females have the most influence on the growth rate of the deer population.



**Figure 3. Percentage of yearling bucks in the overall adult buck harvest during Maine’s 2015 general firearms season.**

## 2015 Hunter Participation

In 2015, Maine sold 218,343 hunting licenses that permit deer hunting, representing a decrease of 6% from 2014. Of these, approximately 10% were bought by non-residents, representing a slight increase in the proportion of sales to non-residents (Figure 4). Statewide hunter participation is estimated at approximately 176,000 hunters, which translates to a hunter density of approximately six hunters per square mile, on average.



**Figure 4. Maine's resident hunting license sales experienced a slight decline in 2015.** In contrast, non-resident license sales increased from 2014. Overall, this may translate to a slight decline in hunter effort. Note that the values for Non-Resident sales are expressed on the secondary axis shown on the right of the graph.

Compared to the regular firearms season, which, on average, attracts an estimated 150,000, or more, participants (estimated by license sales and the Department's Hunter Effort Survey), the expanded archery and special muzzleloading seasons attract far fewer hunters. In its 17<sup>th</sup> year, the expanded archery season attracted 8,911 participants (over 90% residents). The special muzzleloading season continues to be strong with the sale of 14,388 permits, representing a 11% increase in participation.

## Prospects for the 2016 Deer Season

In 2016, the Department will again offer five separate seasons for deer hunting. The expanded archery season will open September 10<sup>th</sup> and run through December 10<sup>th</sup>. 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 in 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 the expanded archery zone, deer populations can only be reduced if the limited number of archers that can gain access to huntable land are each able to harvest a substantial number of does; hence, the unlimited availability of doe tags.

The regular (statewide) archery season will run from September 29<sup>th</sup> - October 28<sup>th</sup>. Youth day will be Saturday, October 22<sup>nd</sup>, and is reserved for hunters between 10 and 15 years old, who are accompanied by a licensed adult. Please remember that youth hunters are limited to bucks-only in WMDs that have not been allocated any doe permits. The 25-day regular firearms season opens for Maine residents on Saturday, October 31<sup>st</sup>, and for nonresidents the following Monday. This season ends Saturday, November 26<sup>th</sup>. Finally, the muzzleloader season will begin in all WMDs on November 28<sup>th</sup>, but will end on December 3<sup>rd</sup> (6 days) in WMDs 1 – 11, 14, 19, 27 and 28. Elsewhere, the muzzleloading season will continue to remain open from December 7<sup>th</sup>-12<sup>th</sup>. **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 population objectives of 15 to 20 deer / mi<sup>2</sup> 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 whitetails (e.g., ornamental plant and crop damage, and deer-car collisions).

To accomplish deer management objectives in 2016, we have set doe harvest quotas ranging from 0 to 635 animals among Maine's 29 WMDs. The 2015 statewide doe quota of 5,297 does is 61% above the doe harvest goal for the 2015 hunting season. A total of 45,755 Any-deer Permits will be issued statewide ranging from 0 permits (WMDs 1, 2, 4, 5, 8-11, 19, 27, and 28) to 8,865 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 5,297 adult does, and an additional 2,547 fawns, in 2016. Antlered buck harvests should be about 16,535, which is approximately a 10% increase from the 2015 buck kill of 14,906 animals. If normal hunting conditions and hunter effort prevail, Maine's statewide deer harvest should be around 24,000.

## **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 2 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 Funds program, and revenue from the sales of hunting licenses.*

-- Kyle Ravana

## **Moose**

### 2015 Moose Harvest

#### **Season Dates and Structure**

Maine moose hunters could hunt moose for 6 days by permit within the structure of a split season framework (September/October/November) during 2015. The September season ran from September 28<sup>nd</sup> to October 3<sup>rd</sup>, while the October season ran from the 12<sup>th</sup> through the 17<sup>th</sup>. For the 6<sup>th</sup> year, a 3<sup>rd</sup> week of hunting was offered in the North Country (Wildlife Management Districts [WMDs] 1-4, and 19) from November 2<sup>nd</sup> through November 7<sup>th</sup>. In 2011, WMDs 22 and 25 were added to the southern Maine moose hunt, which includes WMDs 15, 16, 23 and 26. The southern Maine moose hunt runs concurrently with the November deer season, from November 2<sup>nd</sup> to November 28<sup>th</sup>, and opened for Maine residents on October 31<sup>st</sup>.

## **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 5 management districts between 2014 and 2015, providing an overall decrease of 355 permits. This included decreased Antlerless-only Permits (AOPs) permits in WMD 2, decreased Bull only Permits (BOP) in 6 and 27, and a decrease in Any-moose Permits (AMPs) in WMD 26. The number of moose permits allocated in 2015 was 2,740. 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 2015, a total of 550 AOPs were allotted to 5 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, and 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, 52,374 people applied for a moose permit during 2015. This included 37,527 residents and 14,847 non-residents. Out of those applicant pools, 6.6% of the residents and 1.8% of the non-residents were selected for permits.

## **Statewide Statistics for 2015**

Overall, 1,972 moose were registered during 2015 (Table 9). 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 2015 statewide harvest of 1,602 antlered bulls during the Sept/Oct/Nov seasons was similar to the previous year's harvest (1,599). Among the antlered bulls taken in 2015 (and aged by cementum annuli [i.e., 1,323 bulls]), 129 (10%) were 1½ years old (yearlings) sporting their first set of antlers, while 260 were 2½ years old (20%), and 268 were 3½ year olds (20%). Mature bulls between 4½ to 14½ years old comprised 50% of the bull harvest.

On average, breeding bulls lose approximately 15% of their body mass during the rut. Because of 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 2015 harvest for September were 711 pounds versus 675 pounds (i.e., dressed weights) in the October harvest (a 5% decline in mass<sup>1</sup>). The heaviest bull weighed in at 1,064 pounds dressed (no digestive tract, heart, lungs, or liver) and was killed in WMD 1 during the September season (7.5 years old). The largest antler spread was 60 inches on a 6.5 year old bull with 21 legal points. Among antlered bulls examined in the harvest, 16% of the bulls sported cervicorn antlers (antlers without a defined palm) and ~37% of these animals were yearlings; 11% were mature bulls (>4 years old) including the oldest at 13.5 years-old.

<sup>1</sup>Note the difference in the mass of bulls harvested in September vs. October was less this year because the early season ended on October 3.

## **Antlerless Harvest**

The 2015 statewide harvest of adult (yearling and older) cows was similar to the 2014 harvest (335 vs. 384, respectively). Seventy-five fewer antlerless-only permits were issued in 2015. In addition to the 335 adult cows that were harvested, 35 calves (i.e., 16 males, and 19 females) were harvested for a total harvest of 370 antlerless moose for the 2015 season. This decrease included the antlerless moose taken as part of the 105 AOPs issued within the southern zones. The antlerless moose harvest in the southern zones was comprised of 23 bulls, 8 adult cows and 1 calf.

## **Moose Reproductive Data**

We collected reproductive data critical to assessing and monitoring moose population health and growth from the adult cows harvested during the November season in WMDs 1-4, and 19. In 2015, hunters removed and brought in 129 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. Typically, moose do not become pregnant until 2.5 years old. Of the cow moose examined, 27% of yearlings (very high rate) and 87% of the mature cows (2.5+ years) were pregnant.

Corpora lutea are identifiable structures within the ovaries that provide an indication of ovulation and potential pregnancy rates. Overall, there were 0.98 corpora lutea / cow for cows older than 3.5 years (>1.15 corpora lutea would be considered normal/healthy). The low number of corpora lutea may be an indication that moose in the northern portion

**Table 9. 2015 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	2015 Registrations		WMD	Season	Permit Type	Number of Permits	2015 Registrations			
				Kill	Success Rates					Kill	Success Rates		
1	Sept.	BOP	150	129	86%	15	Nov.	AMP-B	10				
	Oct.	BOP	125	112	90%			AMP-C	4				
	Nov.	AOP	100	87	87%			<b>WMD Subtotals</b>	<b>25</b>	<b>14</b>	<b>56%</b>		
	<b>WMD Subtotals*</b>	<b>375</b>	<b>328</b>	<b>87%</b>	16		Nov.	AMP-B	3				
2	Sept.	BOP	100	86		86%		AMP-C	1				
	Oct.	BOP	100	82		82%		<b>WMD Subtotals</b>	<b>20</b>	<b>4</b>	<b>20%</b>		
	Nov.	AOP	100	72		72%	17	Oct.	BOP	20	5	25%	
<b>WMD Subtotals*</b>	<b>300</b>	<b>240</b>	<b>80%</b>		<b>WMD Subtotals</b>	<b>20</b>		<b>5</b>	<b>25%</b>				
3	Sept.	BOP	100	84	84%	18		Oct.	BOP	40	20	50%	
	Oct.	BOP	80	64	80%			<b>WMD Subtotals*</b>	<b>40</b>	<b>20</b>	<b>50%</b>		
	Nov.	AOP	100	86	86%		19	Sept.	BOP	50	32	64%	
<b>WMD Subtotals*</b>	<b>280</b>	<b>234</b>	<b>84%</b>		Oct.	BOP		50	28	56%			
4	Sept.	BOP	250	127	51%			Nov.	AOP	50	21	42%	
	Oct.	BOP	150	79	53%		<b>WMD Subtotals*</b>	<b>150</b>	<b>81</b>	<b>54%</b>			
	Nov.	AOP	200	116	58%	22	Nov.	AMP-B	0				
<b>WMD Subtotals*</b>	<b>600</b>	<b>411**</b>	<b>69%</b>		AMP-C		0						
5	Sept.	BOP	100	90	90%			<b>WMD Subtotals</b>	<b>0</b>	<b>0</b>			
	Oct.	BOP	25	23	92%	23	Nov.	AMP-B	1				
<b>WMD Subtotals*</b>	<b>125</b>	<b>113</b>	<b>90%</b>		AMP-C		1						
6	Sept.	BOP	100	72	72%		<b>WMD Subtotals</b>	<b>25</b>	<b>2</b>	<b>8%</b>			
	Oct.	BOP	25	25	100%	25	Nov.	AMP-B	4				
<b>WMD Subtotals*</b>	<b>125</b>	<b>97</b>	<b>78%</b>		AMP-C		1						
7	Oct.	BOP	125	90	72%		<b>WMD Subtotals</b>	<b>25</b>	<b>5</b>	<b>20%</b>			
	<b>WMD Subtotals*</b>	<b>125</b>	<b>90</b>	<b>72%</b>	26	Nov.	AMP-B	0					
8	Oct.	BOP	175	123		70%		AMP-C	0				
	<b>WMD Subtotals*</b>	<b>175</b>	<b>123</b>	<b>70%</b>		<b>WMD Subtotals</b>	<b>10</b>	<b>0</b>	<b>0%</b>				
9	Oct.	BOP	75	65	87%	27	Oct.	BOP	10	2	20%		
	<b>WMD Subtotals</b>	<b>75</b>	<b>65</b>	<b>87%</b>			<b>WMD Subtotals</b>	<b>10</b>	<b>2</b>	<b>20%</b>			
10	Oct.	BOP	60	23	38%	28	Oct.	BOP	20	11	55%		
	<b>WMD Subtotals*</b>	<b>60</b>	<b>23</b>	<b>38%</b>			<b>WMD Subtotals</b>	<b>20</b>	<b>11</b>	<b>55%</b>			
11	Sept.	BOP	25	25	100%	<b>OVERALL WMD TOTALS</b>							
	Oct.	BOP	25	18	72%	<b>2,740</b>	<b>1,972</b>	<b>72%</b>					
<b>WMD Subtotals*</b>	<b>50</b>	<b>43</b>	<b>86%</b>	BOP = Bull Only Permit – The holder may kill one male moose of any age.									
12	Oct.	BOP	35	18	51%	AOP = Antlerless Only Permit – The holder may kill a cow, a calf, or a bull w/antlers shorter than its ears.							
	<b>WMD Subtotals*</b>	<b>35</b>	<b>18</b>	<b>51%</b>	AMP = Any Moose Permit - The holder may kill any moose.								
13	Oct.	BOP	35	13	37%	*Does not include additions to total permit allocation through deferment, hunt of a lifetime, and auction.							
	<b>WMD Subtotals*</b>	<b>35</b>	<b>13</b>	<b>37%</b>	**Total includes a projected 89 moose that were harvested, but have missing registration data								
14	Oct.	BOP	35	30	86%								
	<b>WMD Subtotals*</b>	<b>35</b>	<b>30</b>	<b>86%</b>									

of the state are near ecological carrying capacity, since the amount of available forage (food) is what allows cows to attain the body weight necessary for reproductive success. Alternatively, the low corpora lutea count may result from the nutritional stress of high winter tick loads on cows and their calves. We anticipate that additional sampling of female moose and analysis of available browse will provide a clearer picture of this relationship across northern Maine.

### Hunter Participation, Residency and Success Rate

In 2015, 2,468 residents and 272 non-residents won permits to hunt moose. A total of 265 non-residents were successful in their hunt (97% success rate). Out-of-state hunters came from 34 states (as far away as Alaska and Hawaii) and one Canadian Province (Nova Scotia). The majority (18.7%) of out-of-state hunters came from New York. Resident success rates were 69%. When combined with the outstanding success of out-of-staters, the total success rate for 2015 moose season was 72% (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%; highly variable weather conditions and warmer than normal temperatures appear to have lowered statewide success rates in 2015.



## Changes for the 2016 Moose Season

In 2016, there will be 4 separate moose hunting periods in Maine. The September season will run from September 26<sup>th</sup> to October 1<sup>st</sup> in WMDs 1-6, 11 and 19; the October season will run from October 10<sup>th</sup> through the 15<sup>th</sup> and include WMDs 1-14, 17-19, 27, and 28. In WMDs 15, 16, 23, 25 and 26, the season will coincide with November's deer season, which runs from November 2<sup>nd</sup> through November 28<sup>th</sup>. Opening day for Mainers will be on Saturday October 31<sup>st</sup>. Lastly, WMDs 1-4 and 19 will have an additional moose hunt in October from the 24<sup>th</sup> through the 29<sup>th</sup>. In total, Maine's moose hunt will offer 2,140 permits for 2016.

## 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., Commissioner's 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 a study to monitor adult female and calf survival rates over a minimum of five years and to more closely examine sources of mortality. Last winter, a second study area in northern Maine (WMD 2) was added. Since 2014, we have captured 213 moose and fitted them with GPS collars. These collars enable us to track 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's Animal Health Lab.

*This work is supported by volunteer assistance, the federal Pittman-Robertson Funds, and revenue from sales of hunting licenses, and a grant from the Outdoor Heritage Fund.*

-- 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 5).

Maine's bear population is valued not only by hunters, but others who enjoy watching wildlife and appreciate Maine's wildlife diversity. Unfortunately, when conflicts with people and bears do 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 the health and condition of Maine's bears, and estimate how many cubs are born each year, along with mortality rates and factors.

Since 2005, Maine's bear population has been increasing. Hunting is the Department's primary tool for managing this thriving bear population. To meet population objectives, a variety of traditional hunting methods are offered in Maine, including trapping and hunting with bait, dogs, and still-hunting/stalking. Hunters can also take a bear while hunting deer. Over 90% of the bears killed each year by hunters or trappers are shot with the

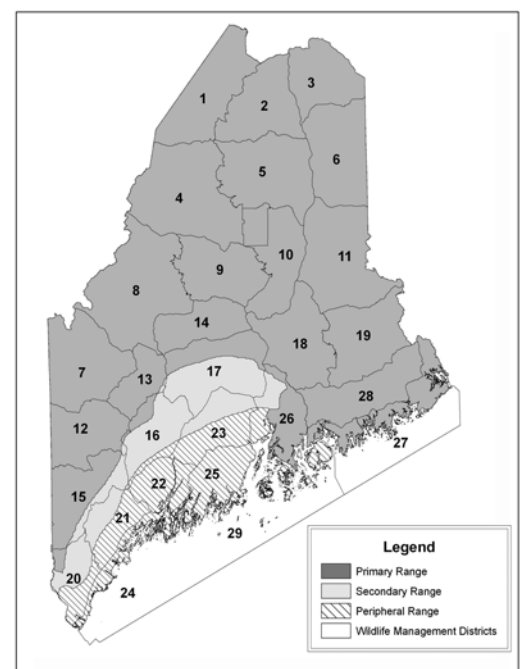


Figure 5. Maine black bear range.

aid of bait or dogs, or they are trapped. 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 a large part, to Maine's dense forests.

Since 2005, the number of bears harvested each year has been below levels needed to stabilize 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 and averages 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 process. To meet current goals and ensure Maine's bear population continues to thrive, hunters in Maine are provided a variety of harvest methods to keep Maine's large bear population in check. In 2016, 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 are of great concern. The majority of conflicts occur in the spring and early summer, after bears emerging from their winter dens 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, more bears will continue to visit your backyard.

Many people expect the Department to move bears that are frequenting backyards, communities, and agricultural areas because it is perceived as a humane response that 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.

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 [http://www.maine.gov/ifw/wildlife/human/lww\\_information/bears.html](http://www.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 secure locations, 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, and 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 fence 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.*

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 and is perceived as a humane response. 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 bears 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. Before the bear is moved, attractants must be removed or secured to prevent future problems.

#### The 2015 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 opens one day early (the last Saturday in August) for youth hunters. This year, 22 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 3-month period. Hunting bears over bait is permitted for the first 4 weeks and with the use of dogs for a 6-week period that overlaps the last 2 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 2015, a record harvest of 150 bears was taken in traps; the majority was harvested by residents (86%). The number of trappers purchasing a permit to trap bears reached a high in 2014, likely in response to a ballot initiative that, if passed, would have eliminated traps, bait, and dogs as legal harvest methods. Although permit sales were slightly lower than 2014, 540 residents and 59 non-residents bought trapping permits in 2015. 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. During the 2015 season, keeping with this trend, 24 hunters/trappers harvested 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 2015, 69% were taken over bait, 17% with dogs, 4% by deer hunters, 5% by still-hunting or stalking prior to deer season, and 5% in traps (Table 10). Few bears were harvested in central and coastal Maine (i.e., Knox, Lincoln, Waldo, Androscoggin, Cumberland, Sagadahoc, Kennebec, and York counties) where bear populations are low and hunting opportunity is limited.

Since 2005, Maine's annual bear harvest has been below the level needed to stabilize the bear population. Although harvest numbers tend to fluctuate from year-to-year; often with a high year followed by a low year, the bear harvest has averaged around 3,000 animals since 2005. During the 2015 season, Maine's bear harvest did not stray from the average, with 3,016 bears registered at check stations, and continued an alternating trend with a lower harvest than the previous season. 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 2 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, it can have the greatest impact on the final harvest figures. Abundant natural food availability also causes bears to continue foraging later in the fall and enter their dens later, which makes them more available to deer hunters. The abundance of natural foods during the 2015 season influenced the lower bait harvest and subsequent higher harvest by deer hunters. Despite the large number of deer hunters (over 170,000), their harvest of bears comprised a small proportion of the annual harvest (5-10%). The 2015 harvest of 119 bears by deer hunters was the highest recorded in the last four years; 31 bears were harvested by deer hunters during the deer archery season and 88 by deer hunters during the November deer firearm season.

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 2015 resident success rate = 19% and non-resident success rate = 37% prior to the deer firearm season). In 2015, non-resident hunters harvested the majority of bears during the bait (68%) and hound seasons (64%). Hunting over bait is also the most popular method for resident

**Table 10. Number of bears harvested in Maine in 2015 by Wildlife Management District (WMD).**

WMD	Method of Take					Total Harvest	Archery	Assisted		Non-resident
	Hunting with Bait	While Deer Hunting	Hunting with Dogs	Trapping	Unknown <sup>1</sup>			by Guide	Resident	
1	134	0	14	10	6	164	14	133	31	133
2	86	2	27	5	0	120	9	97	13	107
3	135	10	13	7	7	172	16	128	48	123
4	196	5	10	1	7	219	23	145	67	152
5	137	1	37	5	5	185	14	135	32	153
6	153	15	14	5	4	191	19	109	66	125
7	102	4	37	15	10	168	10	85	78	90
8	138	2	59	15	15	229	11	138	106	123
9	75	2	19	0	10	106	7	49	44	62
10	110	2	13	1	6	132	11	82	40	92
11	141	10	58	11	15	235	12	158	64	171
12	77	14	39	19	5	154	13	42	107	47
13	20	4	8	8	1	41	1	18	26	15
14	82	2	20	7	7	118	12	61	51	67
15	42	5	11	9	5	72	7	7	57	15
16	2	1	0	1	0	4	0	0	4	0
17	28	11	11	2	1	53	0	7	41	12
18	148	5	18	9	21	201	12	100	98	102
19	85	1	48	2	3	139	11	103	31	108
20	8	3	2	0	0	13	1	1	13	0
21	0	1	0	0	0	1	0	0	1	0
22	0	0	0	0	0	0	0	0	0	0
23	0	1	1	1	0	3	0	1	2	1
24	0	0	0	0	0	0	0	0	0	0
25	4	0	0	0	0	4	0	4	0	4
26	51	13	1	6	7	78	8	14	64	15
27	30	2	5	2	3	42	6	19	21	21
28	101	3	48	9	4	165	9	124	54	111
29	0	0	0	0	0	0	0	0	0	0
Unreported	0	0	1	0	0	7	0	0	1	0
<b>State Totals</b>	<b>2,085</b>	<b>119</b>	<b>514</b>	<b>150</b>	<b>142</b>	<b>3,016</b>	<b>226</b>	<b>1,760</b>	<b>1,160</b>	<b>1,848</b>

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

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 (87% and 86% respectively in 2015).

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 (resident price increased from \$5.00 to \$25.00 and non-residents from \$15.00 to \$65.00). 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 and it is likely that a recent downturn in the U.S. economy contributed to lower bear hunter participation. Since non-resident hunters enjoy a higher success rate than residents, loss of these hunters has a greater effect on the final harvest than a similar loss of resident hunters. If hunter participation does not increase, we may need to increase hunting opportunities to meet bear management goals.

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 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 2015, 981 non-resident bear permits for deer season and 599 trapping permits were sold.

*This work is supported by federal excise taxes on sporting arms, handguns, ammunition, and archery equipment (Pittman-Robertson Fund), and hunting and trapping license revenues.*

-- Jennifer Vashon and Randy Cross

## Canada Lynx

The Canada lynx is a medium-sized grey cat with a bobbed tail and long black ear tufts. Although similar in appearance to a bobcat, lynx have a completely black-tipped tail, longer ear tufts, and larger paws. Lynx are found primarily in northern Maine, where these large feet give them a competitive advantage in deep snow, making them adept at capturing their prey. As you move southward, lynx become less common, as snow depth lessens and spruce-fir forests that provide an abundance of prey transition to hardwood forest. In fact, Maine is at the southern extent of the geographic range of Canada lynx.



Canada Lynx (Photo by MDIFW)

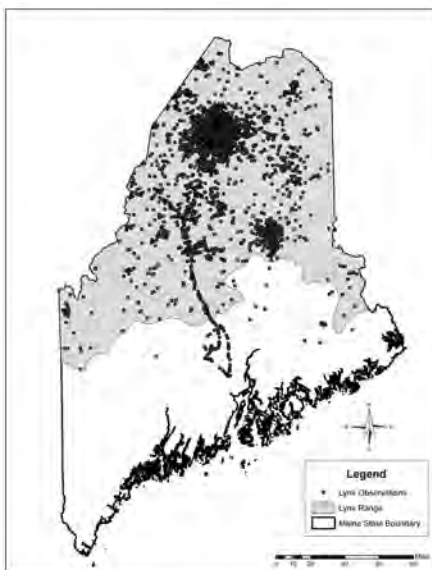
Although lynx were listed as federally threatened species at their southern range limit, Maine is home to the largest breeding population of Canada lynx in the contiguous United States. Until recently, not much had changed in the historic distribution of lynx in Maine, with lynx continuing to be most common north of Moosehead Lake and west of Route 11. However, over the last decade, lynx have begun to expand into eastern and western Maine.

To detect changes in lynx occupancy in Maine and derive population estimates, we periodically survey areas for lynx snow tracks. During the winter of 2015, we began another snow track survey effort that will be repeated over the next 2 to 3 winters. This winter, we found lynx in more areas than previous surveys. This finding supports other indices that have indicated that Maine's lynx population has continued to increase over the last decade. After this resurvey effort is completed (tentatively 2018), we will provide an updated estimate of Maine's lynx population. Our last survey effort, in 2006, provided a conservative estimate of between 750 and 1,000 adult lynx in the core of their range in Maine.

### A History of Lynx in Maine

Lynx numbers are tied to the abundance of snowshoe hare, which are most numerous in young stands of spruce and fir or in older spruce and fir forests with a dense understory of young trees. Disturbance, both natural and human caused, have played the greatest role in providing habitat for snowshoe hare and lynx in Maine. Historically, it appears that lynx have been able to persist in Maine at relatively low numbers, with periods of greater abundance, following forest disturbance. A review of historic records suggests that in the mid-1800s, lynx were relatively common in areas disturbed by fire that created areas of young, dense habitat for their prey. As these forests matured, lynx likely became less common. The next major disturbance event that could have benefited lynx, occurred during the 1913-1917 spruce budworm outbreak.

Although this was the first major spruce budworm outbreak in Maine's post settlement forest, it was not nearly the scale of the 1978-1984 budworm outbreak. The extensive clearcutting of dead or diseased trees that followed the 1978-1984 budworm outbreak created record high amounts of lynx habitat by the late 1990s. As a result, Maine's lynx population is likely at an historic high, and all indicators, to date, suggest Maine's lynx numbers continue to be on the rise with lynx expanding into new areas (Figure 6). As the forest matures, lynx numbers will likely decrease again, but may be resilient in a heavily managed landscape that continues to promote regrowth of valuable spruce/fir timber.



**Figure 6. Observations of lynx in Maine since 2000.**

### State and Federal Protection

The state has been protecting and conserving lynx for nearly 50 years, starting with the repeal of a statewide bounty and closure of all hunting and trapping seasons for lynx in 1967. Thirty years later, MDIFW designated lynx as a species of special concern in Maine. The special concern designation is given to species when there is some management concern, but more information may be needed to determine whether additional protection is warranted. Following this designation, the State began conducting track surveys for lynx and initiated a 12-year telemetry study. Shortly after the telemetry study began, the US Fish and Wildlife Service (USFWS) listed lynx as a threatened species throughout their historic range, due to inadequate habitat protection on federal lands. Although

lynx were federally listed as threatened, information gathered from snowtrack surveys and telemetry studies over the last decade indicate that lynx did not meet the state's threatened or endangered listing requirements. Because they are federally listed, lynx remain on MDIFW's Species of Special Concern list. The USFWS has drafted a recovery outline for lynx that serves as an interim guide for recovery, until a recovery plan is finalized. In 2016, the USFWS began a species status assessment to guide decisions on whether lynx continue to require protection under U.S. Endangered Species Act. If lynx remained listed as threatened, the USFWS is under a court deadline to complete a recovery plan by January 2018.

As a federally-listed species, lynx are protected from intentional and accidental take that may or may not result in the direct death of a lynx. The Department and the USFWS have been working on methods to minimize potential incidental trapping of lynx in Maine. In 2014, the USFWS issued an incidental take permit to the Department that would allow a low level of incidental take of lynx by fur trappers. Most lynx caught have no, or minor, injuries and are released at the trap site. This plan provides measures to minimize the accidental capture of lynx in traps and mechanisms to adapt outreach and education efforts, or regulatory changes, if take is exceeding the permitted level. After two lynx were killed in traps set for marten and fisher in 2014, the Department, in consultation with USFWS and Maine trappers, altered trapping regulations (e.g., required lynx exclusion devices on killer-type traps) to further reduce the chance of lethal take.

#### From Research to Management

Biologists at MDIFW have been in the process of building a lynx management system that involves collecting field data, analyzing what it means, getting input from the public on management goals, and developing a monitoring plan. The process started in the winter of 1999, with the first radiotelemetry study on Canada lynx in Maine. This study collected information on lynx behavior, birth and death rates, and densities. In 2011, Department biologists shifted their focus from acquiring field data to applying information from this long-term study to management and conservation strategies for lynx in northern Maine. In 2012, an assessment was prepared that described lynx habitat and population levels in Maine. This assessment will be used to guide management decisions and is available on the Department's website.

The Lynx Assessment relied heavily on our 12-year study of lynx in northern Maine and periodic snow-track surveys. From 1999-2011, Department wildlife biologists captured and radiocollared 85 lynx and documented the production of 42 litters of kittens in a study area in northern Maine. By studying lynx for 12 years, we were able to determine what habitats lynx prefer, how much area a lynx uses, and the quality of these areas, based on the ability of lynx to survive and reproduce. Data from this study have shown that lynx and snowshoe hares thrive in the regenerating thickets of spruce and fir following logging, and lynx can exist at high densities in northern Maine when this ideal habitat is common. The reproduction and survival data demonstrated that the studied population of lynx in northern Maine was producing an excess number of animals, allowing lynx numbers to increase and colonize new areas.

During the winter of 2015, we started a 3-year resurvey effort to assess changes in lynx distribution and update population estimates. After two years of surveys, we have found lynx in more places than during previous surveys (96% of survey areas vs. 52% of survey areas). We have also observed lynx further south and east. These findings support other observations that Maine's lynx population continues to grow. We plan to complete surveys this winter and update estimates shortly thereafter.

To learn more about lynx in Maine, visit: [http://www.maine.gov/ifw/wildlife/species/mammals/canada\\_lynx.html](http://www.maine.gov/ifw/wildlife/species/mammals/canada_lynx.html).

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

-- Jennifer Vashon

## **Furbearers**

The term "furbearers" refers to all mammals that are harvested primarily for their pelts. In Maine, this includes coyote, red and gray fox, bobcat, fisher, marten, raccoon, skunk, short and long-tailed weasels, mink, otter, beaver, muskrat, and opossum. The pelts of all furbearers, except weasel, raccoon, muskrat, skunk, and opossum, are tagged for tracking the furbearer harvest. Pelt tagging is one of the primary population indices used in our furbearer management systems. Furbearers are primarily trapped, but some fox, coyote, bobcat, raccoon, and skunk can also be hunted. Small game that can be hunted includes snowshoe hare, gray squirrel, woodchuck, porcupine, and red squirrel.

#### Overview of Trapping Season

This year's trapping season was a mixed bag. On one side, fur prices were low, and new regulations associated with foothold and body gripping traps on dry land likely caused a decline in trapping effort throughout the state. On the other side, the weather was great for both water and land trapping, allowing a longer than average ice free trapping season. Overall, this year's harvest saw a small rebound of the harvest of most furbearers tagged in Maine, despite low fur prices and new regulations.

One exception to this rebound in harvest was marten and fisher. From last year, marten harvest was down 67% and fisher down 54% (Table 11). We suggest that these pronounced declines in harvest are due to the implementation of the exclusion device regulations beginning this past trapping season. Lynx exclusion devices are now required for all body-gripping traps set on dry land, unless the trap is set as a blind set (5 inch x 5 inch or smaller trap). We concluded from discussions with members of the trapping community and Warden Service staff that there was a pronounced decline in the trapping of these two species this past year.

**Table 11. Annual harvest of Maine's furbearing species from the 2006 to the 2015 trapping and hunting seasons.**

Species	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08	06-07
Beaver	4,953	3,578	7,841	9,063	15,769	6,976	10,765	9,119	6,357	12,635
Bobcat	236	126	124	205	239	305	281	407	410	344
Coyote	1,281	868	1,237	1,670	2,037	1,623	1,743	1,901	1,819	1,521
Fisher	280	653	617	1,242	925	1,207	1,078	1,456	993	1,968
Red fox	575	269	642	991	989	922	932	893	1,030	1,245
Grey fox	287	496	279	426	308	332	250	163	161	107
Marten	380	1,145	996	3,805	1,317	3,559	2,613	2,291	2,401	2,350
Mink	1,148	1,041	1,398	2,184	2,339	1,926	1,465	1,297	1,888	2,280
Otter	486	261	464	646	1,234	754	696	528	493	968

#### Exclusion Devices: Year One

This past season was the first trapping season that required the use of exclusion devices for baited bodygripping traps set on dry land; the primary method used to trap fisher and marten (for a complete description of these new regulations, please review the 2015-2016 Trapper Information Booklet available at [http://www.maine.gov/ifw/hunting\\_trapping/trapping/index.htm](http://www.maine.gov/ifw/hunting_trapping/trapping/index.htm)). As described in the above paragraph, we observed fewer trappers and fewer traps set, overall, for marten and fisher. Trappers who built and set traps in exclusion devices did catch marten and fisher. One concern voiced by many trappers was that adult male fisher would not enter the exclusion devices. While we do not know success rates of the new devices, as compared to the traditional leaning pole set, adult male fisher were captured in sets that used an exclusion device. Marten also seemed to be willing to enter exclusion devices once temperatures began to drop. While exclusion devices have created a new set of challenges for trappers, this past year proved that both species can be caught when these devices are used with body-gripping traps. Now that trappers know that exclusion devices work, we expect more of these devices will be deployed in the future.

#### Furbearer Management

The use of exclusion devices this past season altered trapping effort and success rates for marten and fisher, so much that we cannot track population trends of these species by comparing last season's harvest data to past years' data. It will likely take 3 to 5 years before we can use harvest data as an index for population trends again for fisher and marten. Also, since bobcats, in the past, were trapped in leaning pole sets for fisher, exclusion devices also disrupted the metrics we use to track bobcat populations. In light of these challenges, we began researching other methods to track the status of furbearer populations such as bobcat, fisher, and marten. The Department will use two new methods for tracking furbearer populations this upcoming season (described below). Ultimately, the collection of these data will strengthen the furbearer program and better inform the management of furbearers.

##### 1. Collection of Age and Sex data

Of Maine's furbearing species, much of our attention is focused on bobcat, fisher, marten, and otter. This year, we will begin collecting teeth/lower jaws from these species along with the usual information collected during pelt registration. From these samples, we will be able to identify the age and sex structure of the harvested population. This will allow biologists to compare harvest rates for these species to changes in their populations and will provide data to model population trends.

##### 2. Population Monitoring Using Trail Cameras

In addition to collecting age and sex structure of the harvested population from teeth, we are working with the University of Maine to develop a protocol to monitor furbearers that is independent of the trapping harvest. A technique that has shown promise with furbearers in other states is tracking changes in occupancy and distribution of species across large areas using trail cameras. This is referred to as occupancy modeling. By tracking the proportion and location of cameras that did or did not see a species of interest across a study area for multiple years, wildlife managers can use these data to detect changes in the population. This past winter, we teamed up with the University of Maine and began a pilot study in northern Maine with a primary focus on detecting marten and fisher. This trial was a success and plans to scale up this effort are scheduled for the 2016/2017 winter. Ultimately, if this effort is implemented over a large scale for multiple years, we will have our first tool, independent of harvest, to monitor fisher, marten, and other furbearers.

## Small Mammals

Currently, much of MDIFW's small mammal research is focused on bats. Often lumped in a single group called "bats", Maine is actually home to eight species of bats, and all carry out their lives in different ways. Three of Maine's species do not hibernate but instead migrate to the southern U.S., much like some of our birds, to spend the winter in warmer climates. The five other species hibernate in caves and mines over winter, waiting for the return of spring. This year, we have implemented three projects that are described below to track the status of several of our bats species over time, and inform our conservation and management of these species.

### Driving surveys

The three species that migrate south for the winter are the hoary, eastern red, and silver-haired bat. These bats are solitary, roost in the foliage of trees, and do not rear their babies in maternity colonies like we see with other bat species. To track the population of these hard to find bats, we have begun driving surveys across the state. During the summer nights, volunteers and Department staff drive routes 25 miles in length at 20 miles per hour with the microphones of bat detectors sticking out of the roofs of their vehicles. Since tree bats like to forage in forest openings, such as road ways, and forage at speeds slower than 20 miles per hour, each call collected by the bat detector of a given species counts as a single individual of that species. At the end of the survey, we can estimate the relative abundance of bats by dividing the number of bats of a given species heard during the survey by the total length of the survey. This gives us a bats/mile index of each species of interest. By conducting these surveys annually, we will be able to track the trends in tree bat populations across the state.

### Maine Bat Colony Count

This July, we sent out a public service announcement across the state asking people to report any known bat colonies. This is aimed at gathering information on two bat species, the big brown and little brown bat. These two species are often found roosting in homes, barns, and other human-made structures. Both of these species have been affected by White Nose Syndrome (WNS). This disease has reduced the little brown bat population by more than 90% and led to its listing as state endangered. Comparatively, the big brown bat, which does not hibernate in large colonies like the little brown bat, is not as susceptible to WNS, but its population has still declined by as much as 30%. The goal of this project is to identify maternity colonies of big and little brown bats across the state and track the colony size over time. While the results from this year were not in at the time of writing this report, as of mid-July we received information from over 300 participants and had identified nearly 150 colonies that warranted follow-up. Much like the driving surveys, these colony counts are designed to enable us to track the status of these species over time. Please read this section of the research and management report next year for a report on our colony count findings.

### Threatened and Endangered Bats

This past year, the little brown and northern long-eared bat were listed as endangered and the eastern small-footed bat was listed as threatened under the Maine Endangered Species Act. All three of these species populations were suspected to be stable before the arrival of the invasive disease WNS in 2011. Since the disease's arrival, the little brown and northern long-eared bat populations have dropped more than 90%, and the eastern small-footed has declined by more than 30%. This year, we began investigating the habitat use of these bat species in coastal and mountainous environments in western and coastal Maine. At the time of writing this report, we are only half way into our field season, but initial field work indicates that these three species are still in our study areas. As the season progresses, we will focus on documenting activity of these bats near suspected hibernaculum. Hibernacula are considered one of the limiting factors on the landscape for these bats species and are also where the animals can contract WNS. Therefore, documenting hibernacula is the first step in directing conservation activities to protect these bats from additional stressors.

*This work was supported by the State Wildlife Grants and Pittman-Robertson funds (federal programs), and state revenues from the sale of hunting and trapping licenses.*

-- Cory Mosby

## New England Cottontail Rabbit

### New Developments

In September 2015, the U.S. Fish and Wildlife Service (USFWS) determined that the New England cottontail rabbit (NEC) could be removed as a candidate for protection under the federal Endangered Species Act (ESA). They concluded that sufficient progress had been made towards implementing the Rangewide Conservation Strategy for NEC (<http://newenglandcottontail.org/>) that these rabbits were no longer imminently threatened with extinction, or likely to become endangered. The Conservation Strategy lays out a 15-year plan for restoring habitat for NEC, building up NEC populations through captive breeding and translocations, and for monitoring NEC populations. The decision not to list NEC as a threatened or endangered species was announced by Interior Secretary, Sally Jewell, at a ceremony in New Hampshire. The ceremony celebrated the collaboration between state and federal biologists, landowners, administrators,



and nongovernmental organizations that put the NEC on the path to recovery. This partnership transcended normal state and federal agency boundaries to bring together teams of biologists to work with landowners on habitat restoration projects; to implement research critical to NEC conservation efforts; and to coordinate the conservation activities of six states, two federal agencies, and numerous universities and organizations.

Although the federal status of NECs has changed, the NEC remains an endangered species under state law in Maine and New Hampshire. Both states have small, remnant populations of NEC that will not persist without habitat and population restoration efforts. The endangered status of NEC in Maine and New Hampshire may seem contradictory to the USFWS's decision not to list the NEC as threatened or endangered. The USFWS' decision not to list the rabbit does not imply that the NEC has recovered. It has not. Rather, the USFWS' decision not to list NEC was based on a long-term plan (i.e., the Conservation Strategy) to recover the rabbit, progress to-date in meeting the objectives of that plan, and an assessment of the threats that NEC populations still face across their range. Based on the progress made in meeting the Conservation Strategy's objectives, the USFWS felt sufficient assurances were in place to safeguard the future of this species. In addition, Connecticut, Massachusetts, and New York now have a much better idea on the extent of their NEC populations than in earlier years. They have more areas with NEC than what was initially estimated when the rabbit was first proposed for federal listing. However, there is little or no information on whether these NEC populations are currently increasing. In Maine and New Hampshire, where NEC have been monitored more intensively than other states, NEC populations have declined in numbers and distribution since the NEC was first proposed for federal listing.

For landowners who would like to directly participate in the restoration of NEC populations in Maine, MDIFW has a new program -- Candidate Conservation Agreement with Assurances (or CCAA). This program was developed with the USFWS to make it easier for landowners to provide conservation benefits to NEC and other wildlife. It is primarily for landowners that have NEC on or near their property. It streamlines the regulatory process under Maine's ESA, provides assurances for no new federal restrictions on land use that might result in incidentally killing or harming NEC, and provides landowners with information about other incentive programs that may be available to them for conserving habitat for NEC. If a landowner does not have NEC on or adjacent to their property, but lives in a town that has NEC (Figure 7) and would like to help in the restoration effort, please contact either Kelly Boland, at Rachel Carson National Wildlife Refuge; Cory Sterns, at MDIFW's regional office in Gray, ME; or Andrew Johnson, Natural Resources Conservation Service (NRCS), in Scarborough, ME. These individuals should be able to direct your call to the appropriate person and conservation program to meet your needs.

#### 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, as the old fields from abandoned farms in southern Maine reverted into mature forests, and brushy habitat was developed into residential areas, NEC populations declined markedly. 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 7).

The fact that a species with a high reproductive rate, like the NEC's, is endangered, raises serious questions about the status of other species that use brushy / old field habitats. There are at least 42 Species of Greatest Conservation Need that use habitats similar to what NEC require in Maine. These include species such as the Eastern Towhee, 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, is targeted at creating or maintaining dense shrublands that will benefit other wildlife as well.



**Figure 7. Maine's five focus areas and approximate location of remaining New England Cottontail (NEC) populations.**

Cottontail populations are denoted by black dots, and focus areas are named and delineated by various shades of grey 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 three biggest challenges to NEC recovery in Maine are 1) the low percentage of the land base that is composed of shrublands; 2) very low NEC numbers and the isolation of these populations from each other (Figure 7); and 3) limitations on the ability to promote and maintain shrubby habitat because of the public's desire for mature forests and shoreland zoning regulations.

### Management and Research Updates

Biologists and landowners have made good progress meeting the habitat restoration goals of the Rangewide Conservation Strategy (Table 12). MDIFW acknowledges the tremendous help it gets from its partners in the USFWS, the NRCS, and the Wildlife Management Institute in this effort. The Department would especially like to **thank the many willing landowners** who have participated in NEC conservation efforts.

**Table 12. Habitat restoration goals and progress by focus area in Maine.** All units are in acres and represent protected lands (i.e., private lands under management agreement, state & federal lands, or non-governmental conservation lands). Habitat patches smaller than 5 acres in the natural habitat were not included because they are unlikely to sustain rabbits. As of 2015<sup>1</sup>, we had achieved 21% of our 2030 habitat goals.

Focus Area	Habitat Goal	Self-sustaining Habitat	Management Implemented	Management Planned	Totals
Berwicks, Eliot & York	<b>1,800</b>	189	70	50	309
Cape Elizabeth & Scarborough	<b>1,000</b>	78	150	75	303
Coastal Kittery	<b>350</b>	45	35	0	80
Wells East	<b>350</b>	117	92	13	222
North-South Connector*	<b>1,015</b>	Unk	20	66	86
Greater Maine	<b>625</b>	Unk	99	6	105
<b>Total Acres</b>	<b>5,140</b>	429	466	210	1,105

During the winter of 2016, MDIFW and its partners conducted surveys for NEC as part of a rangewide monitoring effort. A contractor was hired to visit 21 pre-selected sites, comprised of different habitat types believed to be suitable for NEC, and note the presence or absence of NEC. The objective of the survey was to determine the probability of locating NEC in a particular type of habitat, and in turn, use this information to model changes in occupancy rates and rangewide population trends. Survey results should be available by the end of July 2016. In addition to the rangewide monitoring effort, 31 surveys were conducted at management sites and at sites where MDIFW had anecdotal information that NEC might be present.

One of the threats to NEC is the non-native eastern cottontail rabbit (*Sylvilagus floridanus*), which occurs in every other state that has NEC except Maine. Eastern cottontails are not native to New England, but were brought into many New England states in the late 1800's by fish and game agencies and hunting clubs that were interested in increasing hunting opportunities. Eastern cottontails indirectly compete with NEC for available habitat. It is not uncommon to see habitat patches that were once occupied by NEC revert to patches with only eastern cottontails in them. Rhode Island once had a thriving NEC population; however, today most of their available habitat is occupied by eastern cottontails. In Maine, it is illegal to bring eastern cottontails into the state. However, a few eastern cottontails have found their way into the state in nursery stock, as stowaways in wooden pallets, and by being hand-carried by people from other states looking for a wildlife rehabilitator. For the cases MDIFW is aware of, these cottontails died or were turned over to MDIFW shortly after coming into the state. This past year, an eastern cottontail ran from a wooden pallet and was hit on the highway in York. To make certain that eastern cottontails were not living in the area, MDIFW conducted surveys within 4.5 miles of the site where the rabbit was hit. A total of 33 surveys were conducted at 20 sites. Biologists found no evidence that eastern cottontails were living in the area, and to our knowledge, Maine is still free of eastern cottontails.

*This work is supported by the State Wildlife Grants and Pittman-Robertson funds (federal programs), state revenues from the sale of hunting and trapping licenses, National Fish and Wildlife Foundation, Wildlife Management Institute, USFWS' Partners' Program, Rachel Carson National Wildlife Refuge, NRCS, and many private landowners.*

-- Wally Jakubas

## **Wolves**

Keeping up with the status of the various wolf species in North America has been challenging, to say the least. There has been much discussion over the last 5 years on which species or subspecies are legitimate. In the Northeast, this discussion has focused on whether the Algonquin wolf (formerly known as the eastern wolf; *Canis lycaon*) is a legitimate species, and whether Algonquin wolf or Gray wolf (*Canis lupus*) was the original species that occurred in this area. On top of the genetic and taxonomic issues, the US Fish and Wildlife Service (USFWS) has been in the courts, again, trying

to remove the gray wolf in the eastern US from protections under the federal Endangered Species Act. Given all of this activity and uncertainty, I figured it was time for a wolf update.

At this time, some select information indicates that the Algonquin wolf is a legitimate species. The controversy of whether the Algonquin wolf is a separate species from the gray wolf is relevant to Maine in several ways. Genetic analysis of wolf pelts originally collected in Maine, indicate that this species of wolf historically occurred in our state. Secondly, the Algonquin wolf can hybridize with coyotes. Maine's coyotes have some Algonquin wolf genes. The ability of Algonquin wolves to hybridize with coyotes makes natural recovery of this species in Maine very difficult. If an Algonquin wolf were to disperse into Maine, it would be much easier for it to find a coyote to mate with than another Algonquin wolf. Over time, each generation of Algonquin wolf x coyote hybrids would likely mate with other coyotes, acquire more coyote genes, and consequently "dilute" any wolf characteristics. Lastly, the question has been raised as to whether Algonquin wolves need special protection under federal law in Canada and the United States. There are far fewer Algonquin wolves than gray wolves in North America; with the largest population of Algonquin wolves primarily occurring in Ontario. Both the USFWS and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) have reviewed the status of Algonquin wolves, and, in 2015, COSEWIC recommended that Canada consider the Algonquin wolf as threatened under the Species at Risk Act. The USFWS has not made a decision on whether this species should receive protection under the Endangered Species Act.

Currently, the Department is not aware of any wild wolves in Maine. In our 2015 Wildlife Action Plan, the gray wolf is listed as extirpated and is not considered a species of greatest conservation need. Even though wolves are not listed as a species of greatest conservation need, our Department continues to record sightings of wolf-like animals, investigate possible wolf sightings, and participates in discussions on the feasibility of wolf recovery efforts in the Northeast. While we have physically documented individual wolves or wolf-like animals in the past (e.g., 1993, 1996, and 2007) these animals were shown to be either domestic in origin through DNA testing and stable carbon isotope analysis, and/or were determined to be wolf-dog hybrids. If a wolf were to disperse into Maine, it would be protected under Maine's hunting and trapping laws and it would be considered a federal endangered species. Species that are considered endangered under the Endangered Species Act are protected under federal law from harm or harassment.

Many people are still interested in recovering wolf populations in the northeastern United States to restore a top predator to the greater ecosystem. Back in 2000, the Department worked with researchers at the University of Maine to survey Maine residents about their attitudes on wolves. While 73% of the respondents agreed that wolves have the right to exist in Maine (only 13% disagreed), a greater percentage of people (48% vs. 31%) did not want an agency to reestablish a wolf population in Maine. Another way to look at this is that residents were more comfortable with the idea of wolves coming back on their own than a government agency bringing them back. Since the results of this survey were published, the Department has held the position that it would not support a reintroduction of wolves into Maine until there was a clear mandate to do so from Maine citizens.

Recent changes to the legal status of the Algonquin wolf in Canada have raised questions on whether the chances of natural wolf recovery in Northeastern US may be better than in the past. On June 15, 2016, Ontario classified the Algonquin wolf as threatened under the Species At Risk in Ontario Act. There appears to be a good chance the Canadian federal government will follow Ontario's lead and accept COSEWIC's recommendation to protect the Algonquin wolf. Currently, the Algonquin wolf is protected in Ontario by restricting wolf and coyote trapping and hunting. It is thought that the same protection procedures will be used in other provinces if the Algonquin wolf becomes federally protected in Canada. The nearest wolf population to Maine is in Laurentides Provincial Park, Quebec, which is only about 100 air miles away. Although this wolf population is close, there are several significant barriers to their dispersal into Maine. These include the St. Lawrence River, a dense human population around Quebec City, and heavy trapping pressure south of the St. Lawrence River. While wolves have dispersed south of the St. Lawrence River into Quebec and New Brunswick, these are rare events. We know about these dispersals because the wolves were killed and reported to authorities. It remains to be seen whether Quebec will have to change its hunting and trapping regulations to protect the Algonquin wolf and whether such changes will increase the chances of wolves successfully emigrating south of the St. Lawrence River. Wolves normally disperse as they near adulthood, and they normally disperse as individual animals. The probability of two wolves of the opposite sex dispersing to Maine, finding each other, and reproducing still remains very low.

-- 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 Frigga Fritillary 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 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-ordination of state atlas 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 several invertebrate taxa, with recent efforts devoted to assessment and conservation of Clayton's Copper butterfly, freshwater mussels, rare mayflies, and bumble bees. 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 issues where he coordinates research and conservation efforts on several rare turtle and snake species. Derek is currently focused on assessing the distribution, status, and management needs of black racers, Blanding's, spotted, and wood turtles in Maine and is also studying and guiding mitigation recommendations for the impacts of roadways on Maine's reptiles and amphibians.

**Seasonal Staff/Cooperators** – The RAI Group could not address such a diverse suite of taxa without the expert assistance provided by the following professionals (in 2015-2016): Dr. Catherine Bevier, Kalyn Bickerman, Paul M. Brunelle, Dr. Ron Butler, Dr. Frank Drummond, Ken Hotopp, Dr. Cynthia Loftin, Derek Moore, Ethan Nedeau, Trevor Persons, Gannon Pratt, Dr. Leif Richardson, Jeremy Shapiro, 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: the 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 2016 annual meeting at Green Mountain College in Vermont.

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, c) developing fact sheets on emerging amphibian and reptile diseases, and d) 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 [www.parcplace.org](http://www.parcplace.org).

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

-- 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: <http://www.maine.gov/ifw>.

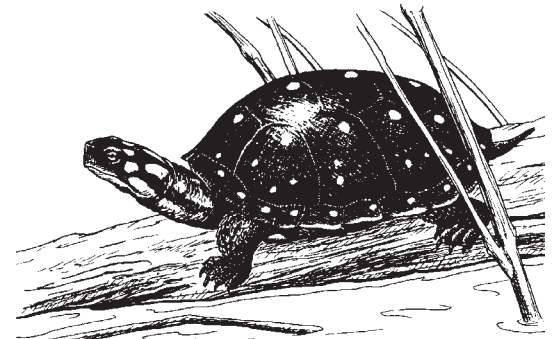
MDIFW continues this atlas work and maintains a comprehensive database on the distribution of Maine's 36 amphibian and reptile species (34 native and 2 exotic). Though most of this work is opportunistic, as of spring 2015, over 10,600 records from more than 760 volunteers have been logged. The results of the MARAP project have helped 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).** For more information on research, assessment, and conservation efforts for Maine's amphibians and reptiles, visit the RAI Group's webpage here: <http://www.maine.gov/ifw/wildlife/species/reptiles/index.html>.

*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.*

-- 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

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:

- *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 DOT, The Nature Conservancy, and local towns, temporary yellow warning signs are installed in strategic locations to alert motorists to the possible presence of 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 11th 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: <http://www.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, 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 across the southern half of the state. MDIFW is currently undertaking field surveys in an attempt to verify the presence of Spotted Turtles at a number of these locales and determine if the previously reported turtles represent wild populations, possible released captives, or misidentifications of other turtle species. The spring seasons of 2015 and 2016 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

was previously known. Much remains to be learned in the upcoming 2017 field season as we assess additional sites and search further at a few promising locations where we failed to find Spotted Turtles in the past 2 years.

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

-- Derek Yorks

### **Conservation Planning and Implementation for the Wood Turtle from Maine to Virginia**

The Wood Turtle is one of the state's rarest turtles, listed as Special Concern. It is a medium sized turtle (5–8 inches) with a distinct sculpted shell and orange coloration on the neck and legs. They are a handsome and long-lived species that is known to live at least up to 58 years of age. For much of the year, wood turtles are found in slow-moving, clear-water streams with a predominantly sand or gravel substrate. During late spring and summer, they use the surrounding upland areas including forests, floodplains, meadows, and hayfields. From late fall to early spring, wood turtles hibernate underwater in sheltered areas of rivers, including deeper pool bottoms, under riverbanks, or under woody debris. No other Maine turtle species makes such extensive use of both aquatic and terrestrial habitats.

Widespread concern about the status of the Wood Turtle prompted the 2009 establishment of the Northeast Wood Turtle Working Group (NEWTWG) through the Northeast Partners for Amphibian and Reptile Conservation (NEPARC). This group, consisting of biologists, agency representatives, land managers, and others from 13 states and the District of Columbia, collaborated on a two-year status review funded by the Northeast Association of Fish and Wildlife Agencies (NEAFWA) Regional Conservation Needs (RCN) Program. In 2014, stemming from the collaborative work of the RCN, MDIFW and wildlife agencies in seven other states active in NEWTWG were awarded a federal Competitive State Wildlife Grant entitled *Conservation Planning and Implementation for the Wood Turtle (*Glyptemys insculpta*) and Associated Riparian Species of Greatest Conservation Need from Maine to Virginia*. MDIFW biologists began field surveys for this project in the spring of 2015, and they will continue this scientific process for identifying the best Wood Turtle populations across the state through the fall of 2016. This exciting new effort is the most comprehensive study, to date, focused on this species in Maine and will help ensure a future for this important and beautiful inhabitant of Maine's wild rivers and forests.

*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.*

-- Derek Yorks

### **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 (lack 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 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 and, in many areas of its range, 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.

In the spring of 2016, MDIFW biologists began a two-year project seeking to confirm and document new or poorly known racer occurrences and to establish a monitoring program at sites where Black Racer populations occur. Currently we are using VHF radio transmitters to track seven individual racers spread out across three sites in three towns. During the 2017 season, radio telemetry will continue and our racer monitoring program will expand to include additional sites. We will initiate a monitoring program that uses multiple techniques including trapping, transect surveys, and cover object 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 License Plate and Chickadee Check-off.*

-- 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 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, pesticides, and intensive agricultural likely 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 will enlist 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 year, over 80 volunteers were trained in a standardized survey protocol and provided the field equipment to participate. This enthusiastic and productive group of citizen scientists then went to work and by the end of the first field season had contributed nearly 5,000 new bumble bee records! Their data showed that 13 of the 17 species historically known to occur in Maine (Table 13) were still present, and that some species had decreased in relative abundance, while others had increased.

Four previously documented species were not found during the 2015 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 well-documented 90% decline in both numbers and distribution throughout its entire North American range and is currently undergoing review by the U.S. Fish & Wildlife Service for potential listing under the federal 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 four 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 <http://mainebumblebeeatlas.umf.maine.edu/>. You can also follow the project on Facebook at <https://www.facebook.com/MaineBumblebeeAtlas> and at the MBBA blog at <http://www.maine.gov/worpress/bumblebeeatlas/>.

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

-- Beth Swartz

**Table 13. Bumble bees of Maine.**

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 pennsylvanicus</i>



## **A Conservation Status Assessment of the Dragonflies and Damselflies of Maine and the Northeastern United States**

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.

This assessment can be used to inform the strategic allocation of limited state and federal conservation resources and help foster collaboration across state lines to conserve regionally at-risk Odonata. We also anticipate this research will help guide and standardize conservation assessments of other invertebrate taxa. Finally, we recommend 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.

Contact Phillip deMaynadier ([phillip.demaynadier@maine.gov](mailto: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.



Dragonfly (Photo by Sharon Fiedler)

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

-- 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 those species most vulnerable to decline and potential state extinction.

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 123 species. Of special note is the relatively high proportion (~20%) of Maine butterflies and skippers that are extirpated (five species) or state-listed as Endangered, Threatened, or Special Concern (19 species) -- a pattern consistent with global trends elsewhere for the group. Contact MDIFW to receive an updated checklist of the butterflies of Maine ([phillip.demaynadier@maine.gov](mailto:phillip.demaynadier@maine.gov)) or visit <http://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 9-year statewide volunteer butterfly atlas originally took flight in 2007, 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 to date include: a) a comprehensive database of Maine butterflies comprised of over 34,000 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 one-stop 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 difficult 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 world of butterflies and potentially other invertebrates.

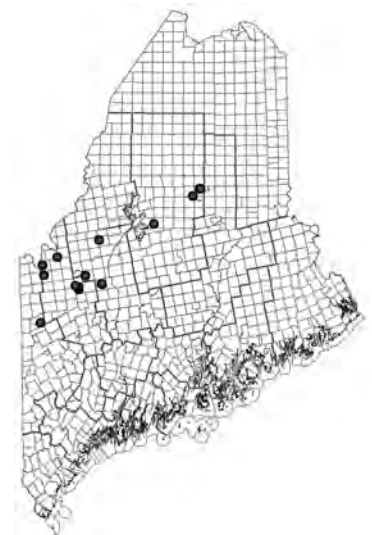
*Funding for this work comes from volunteer assistance, The Nature Conservancy, the federal State Wildlife Grants program, and state revenues from the Loon License Plate, Chickadee Check-off, and the Maine Outdoor Heritage Fund.*

-- 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 8). 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.



**Figure 8. Distribution of Roaring Brook Mayfly in Maine.**

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.

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

-- 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 14).

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 also has been petitioned for listing under the U.S. Endangered Species Act and will soon undergo a status review by the U.S. Fish & Wildlife Service to determine if it warrants federal protection.

In most locations where it is found, the Brook Floater is observed in very low densities with little evidence of recruitment. 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 St. George River, lower Kennebec River watershed, and several Downeast and midcoast rivers. During the past six years, the Department has focused on intensively surveying streams and rivers where the Brook Floater has been documented in the past. Many of these sites had not been visited for over 20 years, so little was known about the species' current status at each. MDIFW contracted Ethan Nedeau (Biodrawiversity LLC), a mussel biologist with vast experience studying Brook Floaters in the Northeast, to conduct the surveys. So far, Ethan has surveyed 20 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 always presumed the population was healthy, based on past numbers observed, Ethan found relatively good numbers, but they were all old animals with little evidence of reproduction. Conversely, some sites like Kenduskeag Stream, Wesserunnett Stream, Marsh Stream, and the Passadumkeag River appear to have relatively large, healthy populations. At each site visited, Ethan is documenting the Brook Floater's population density and size, as well as microhabitat use and potential threats. In 2016, he will be surveying the Carrabassett and Sebasticook Rivers. 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 upcoming federal status review.

In 2016, MDIFW and several partnering states were awarded a Competitive State Wildlife Grant from the U.S. Fish & 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 Maine. 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 (<http://www.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.*

-- Beth Swartz

**Table 14. Freshwater Mussels of Maine.**

Eastern Pearlshell ( <i>Margaritifera margaritifera</i> )	
Eastern Elliptio ( <i>Elliptio complanata</i> )	
Triangle Floater ( <i>Alasmidonta undulata</i> )	
Brook Floater ( <i>Alasmidonta varicosa</i> )	<b>THREATENED</b>
Eastern Floater ( <i>Pyganodon cataracta</i> )	
Alewite Floater ( <i>Anodonta implicata</i> )	
Creeper ( <i>Strophitus undulatus</i> )	
Yellow Lampmussel ( <i>Lampsilis cariosa</i> )	<b>THREATENED</b>
Eastern Lampmussel ( <i>Lampsilis radiata radiata</i> )	
Tidewater Mucket ( <i>Leptodea ochracea</i> )	<b>THREATENED</b>

## Special Habitats for Reptiles, Amphibians, and Invertebrates

### 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, so do 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.

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), and 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 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, approved by the 120<sup>th</sup> Maine Legislature in 2006. Criteria for designating Significant 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 2,600 vernal pools statewide, in collaboration with DEP, 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.

For more information on other important habitats for reptiles, amphibians, and invertebrates including Pitch Pine Barrens, Riparian Sedge Meadows, and Marshes and Shrub Swamps, see other recent annual reports here: [http://www.maine.gov/ifw/wildlife/reports/research\\_management.html](http://www.maine.gov/ifw/wildlife/reports/research_management.html).



Vernal Pool (Photo by Jonathan Mays)

*Funding for MDIFW's efforts at research and protection of vernal pools comes from the federal State Wildlife Grants program, and state revenues from the Loon License Plate and Chickadee Check-off.*

-- Phillip deMaynadier

## FISH GROUP

Maine is home to about 50 native species of freshwater and diadromous fishes and about 17 species that are considered to be non-native to the state. The issues and needs associated with such a diverse assemblage are broad. Hence, the Fish Group tends to focus on issues and needs complementary to the Fisheries Division. Group members are actively involved in many aspects pertaining to native fish conservation, aquatic habitat restoration, inland commercial fisheries management, invasive fish control and remediation, and fishery resource data management, landscape analysis, and mapping.

The Fish Group coordinates and actively participates in a variety of collaborator and partnership-driven efforts, such as active stream and riparian habitat restoration, large-scale river connectivity projects, inventory of unsurveyed habitats, and Northeast regional aquatic resource conservation efforts. The Group also collaborates and coordinates a variety of on-going research projects with academic researchers, conservation organizations, and other state and federal agencies.

**Merry Gallagher, Fishery Research Biologist and Group Leader** – Merry supervises Group activities and is a stream ecologist with expertise in stream survey methodology, native fish ecology, and landscape/GIS data analysis. She oversees statewide efforts to survey and assess remote ponds and coastal stream habitats, documents wild brook trout populations, and improves the general knowledge regarding the distribution of Maine's native fishes. She is also integral to managing Maine's inland commercial fisheries, including baitfish. Merry represents Maine and MDIFW on a variety of committees and Northeast partnership efforts, such as the Eastern Brook Trout Joint Venture, the Northeast Fish and Wildlife Diversity Technical Committee, and the Maine Stream Connectivity Work Group.

**Kevin Gallant, Fishery Specialist** – Kevin assists with a variety of fisheries research projects statewide and most of the Group's data collection efforts. The primary focus is on documenting wild brook trout populations in all habitat types, but all freshwater fish species encountered are recorded. Kevin's primary projects this year have included the Remote Pond Survey Project and assessing coastal brook trout. Kevin is also a member of MDIFW's Black Bass Committee and a certified pesticide applicator and is integral to many MDIFW chemical reclamation projects.

**Tyler Grant, Contractor** – Tyler coordinates the field collections of fish species for research projects, including the Sea-run Brook Trout Project and the Remote Pond Survey Project. He assists in maintaining the stream survey, sea run brook trout, and commercial fishery databases, and helps fill data and fish collection requests that come to the Fish Group. Tyler is also involved in monitoring 'chop and drop' habitat restoration projects statewide and invasive fish species monitoring projects.

**Cooperators** - The Fish Group could not accomplish all that we do without the ever present assistance from our collaborators, cooperators, and volunteers. We graciously thank the following dedicated organizations and individuals for your continued assistance: MDIFW Regional Fisheries staff, Sally Stockwell, Emily Bastian, Leah Bevins, Jeff Reardon and the cadre of volunteers (Maine Remote Pond and Coastal Stream Survey Project), Michael Hopper and Geof Day (Sea Run Brook Trout Coalition), Dwayne Shaw (Downeast Salmon Federation), Jacob van de Sande (Maine Coast Heritage Trust), Dr. Michael Kinnison, Wes Wright, Dr. Joe Zydlewski and their students (UMaine), Keith Kanoti, Jed Wright, Serena Doose, Alex Abbot, Scott Craig, Josh Royte, Barbara Charry, Jacob Aman, Ben Naumann, Jeff Norment, Pat Sirois, Bruce Connery, and the many volunteers and private land owners who have worked with us over the last year.

## FISH CONSERVATION AND MANAGEMENT

### **Northern Pike in Pushaw Lake: A Ten Year Update**

On August 7<sup>th</sup> of 2003, an angler reported that he caught and released a northern pike (*Esox lucius*) in Pushaw Lake that weighed approximately six pounds. The following summer, the same angler reported catching another pike that was 19" long in nearly the same location as the first reported catch. This was the first known occurrence of this invasive species within the Penobscot drainage and, since then, pike have spread throughout much of the lower Penobscot drainage. The Penobscot River watershed encompasses 269 surveyed lakes and ponds totaling 189,486 surface acres, and 4,753 miles of brooks, streams, and rivers, which include many valuable and historical fisheries that would be severely impacted by the introduction of pike. There is grave concern about pike colonizing the upper reaches of the Penobscot River system, so since their initial introduction, efforts have been underway to suppress their population.

Northern pike (Figure 9) are an aggressive, highly piscivorous, rapidly growing, and highly reproductive fish. Adult pike spawn in early spring, generally around ice-out when water temperatures range from 4-10°C (40-52°F). Female pike will produce around 9,000 eggs per pound of body mass. That is compared to around 700 eggs per pound for an Atlantic salmon, or about 500 eggs total for a 10 inch brook trout. Eggs hatch in about 10—14 days, and larval pike convert to a predominately fish diet within 30 days post-hatch or at around 2 inches in length. Their growth is rapid, sometimes reaching 10—15 inches in their first year, and growing up to 8 inches per year after that until they sexually mature at 3 to 4 years-old. As pike mature, their rapid growth rate, predatory nature, and few natural predators contribute to generally high rates of survival. As such, their effects on the local fish community can be quite devastating.

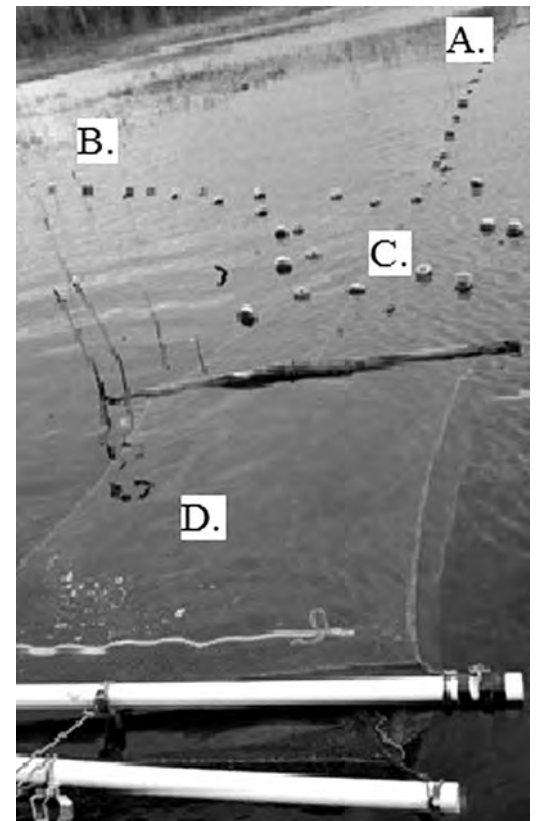


**Figure 9. A Northern Pike next to a Chain Pickerel.** Note the distinctive chain patterning on the pickerel, as well as the black line under the eye. (Photo by Kevin Gallant)

In the winter of 2006, regional fisheries staff conducted a creel survey to help determine the extent of the population. 270 parties, consisting of 872 anglers fishing for a total of 3,493 hours were checked at Pushaw Lake during the 2006 winter creel census. Nine pike were caught by anglers, eight of which were harvested, and one was released by the angler. This effort was repeated in the winter of 2016. The winter of 2016 was a poor one for ice fishing with warm temperatures that kept ice from forming until late January. 131 parties, consisting of 310 anglers fishing for a total of 1,232 hours were checked. Six pike were caught by anglers, and all of the pike were harvested.

Starting in 2006, MDIFW biologists deployed fyke nets in the inlet in an effort to capture and remove as many pike as possible (Figure 10). Fyke nets, often called trap nets, are a passive capture method that collects fish as they swim through an area and holds them in a collection box until the net is tended. The design of the net allows for very minimal mortality of captured fishes. Since eradication of the species is highly unlikely, suppression of the population was determined to be the best method to help slow the dispersal of pike throughout the Penobscot River watershed. We tested the efficacy of gillnets, seines, and electrofishing boats as methods for pike removal, but the spring trap netting was by far the most successful, efficient, and cost effective.

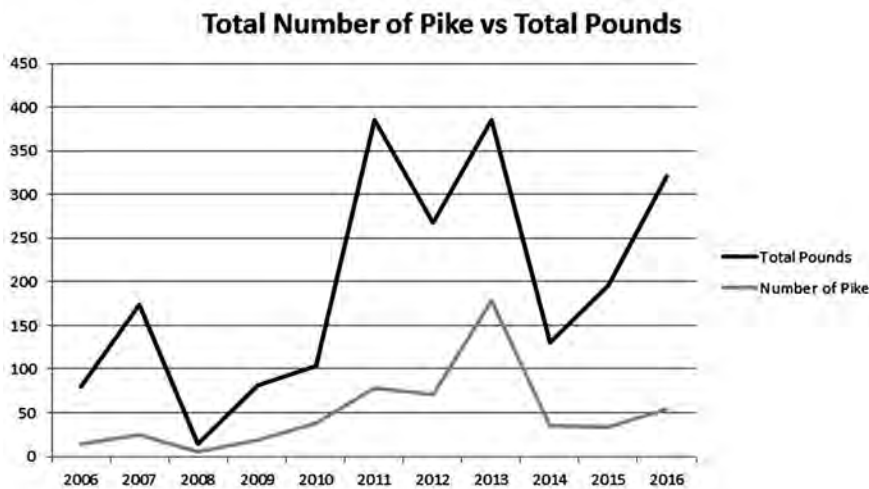
MDIFW has continued the pike suppression effort each spring since 2006 (Table 15). The number of nets used and the geographic area that has been trapped has varied greatly over the years, but continues to be centered on the inlet of Pushaw Lake that is a known pike spawning location. 2016 was the earliest year that the nets were able to be set, which likely allowed for a slightly higher number of pike caught, with a similar catch rate to the last few years. The 2013 trapping season continues to be noteworthy in both the number of pike trapped, and the catch rate. This is possibly due to low water levels that facilitated much more efficient trapping and to a high number of smaller-sized individuals caught that year. If the total pounds of pike collected each year is compared (Figure 11), 2013 is nearly the same as 2011 when only 78 individuals were collected, and only a small margin above the total pounds collected in 2016. The 2016 trapping season resulted in some of the largest fish caught yet, with 13 of the 55 fish taken being over 10 pounds, compared to 5 in 2013, one from 2014, and 6 collected in 2015 (Figure 12). This could be partially due to the newly re-established run of sea-run alewives, resulting from the stocking efforts of the Department of Marine Resources. It could also be partially due to our own suppression efforts, which decreases the population density and increases the availability of food and habitat for an individual fish.



**Figure 10. A fyke net deployed in the Pushaw Lake inlet showing:** A. The long lead that reaches toward shore, B. The wings that help guide the swimming fish, C. The funnel area that the fish can swim into, but cannot easily swim out of, and D. The holding box where the fish can be collected through the zippered opening.

**Table 15. A 10-year summary of the pike caught by spring trap-netting in the Pushaw Lake system.**

	Start Date	End Date	# Nets	# Net Days	# Pike	Day	# Pike/Net	Males			Females		
								Average Length (Inches)	Average Weight (Pounds)	Max Weight (Pounds)	Average Length (Inches)	Average Weight (Pounds)	Max Weight (Pounds)
2006	3/29/2006	4/27/2006	3	90	14	0.16	20.3	1.6	1.6	28.0	5.3	11.5	
2007	4/9/2007	4/27/2007	3	57	24	0.42	17.0	1.0	1.0	30.4	7.5	13.4	
2008	4/6/2008	4/24/2008	4	76	5	0.07	19.8	1.9	1.9	24.7	3.2	4.9	
2009	4/6/2009	4/29/2009	4	96	19	0.20	18.0	1.4	1.9	27.9	5.4	12.3	
2010	3/22/2010	4/17/2010	7	198	38	0.19	20.2	1.9	4.0	26.4	5.1	14.0	
2011	3/29/2011	4/21/2011	15	257	78	0.30	23.9	3.5	11.9	27.8	5.5	16.8	
2012	3/16/2012	4/13/2012	15	316	71	0.22	20.9	2.5	6.0	28.0	5.9	12.1	
2013	4/1/2013	4/22/2013	8	168	178	1.06	18.8	1.5	5.0	21.9	3.1	13.2	
2014	4/14/2014	5/5/2014	5	79	35	0.44	22.2	2.7	6.4	26.0	4.5	10.4	
2015	4/15/2015	5/6/2015	3	61	34	0.56	22.8	2.9	6.6	32.2	8.6	18.7	
2016	3/7/2016	4/19/2016	3	124	55	0.44	21.2	2.3	6.5	31.1	9.0	18.1	



**Figure 11. The total number of pike caught per year compared with the total poundage measured.**



**Figure 12. Fisheries Contractor Tyler Grant with 2 pike collected in the spring of 2016. Both fish are over 14 pounds.**

In addition to length and weight information, we remove the cleithrum from each fish collected (Figure 13). The cleithrum is a bone of the gill and pectoral region of the fish, which grows as the fish does, and can be used to determine the age of an individual fish (Figure 14).

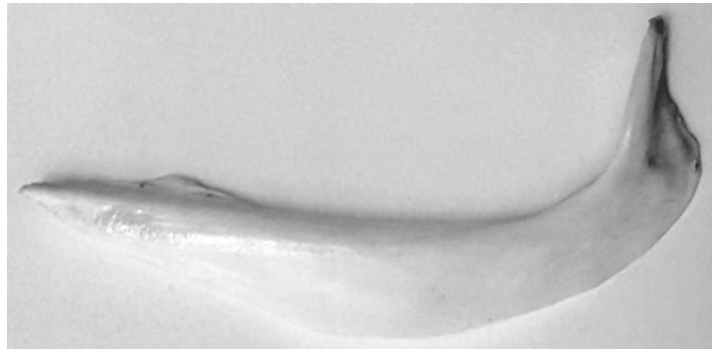
A study of the cleithra removed from the collected pike shows that the majority of the fish collected since 2006 are in the 3–4 year old range (Table 16). Very few fish collected in any year are one year old, mostly due to the larger mesh size in the trapnets, and the reduced likelihood that a one year old fish would be sexually mature and ready to spawn. From 2006 through 2012, a few trends emerge. There is a slight tendency for the fish in 2006 to be older. It's likely some of those fish were from the original illegal stocking event. In 2010 there is a conspicuous amount of the population that is 2 years old. This might be due to a poor trapping year in 2008 when only 5 pike were collected. With fewer pike removed, overall spawning success may have been higher for the remaining population that year. 2013 again appears to be noteworthy in that 76% of the fish collected are 3 years old or less. Since then, in 2014 and 2015 there is a slight shift back toward older individuals, with 62% of the fish collected in 2015 age 4 or older. The ages of the fish collected in 2016 have not yet been determined. From a population suppression standpoint, a shift toward older individuals can be an indication of decreasing recruitment, and could be a sign that our suppression efforts might be working.



**Figure 13. Fisheries Specialist Kevin Gallant and Fisheries Contractor Tyler Grant measuring a pike caught in March of 2016.**

Over the ten years that the trap-netting project has been in place, pike have colonized all of the Pushaw Lake system, having been confirmed in Little Pushaw Lake and Mud Pond and throughout Pushaw Stream. They have also been confirmed in lower Kenduskeag Stream, and the lower Penobscot River below the Milford Dam. In 2015, a pike was captured and killed at the newly installed fish lift on the Penobscot River at the Milford Dam. This is the farthest upstream that a pike has been confirmed, though sporadic, unconfirmed angler reports allude to their presence higher in the drainage. So far in 2016, no pike have been caught at the Milford fish lift, and there have been no additional reports of new areas that have been colonized by pike. While the pike have managed to colonize most of the habitat available to them currently, they have been limited to a relatively small area in the lower Penobscot watershed, and overall numbers appear to remain low. New data will soon be available from the University of Maine’s environmental DNA project, which detects small amounts of pike DNA in the water and can confirm the presence of pike even at very low population numbers. Water collections are underway to determine the extent of pike colonization in the lower Penobscot watershed all the way north to Millinocket. Early detection of any new pike occurrence is invaluable in staying ahead of pike expansion.

Anglers fishing in the Penobscot River system can assist us by harvesting any pike caught in the drainage. Any suspected pike caught, especially in areas not mentioned in this report as having confirmed populations, can be brought to a regional MDIFW office to be confirmed as a pike and documented as a new occurrence. This documentation will help us to stay ahead of their movements and concentrate our removal efforts where they will be the most effective. The hope of eradicating pike from the system will likely never happen, but the management goal of suppressing the population and slowing down their progression through the river system in order to protect valuable and historical fisheries upstream has so far been successful, and will continue.



**Figure 14. The Cleithrum from a pike collected in Pushaw Lake.** The longitudinal lines on the bone can give an approximate age of the fish.

-- Tyler Grant

**Table 16. An age distribution of the Pike collected from the Pushaw Lake system. The values indicated are the proportion of the total catch that falls in that age group.**

	1*	2	3	4	5	6+
2006	0	0.07	0.14	0.57	0.14	0.07
2007	0	0.04	0.04	0.5	0.38	0.04
2008	0	0	0.4	0.2	0.4	0
2010	0	0.39	0.24	0.11	0.13	0.08
2011	0	0.06	0.27	0.4	0.22	0.05
2012	0.08	0.17	0.11	0.31	0.25	0.04
2013	0.01	0.25	0.52	0.11	0.04	0.02
2014	0.03	0	0.69	0.17	0.09	0.03
2015	0	0.12	0.21	0.44	0.15	0.03



## Stream Temperature Monitoring

The Maine Water Temperature Working Group (MWTWG) was established in 2014 to develop a coordinated stream temperature monitoring network that can be integrated with regional and national efforts. The group is composed of multiple state agencies, academics, NGOs, tribes, and federal agencies. The MWTWG has developed standardized monitoring protocols and conducted a comprehensive inventory of existing data for current and past water temperature monitoring efforts.

Regional models can be useful for characterizing spatial variation, making robust predictions, and estimating effects across wide environmental ranges. The project uses developed hierarchical, or nested, regional models for stream flow, temperature, and brook trout (*Salvelinus fontinalis*) occupancy developed by USGS. In an effort to maximize the utility of these models by making them updatable and accessible, USGS has developed a web application that links the models together and links databases to the models. This integrated Spatial Hydro-Ecological Decision Support system (SHEDS) allows rapid updating of model results as new data become available, putting the models in the hands of the users and creating a stronger link between data collection and model results. SHEDS allows hindcasting of stream flows and temperatures by catchment as well as forecasting under alternate future scenarios. These environmental predictions are often useful on their own, but can also be linked to predict probabilities of occupancy for brook trout. For example, the user can examine regional maps and use slider bars to visualize the effects of changing forest cover or air temperature on stream temperature, flow, and brook trout occupancy. More information regarding the regional database can be found here: <http://db.ecosheds.org>.

In order for these models to be accurate, credible, and useful to a wider audience, stream temperature data collection has to occur somewhat consistently across the whole geographic region. Hence, many new data logging stations in Maine have to be established. The loggers (Figure 15) are set up to take a temperature every 30 minutes and are recording year-round. The data are typically downloaded annually, but the logger's battery can continue to record and store around 2 ½ years of temperature observations. Using anchors (Figure 16) or underwater epoxy (Figure 17), the loggers are placed into certain streams spatially distributed throughout the target river drainage. Using these methods, the MWTWG has deployed 278 loggers since 2014 and, combined with the historic sites, totals over 800 water temperature monitoring locations (Figure 18). The Bangor Research and Assessment Fish Group has launched 51 loggers to date from Northern Maine to Downeast Maine to Western Maine. These areas were typically underrepresented in previous statewide efforts to monitor stream temperatures.



Figure 15. A Typical temperature logger (middle) and housing, using a pencil for scale.

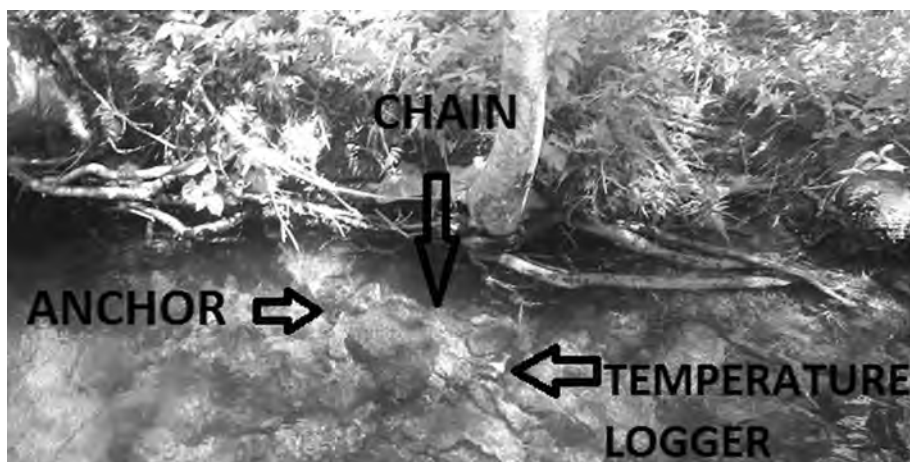


Figure 16. A typical anchor deployment of a temperature logger.



**Figure 17. A temperature logger epoxied to the downstream side of a large boulder. MDIFW contractor Chris Introne is pointing to where it is attached.**



**Figure 18. A map of all currently deployed temperature dataloggers in the State of Maine.**

These stream temperature data will be very useful to a variety of agency decision makers statewide. With this information they will be able to make informed decisions leading to better management and conservation of Maine's fish and wildlife species. These data and the predictive models developed from them can be used to point out areas that may be resilient to warming regimes in spite of changes in climate or local land use, where coldwater fisheries management may be problematic in the future, or habitats that may be considered for habitat or riparian restoration practices. This is an ongoing project of the Fish Group, and we will continue to manage our stations in the foreseeable future and continue to add new stations where feasible.

-- Kevin Gallant

## WILDLIFE MANAGEMENT SECTION

The Wildlife Management Section is an important conduit for communication and interaction with the sporting community in the State. Scattered across seven regional offices, staff in these offices field calls, walk-ins and continuously talk with and interact with residents and visitors while conducting work activities in the field. If someone needs information, frequently they call or visit a regional office to have their questions answered.

In each of the coastal regions, three wildlife biologists work to accomplish goals and objectives, with two wildlife biologists in each of the other four regions. In addition to regional wildlife staff, the Lands Management Program is staffed with two licensed foresters. An additional staff biologist is assigned to the Department of Agriculture, Conservation and Forestry to promote wildlife and habitats on lands managed by DACF.

The Wildlife Management Section work program encompasses planning and biological data collection for species management, 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.

The vast majority of the funding for work activities outlined above comes from the Wildlife and Sportfish Restoration Program. Use of this funding ensures that the wildlife resources are managed appropriately and the sporting community has access to the wildlife resources for hunting, trapping and viewing now and into the future.

This year marked the end of two long careers within the Wildlife Management Section, and I'm sure quite a few that read this will find these names familiar.

In June, Assistant Regional Biologist Jim Hall retired from the Department. Based out of the Jonesboro office, Jim had over 43 years of service with the Department, and, as is typical for Section staff, was involved in most everything the Department touches on, from wetlands inventory to issues surrounding trapping regulations. Jim was also particularly interested in management on our Wildlife Management Areas and how forest product markets impacted what was able to be accomplished.

In July, Regional Biologist Richard Hoppe retired after 28 years of service with the Department. Rich was the Regional Supervisor out of the Ashland Regional Headquarters – the largest Region in the State, containing more land area than Rhode Island and Connecticut combined! Rich was able to establish valuable relationships with landowners and sporting groups during his tenure. Through the course of his career, considerable land management and ownership changes necessitated adapting approaches to management of the wildlife resources in his Region. The relationships he forged gave him the ability to remain effective as these changes occurred.

We appreciate the hard work, dedication, experience, and knowledge of the wildlife resources these gentlemen brought to the Department and recognize their contributions to meet the Department's mission.

As we move forward to deal with the ever evolving landscape of wildlife management in the State of Maine, we see both challenges and opportunities. Challenges lie in addressing the impacts and conflicts of wildlife and people – both of which influence the other. Opportunities present themselves with the amount and quality of information available to the wildlife biologists charged with sustained management of wildlife resources; and also the amount of information available to the users of those resources.

I'd encourage you to reach out to the Regional offices when in need of assistance or information about the great wildlife resources we have in the State. Each biologist can answer general questions you might have, or give you detailed specific information about the resources in their respective regions. You can find their contact information at: [www.maine.gov/ifw/aboutus/contactus.htm](http://www.maine.gov/ifw/aboutus/contactus.htm).

-- Ryan Robicheau  
*Supervisor, Wildlife Management Section*

# REGIONAL WILDLIFE MANAGEMENT

## Region A - Gray

Region A encompasses the state's southernmost counties. It includes the populous towns of the south coastal plain and Sebago Lakes Region, west through the more rural towns in the foothills of the White Mountains.

Throughout most of the region, water is a significant part of the landscape. These wetlands and the adjacent uplands provide valuable wildlife habitat for a variety of species from freshwater mussels to Bald Eagles. The wetlands are a gift of our geology and climate. Like most natural features, wetlands are always changing, some to a greater extent than others. People have demonstrated the ability to make additional changes; fill them, dam them, reroute them. Perhaps second only to us, beaver show a propensity to change wetlands to suit their needs. For a wildlife biologist, this often means time to get to work when beaver set up shop by plugging a road culvert or flooding a woodlot, snowmobile trail or backyard.

Though the benefits of beaver far exceed any problems they may create, problems do occur, and we can help. We are fortunate to be able to put landowners in contact with a recreational trapper. Often, in newly established flowages, trappers can remove beaver during the fall/winter trapping season and the problem will go away until another dispersing beaver finds it in the future. This is easier to do when world fur markets are strong and pelt values are higher, say \$40. When there is lower demand for beaver pelts in the market, values can drop to below \$15, even for good eastern pelts. Just as a small woodlot owner may hold off on a timber harvest until pulp values increase, a trapper may put in less time targeting beaver and focus on other more valuable species. Thus, in times when fur values are down, such as they are today, our office will likely get more calls for assistance with beaver flowages that occur in places they normally don't.

When recreational trapping effort is down, we must consider other options for resolving problems. Landowners and/or municipalities can hire registered Animal Damage Control agents. These are private contractors that work to resolve human/wildlife conflicts for a fee. They are deployed by and work in consultation with MDIFW Biologists and Game Wardens in all regional offices. Most ADC agents either trap or relocate beaver.

If beaver continue to target the same wetland and it is a wetland of high habitat quality, site modification is the preferred long term solution. This is done through the installation of one of various structures made of drain pipe and fencing. The goal is to lower the water to a point that is acceptable to the landowner and the beaver. Thus, the high value wildlife habitat is retained, the beaver stays put and the landowner is content in that the road, woodlot, backyard or hayfield is not underwater. These structures, dubbed "beaver deceivers" are in use across the country in various iterations. Regional staff has installed them at several chronic problem sites, and they have performed well.



Site Modification (Photo by landowner Bill Crain)

Landowners are encouraged to consult with regional staff for more information on whether a beaver deceiver may be a good option for your property.

-- Scott Lindsay  
*Regional Wildlife Biologist*

## Region B - Sidney

Region B in Central Maine contains twenty five separate Wildlife Management Areas that comprise approximately 32,000 acres of land, available for both consumptive and non-consumptive users to enjoy. With this land, comes the responsibility of land ownership and maintenance. Each spring and summer season brings new opportunities to improve the infrastructure of our Department properties.

During 2015, Region B acquired two very large parcels of land that creates two new Wildlife Management Areas in central Maine. The Sebasticook Woodlands Wildlife Management area was acquired with funds from the Land for Maine's Future program. It is 1,063 acres in size and is located in the town of Burnham between the Mount Road and the Horseback Road. The best access will be from the eastern side off of the Mount Road, where we are currently planning a small parking area to be located adjacent to the access road. That parking area should be completed by the fall of 2016. This property contains a variety of habitat types and will provide access for both consumptive and non-consumptive uses by

the public. A well-defined network of old log roads and twitch trails will help facilitate access. The property lines have been established and marked with signage. A larger WMA sign will be placed following the construction of the parking area.

The Carlton Stream Wildlife Management Area was acquired simultaneously with the Sebec Woodlands WMA. This wildlife management area is located in Detroit and encompasses the upland areas north of the Carlton Bog. This area was also purchased with funds from the Land for Maine's Future program. It is bounded on the east by Route 220 and on the west by the Tuttle Road. Access is best gained from Route 220, where a small parking area will be constructed off of the unimproved access road. This management area is 1,027 acres in size and contains a wide variety of habitat types and wetlands. An access road through the management area is currently unimproved, but will provide access for both consumptive and non-consumptive use.

Both of these acquisitions offer excellent upland bird hunting, deer hunting and trapping opportunities as well as other uses compatible with state owned wildlife management areas. Please obtain written permission before placing tree stands, game cameras or bear baits on any of these or other wildlife management area properties.

These new parcels, along with our existing holdings, require upkeep to optimize their wildlife habitat potential, which is our primary management objective. These improvements allow the public to have an easier and more enjoyable experience. Come enjoy some of the new properties in Region B.

-- G. Keel Kemper  
*Regional Wildlife Biologist*

### **Region C - Jonesboro**

From a wildlife management perspective, one of the varied and interesting aspects of the Region C work program is the fact that we are one of three Regions that include a section of Maine's coastline. This provides us with often unique opportunities to conduct assessments, surveys, and address management issues involving coastal environments and the wildlife species that inhabit them. While this may seem to extend beyond the "inland" designation of our agency, our management oversight includes nesting seabirds, which occupy upland habitats of a finite group of islands for breeding purposes, as well as both aquatic and upland mammals, whose home ranges overlap and include coastal environments.

As some examples, we have addressed issues involving raccoon, mink, otter, coyote, bear, moose, and deer on coastal islands that have either seasonal camps or year-round communities. Deer populations have become a management concern in certain coastal mainland settings and on some coastal islands, particularly in light of the advancement of deer ticks and the increasing incidence of Lyme disease. Recently, one coastal island community raised concerns about a reportedly high raccoon population and their potential influence on the closure of mudflats normally open to commercial harvesting of shellfish, now closed due to high coliform bacteria counts. On another offshore island a couple of years ago, two bears took up seasonal residence and ended up rototilling grassy areas that were being maintained as a "golf course" by the summer camp owners. The bears were most likely in search of insect grubs given the island's lack of traditional foods.



Bear Damage (Photo by Warden Dave Simmons)

In addition to the various management issues that arise on privately owned islands, Region C personnel are also responsible for the oversight of a notable number of coastal islands that the Department owns or has acquired management authority for. Statewide, this accounts for approximately 292 islands and ledges managed under the umbrella of the Coast of Maine Wildlife Management Area. Many of these islands support significant wildlife resources, including colonial nesting seabirds, nesting Bald Eagles, and numerous other wildlife. Other sites provide critical habitat features, which provide foraging and roosting habitats for staging, migratory, and over-wintering species of shorebirds and waterfowl. Region C Wildlife Biologists collaborate with the Department's Bird Group species specialists and other federal and conservation partners in conducting various population and habitat surveys to aid in managing these resources.

With a landscape as vast as the coast of Maine, the Department benefits greatly by collaborating with a broad group of conservation partners who have overlapping resource interests and responsibilities. As such, we reciprocate in cooperating with other initiatives to the extent possible, to help attain State-wide species goals and objectives. One

such example occurred recently when we provided assistance to the Maine Coastal Islands National Wildlife Refuge of the U.S. Fish & Wildlife Service in restoring nesting habitat on a small seabird nesting island in Blue Hill Bay. Suitable nesting habitat for Common Terns had been reduced to a narrow band of gravel near the high water line, and storm events had resulted in significant losses of tern chicks and nests in recent years, as well as degradation of remaining habitat. To set back succession and provide buffer to storm surges, we assisted in a two-day effort to create suitable nesting habitat buffered from the water's edge.



Common Tern Nesting Habitat Restoration (Photo by Biologist Sarah Spencer)

Responsibilities and experiences such as these serve to broaden and enhance the scope of wildlife management involvement in Region C.

-- Tom Schaeffer  
*Regional Wildlife Biologist*

## **Region D - Strong**

### Responding to Wildlife in a Fix

It is common for wildlife biologists and game wardens to respond to wildlife in a fix. If captured, they are examined and released, brought in for rehabilitation, or euthanized, if that is the appropriate humane choice. One of my biggest surprises since becoming a wildlife biologist is how common it is for wildlife to become stuck, or injured from the human equivalent of falling off a ladder.

It is not rare for unintended wildlife to get caught in a foothold trap set during the trapping season for furbearers. Because foothold traps are designed only to "hold a foot", non-target wildlife are easily released by the trapper, and in a majority of the cases are no worse for the experience. The first time I was asked to release a non-target, it was a great-horned owl in a coyote set. These owls have really big feet and talons. This bird had a minor scratch on one knuckle so I decided to bring it to my vet for his opinion. I must say it was kind of fun sitting in the waiting room, with a big owl in one of those cardboard pet carriers. The lady waiting beside me had a cat in a similar carrier and wanted to know what kind of cat I had. When I told her I had a great horned owl, she said she would be careful to keep her cat away from the bird. I said that would be a good idea because these birds would readily eat a cat. Upon examination, my vet said the owl was fine, needed no special treatment, and could be released.

Canada lynx numbers have been slowly, but steadily, increasing in northern and western Maine over the past 25 years. This is due to a change in forest practices that has benefitted lynx and their prey, snowshoe hare. With really long legs and oversized feet, lynx are adapted to live where the snow is deep, the winters long, and in a forest dominated by spruce and balsam fir. The northern half of Maine satisfies these habitat requirements. Maine, and a handful of other northern states, represents all the Lower 48 has to offer lynx, as we are at the extreme southern end of their range. Most lynx live and are thriving in Canada and Alaska.

Lynx are legally listed as 'Threatened' under the Endangered Species Act (ESA) in the United States. Even though their numbers have been increasing in Maine, they will never be as abundant as bobcat. As a result, Maine worked for several years to obtain the federal permit required for lynx to be accidentally caught, incidental to other trapping activity.

Years of winter lynx track surveys, plus a multi-year radio-telemetry study of lynx in northern Maine, were helpful in supporting the position that sustaining lynx, while retaining a trapping season for other species, is compatible. Central to this approach was the development of a formal protocol where regional wildlife biologists or a wildlife biologist from the Department's Mammal Group, would respond, handle, and assess the condition of every lynx incidentally caught in a foothold trap.

Wildlife biologists in the Mammal Group maintain a 24-hour hotline that trappers, game wardens, and regional wildlife biologists call if a lynx is caught. Our response is immediate. Every biologist follows the same protocol to collect important information relative to the location, capture site, trapper, and condition of the lynx. A game warden will go to the site and secure it from any unintentional human disturbance.

The nearest wildlife biologist responds, usually those assigned to that region. Handling of the lynx is usually done by a team of two regional wildlife biologists. If short-handed, a wildlife biologist from the Mammal Group will assist. The Mammal Group picks up a lot of the load outside the normal work days.

Our phone rang twice this November with a lynx report. In both cases, it was District Game Warden Patrick Egan, who was called by the trapper. Warden Egan called me, and I called Bob Cordes, the other Region D wildlife biologist. Bob was working an hour east of the headquarters, where our animal capture and care gear are kept. By protocol, I called the lynx biologist in Bangor. She offered to have a biologist from the Mammal Group come over to assist. We accepted, but, being headquartered in Bangor and three hours east of the capture site, Bob and I headed west immediately to meet Warden Egan. This was just a little more than an hour after receiving the call.

The capture location was in a very remote part of our region, about 25 miles northwest of Rangeley. Present upon our arrival were the Warden Egan and the trapper. His sets were for coyote. Through information provided to all licensed trappers, they know to access the 24-hour hotline in the event they inadvertently capture a lynx. As a group, trappers are doing a very good job coming directly to MDIFW. This fellow contacted the game warden immediately. We met up with them at a spot just out of sight of the animal.

So not to excite the cat, only Bob and I approached. Typical of lynx, it just crouched and kept turning his attention from me, to Bob, and back. A relaxed animal is key to safely delivering the drug used to put it under anesthesia. To that end, there is no talking, only hand signals. While Bob drew the cat's attention, I delivered the prescribed dosage (based on weight estimate) to the fleshy part of the hind leg. The needle and syringe containing the drug is specialized for use in an adjustable pole designed specifically for this function. It is not unlike receiving an injection from your doctor except we are doing so well beyond his reach.

As with all chemical immobilization of wildlife, we retreat beyond sight and hearing and give the drug combination 10 minutes to work. The cat was fully sedated when we returned. Bob removed the foot from the trap while Warden Egan checked the set for compliance with equipment-related rules in place to protect lynx. Meanwhile, I prepared the gear to begin a complete physical examination. Every regional wildlife biologist receives annual training from a veterinarian on how to conduct a physical nose-to-tail exam, as well as treating minor injuries. Key to this training are standards to apply in determining if an injury is significant enough to bring the animal in for treatment by a vet.

Once under the effects of anesthesia, all wildlife receive necessary care, and their vitals closely monitored. Maintenance of normal body temperature can be affected by the drugs, so keeping animals warm when it is cold, and cool when it is hot, is foremost in our care giving. We constantly monitor blood circulation, heart rate, respiration rate, and body temperature. In this case the animal was put on a dry foam sleeping pad and kept covered with a sleeping bag. Eyes and ears are also covered to reduce external stimulation. Teeth, eyes, claws, toes, bones, coat, and joints are all checked. Administration of antibiotics is automatic with any animal. They are hydrated using a glucose/water mix (Ringers lactate), applied as a precaution, and to provide an energy boost. This is applied continuously throughout the care, under the skin via IV needle/bag. Towards the end of sedation they receive a very small numbered tag in each ear. This causes no pain because one of the drugs in the combination is also an analgesic, meaning it takes care of any pain.

The exam takes about one hour. It is just under two hours from the time the cat goes under anesthesia until it is fully recovered. For the two lynx we handled, one had a very minor foot injury, treated on site prior to release. The other lynx had no signs of injury associated with capture. The latter is the case most of the time. Upon full recovery, both were released where captured, so they would remain in their respective territories. At our request, the trapper gladly removed all his traps from that area, so they could not be caught again.

-- Chuck Hulsey  
*Regional Wildlife Biologist*

## **Region E - Greenville**

Region E staff headquartered in Greenville collaborates closely with the Department's Research and Assessment Section in Bangor on a number of projects that have both local and statewide management implications. The moose survival study, which began in 2014, is a good example of such a project. The project began by designating one of the state's wildlife management districts (WMD) as an initial study area to intensively research. For a number of reasons, WMD 8 (west of Moosehead Lake) was selected, and geographically this WMD is convenient for Region E wildlife biologists to assist. This project relies on a dedicated team of biologists whose duties include, but are not limited to: assisting in the capture and collaring of adult cow moose and calves with GPS radio collars, investigating the deaths of these marked animals, and tracking breeding-age cows during spring and summer to document reproduction and survival of newborn calves during the first few months of life.



Wildlife Contractor Matt O'Neal Radio-collaring a Moose

This research project has allowed Region E staff to be fully immersed in many aspects of moose behavior, research and management, at a much finer scale than before. It has also allowed us to communicate with the public about some of our findings, and has often included their involvement with the project. In addition, we are able to travel into particular areas of our region that we may not have otherwise, to better understand the landscape and other wildlife issues that exist there. It has also allowed us to work closely with the Maine Warden Service on situations that have resulted in a win-win situation for both parties. Overall, it has widened our breadth of knowledge of moose and other wildlife and wildlife habitats within our jurisdiction.

-- Scott McLellan  
*Assistant Regional Wildlife Biologist*

## **Region F - Enfield**

Region F oversees management on seven wildlife management areas, but is also responsible for other parcels of land that may be in fee ownership or conservation easement. Examples of both can be found along the shores of Spednic Lake; a 17,000 (+) acre lake located along the border with New Brunswick and part of the larger (1,649 sq. miles) St. Croix River Watershed. The 110-mile waterway serves as a natural boundary between Canada and the United States. Spednic Lake is one of the largest lakes in Maine and is largely undeveloped, being surrounded by both commercial forestland and conservation lands. The river and its headwater lakes are one of only two international waterways in the country that have received international protection status, the other being the Boundary Waters Canoe Area between the State of Minnesota and the Province of Ontario.

Conservation efforts on both sides of the border over the last three decades have resulted in over 700,000 acres (2/3 of the watershed) included in some form of protection. Conservation partners have included the Province of New Brunswick, the State of Maine (MDIFW & MDACF), corporate and smaller private land owners, land trusts, NGOs, and municipalities. The Land for Maine's Future program has been prominent in many of the acquisitions. All of these conservation efforts have helped to maintain a healthy ecosystem within the St. Croix River Watershed.

The Department's conservation responsibilities along the western shoreline of Spednic Lake include a 500-foot shoreland corridor along 14.4 miles of conservation easement, and 15.8 miles of fee ownership, along with several islands. Also included in the overall conservation effort is the Department's 650 acre Booming Ground WMA located at the very northern end of Spednic Lake.

The Department and the DACF's Bureau of Parks and Lands work closely with both the Woodie Wheaton Land Trust and the St. Croix International Waterway Commission, addressing both management and recreational issues. The Department oversees management on Spednic Lake while the BPL oversees management on the St. Croix River. Both agencies' activities are largely guided by the Spednic Lake/St. Croix River Management Plan. The Department promotes traditional uses including hunting, trapping, fishing, canoeing, camping, and wildlife watching. The focus is to maintain a "back country, semi-wilderness experience".

-- Mark A. Caron  
*Regional Wildlife Biologist*

## **Region G - Ashland**

Acquired in 1989 by the State of Maine, Dickwood Wildlife Management Area (WMA) is a 3,860-acre management area situated in Northern Aroostook County in the northwest corner of the town of Eagle Lake. In the center of the parcel lies Dickwood Lake, a shallow lake at its maximum 8 feet deep and approximately 96 acres. The management area is split into 2 parcels, with a 500-acre bisecting parcel owned by the Town of Eagle Lake.

Dickwood WMA's long history of logging, most recently in the late 1970s – early 1980s, provided for the current system of roads and trails that provides outdoors men and women access to its plethora of wildlife for both viewing and hunting opportunity. Most of the management area was harvested in the late 1980s, leaving a large tract of early successional regenerating mixed hardwood/softwood or hardwood forest. This early successional forest was ideal for grouse, woodcock, moose, and bear. Now in a more mature state, management



An Aerial Shot of the Northern Half of Dickwood Lake (Photo by Biologist Amanda DeMusz)



will focus on creating a more diverse age structure and species composition. We will use techniques such as targeted selective harvest and hardwood management to achieve these goals. By diversifying the age structure, we will maintain critical early successional forest for grouse, woodcock, moose, and lynx. Another focus for management, is to increase softwood stand acreage, particularly in areas known for historically providing deer winter cover. While some lowland cedar and softwood stands do remain in the valley around the lake, much of this habitat had been intensively cut prior to state ownership.

Besides its upland habitat for wildlife, wetlands are another habitat important to the wildlife of the area. Along the stream bottoms, you will find areas of low lying cedar pockets and wooded swamps. Improvement of riparian buffers along streams and the lake will provide additional critical habitat for deer and many other species. Riparian areas are important travel corridors between areas for many species, providing needed cover and food resources often not present in areas farther from water bodies.

Keep your eyes peeled for the handy work of an iconic Maine furbearer, the beaver! Many of the wetland areas found on the management area occur along the brooks or streams and are generally the result of beaver activity.

If you are more into fishing, there is a foot path to the southeastern shore of the lake to a break in the trees where you can launch a canoe or kayak. The lake boasts a healthy population of Brook trout that seek the many cool spring areas to survive during the warm summer months.

Access to the management area is off the Devoe Brook Road in the Town of Eagle Lake. While most of it is fit for 2-wheel drive, there are occasional washout areas better suited for 4x4. Additionally, ATV and snow sled trails follow this road system, and there are additional side trails utilizing old logging roads. Local clubs maintain these routes and have the trails well marked. Another access point is off Gilmore Brook Road, where you can access the northeasterly boundary of the management area.

-- Amanda DeMusz  
*Regional Wildlife Biologist*

## **Lands Management Program**

### Tree Marking for Wildlife Management

The Maine Department of Inland Fisheries and Wildlife manages for all wildlife, both game and non-game species. One of the tools the Lands Program employs to create or enhance wildlife habitat is timber harvesting. Among other things, harvesting can be used to create young forest for the benefit of species such as grouse, woodcock, New England cottontail or certain songbird species, or it can be used to enhance cover and browse in a deer wintering area. Timber harvesting is not necessarily about the removal of trees but, more so, the retention of various elements for the benefit of certain species and their habitat. Habitat is the environment where an organism finds food and shelter. Tree marking plays a major role in indicating to equipment operators what to retain and what to remove.

Individual tree marking allows trained personnel the opportunity to evaluate tree species and condition, while looking for characteristics beneficial to wildlife species. In the picture to the right is an oak tree with a cavity, useful to a number of species. Many times, cavities can be in the crown or bole of trees and well above the visual range of equipment operators. While cavities certainly represent a significant weak spot, and will likely result in crown breakage in the future, retaining these trees for value as a nesting cavity is an important habitat consideration. Another feature MDIFW employees typically look to identify and preserve is nests. Many nests are reused year after year. For most species of raptor, disturbance to the site is to be avoided from early March to late July when the nest is active, and limited following July to allow the area to continue to be attractive for further activity. The nest tree pictured to the right was retained along with a certain amount of adjacent shelter.

Deer wintering area management frequently involves the removal of hardwood species, overtopping softwood for the development of cover. A dense softwood over story is the most critical factor regarding deer survival in the winter because snow will not accumulate as deeply as it will outside cover. The second most important factor in management is browse. In some stands, hardwoods overtop densely developing young softwood trees, like hemlock – an ideal species providing cover in a deer wintering area. Often times in conjunction with hemlock, oaks with well-developed crowns are found and should be retained to provide a source of hard mast (acorns) during the fall and early winter when deer (and



Raptor Nest (Photo by Leigh Hoar)

turkeys) could forage for them on the ground. Larger, better developed crowns typically translate to a greater acorn crop. Some oaks, along with other hardwood species like red maple, should be harvested, not only to release the hemlock they were overtopping, but also because they are trees that sprout from the stump, providing a source of food for deer once snow covers the ground.

The key to the Department's management approach is the ability of a trained individual on the ground to visually evaluate habitat in the upper two thirds of a tree, which an equipment operator cannot see, as well as the health and condition of the crowns and upper stems to determine either removal or retention. MDIFW favors a deliberate approach to wildlife management on Wildlife Management Areas for which it is responsible. While the effort can be rather time intensive, the wildlife benefit is certainly worth it.

-- Leigh "Eric" Hoar  
*Lands Management Biologist*

### **Joe Wiley, Staff Biologist Assigned to Department of Agriculture, Conservation and Forestry** Status Report on Canada Lynx ITP Management Area

In 2014, the Maine Department of Inland Fisheries and Wildlife (MDIFW) and The Maine Department of Agriculture, Conservation and Forestry, Bureau of Parks and Lands (BPL) executed a Memorandum of Agreement where 22,000 acres of BPL's Seboomook Unit would be managed for high quality hare habitat (HQHH) to maintain Canada Lynx populations. The management goal is to create 6,200 acres of HQHH by 2029.

HQHH is dense softwood-dominated regeneration with 12,000 stems per acre that is 15 to 30 feet in height and approximately 10 to 30 years old. Since 2014, agency staff have conducted field assessments to identify areas of both existing and potential HQHH. This information has guided planning efforts for timber harvests by BPL for the next 15 years. Most existing HQHH was created by extensive clearcuts to salvage softwood killed by the 1970s spruce budworm outbreak. Most potential HQHH consists of softwood stands with a sparse overstory and a dense understory, in need of release by removing the overtopping trees.

#### 2016 Harvest Areas within the Habitat Management Area (HMA)

There are two summer harvests within the Lynx HMA.

The first harvest is in the eastern portion of the lynx HMA area between the Seboomook Road and Seboomook Lake and began on 6/20/16. The harvest area is in primarily hardwood and mixedwood stands not identified as a candidate for primary future HQHH. There are some patch cuts being done in areas where there is potential to enhance current habitat to create future HQHH, but these areas are relatively small and not connected to other habitat. There is ample deciduous browse for snowshoe hare in these areas, but very little cover.

The second harvest within the Lynx HMA is in a poplar burn area where patches are being harvested to capture the mortality of mature aspen and to create Ruffed Grouse habitat. This is primarily hardwood, specifically mature poplar. This is adjacent to Carry Brook south of the Seboomook Road, where there are areas of current HQHH. This harvest could provide potential feed areas in summer for snowshoe hare as they move from cover to a deciduous food source. This harvest is scheduled to begin around August 15, 2016, and to be completed by mid-November.

The winter 2017 harvest planned is within the western portion of the first harvest referenced above and does have some targeted areas of future HQHH, but it is not primarily a HQHH harvest. That harvest is scheduled for December 2016 and should be complete by mid-February 2017.

-- Joe Wiley  
*Wildlife Biologist*

## FISHERIES MANAGEMENT SECTION

The State of Maine contains over 5,800 lakes and ponds one acre or more in size, totaling nearly one million acres, and about 36,000 miles of rivers and streams. In the early 1950s, the Legislature and Maine's Department of Inland Fisheries and Wildlife created the Fisheries and Hatcheries Division to manage this vast inland fishery resource, an asset that is now estimated to add over \$300 million annually to the state's economy. The Fisheries Division is responsible for protecting native fish species and their critical habitats, while providing a diversity of opportunities for Maine's angling community. A staff of 24 fishery biologists in the Fisheries Section works from seven Regional Headquarters, Bangor, and Augusta to achieve these objectives.

Progressive fisheries management emphasizes the protection of native, self-sustaining populations, along with carefully considered stocking programs to maximize fishing opportunities in all areas of the state. The Fisheries Section receives national acclaim for its efforts to protect native species, while making Maine a destination for serious anglers. Below are just a few examples of the work Maine's inland fisheries biologists are conducting in support of the state's incredibly rich and diverse freshwater resources.

## REGIONAL FISHERIES MANAGEMENT

### Survival and Movement of Fall-Stocked Brown Trout in the Lower Saco River

#### Study Design and Results

Seasonal mortality, habitat use, and potential contribution to a stocked brown trout (*Salmo trutta*) fishery were investigated in the lower Saco River. Advanced Telemetry Systems (ATS) transmitters (Model F1820) were surgically implanted into fifty-nine of the 500 fall yearling New Gloucester Strain brown trout stocked annually in the Skelton Dam tailrace (Figure 19). Study fish were monitored from October 2013 through August 2014 using a stationary and portable receiver. The 13.1 mile (21.1 km) long study reach was located between Skelton Dam and Cataract Dam hydroelectric projects; Cataract Dam is the lower most dam located at head of tide. A stationary receiver (ATS R4500SD) was installed a short distance upriver from Cataract Dam and remained operational from October 31, 2013 to March 20, 2014, except between November 1 and November 12, 2013 when a battery failure precluded data collection. A portable receiver was operated from a small skiff to survey the entire study reach on nine occasions between October of 2013 and August of 2014. Over this same period, 12 additional monitoring events were conducted with the portable receiver at selective walk-in access sites. Approximately two months post-stocking, transmission signals were detected from 64% of the study fish, by May of 2014, signals were detected from 25% of the study fish, and by August of 2014, signals were detected from 3% of the study fish (Figure 20). These detections reflect live fish that remained within the study area. Transmitters were equipped with mortality switches, which were permanently activated in 44% of the fish over the course of the study. Generally, the incidence of mortality occurred at relatively low levels during each month of monitoring, with the highest mortality (58% of all activated mortality switches) documented between March and May of 2014. In addition, transmission signals vanished for 51% of all the study fish, with the highest losses detected in March of 2014 (Figure 21). Only seven (12%) of the study fish migrated downriver from the Skelton tailrace stocking area, most of which departed immediately after stocking. None of the migrants returned to upriver locations until May of



Figure 19. A study brown trout caught by an angler below Skelton Dam in June, 2014.

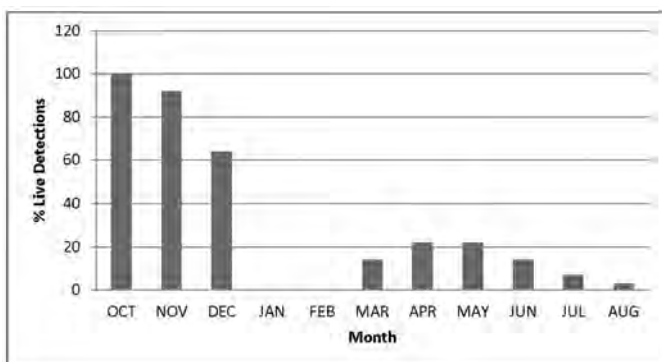


Figure 20. Percentage of study fish detected "alive" by month.

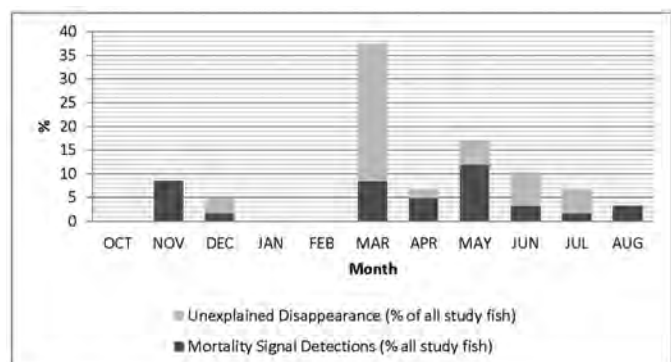


Figure 21. Documented loss (mortality and unexplained) from the fishery by month.

2014, when three of the seven migrants (43%) returned back to the Skelton tailrace. The remaining four (57%) migrants stayed in the lower river in the vicinity of Spring Island during the fall and winter period. Since the stationary receiver was neither operational between November 1 and November 12 of 2013, nor operational after March 20 of 2014, study findings regarding down river movement likely underestimated the extent of down-river movement. Movement upriver above Skelton Dam was generally prevented at the trap and sort fish lift, where all captured brown trout were returned to the downriver study area.

### Conclusions and Recommendations

The results of this investigation offered insight regarding post stocking seasonal movement and survival of fall-stocked hatchery brown trout on the lower Saco River, including their availability to recreational anglers, as well as potential for attainment of statewide performance expectations. Virtually all of the stocked brown trout appeared to utilize the Skelton Dam tailrace, where good public access for angling created a high probability that stocked trout were being well utilized by the angling public. There was also evidence that limited numbers of stocked brown trout survived the winter and summer, creating some limited potential for growth to larger size expected under the current statewide brown trout management plan. A much broader understanding of brown trout performance in the lower Saco could be realized from the following additional recommended assessments:

- Understanding age class structure and associated size quality would be useful in characterizing this fishery, and more definitively, assessing conformance with the statewide brown trout plan. While this investigation indicated some brown trout survival from October through mid-August, growth rates and overall condition of these fish were unknown.
- Understanding the cause of documented brown trout mortality would provide insight regarding factors that influence performance and provide a basis to assess efforts to improve survival and contribution to the fishery. Recovering mortalities equipped with transmitters would be difficult and would likely require use of scuba, as well as more frequent monitoring.
- Understanding the root cause for lost detection signals would also be useful since this loss accounted for over half the stocking. Aerial surveys would be useful in locating lost tags outside the study area, if removed by birds, or if the fish moved upstream or into tributaries flowing into the study reach. Also, the role of angling, as a factor accounting for lost detection signals, as well as limiting survival and future contribution to the fishery would be of particular interest. This concern could be examined by conducting an angler creel survey in the Skelton Dam tailrace. A clerk survey conducted to assess catch, harvest, and use would also provide information useful in characterizing the fishery, assessing compliance with statewide performance expectations, and assessing overall program success.

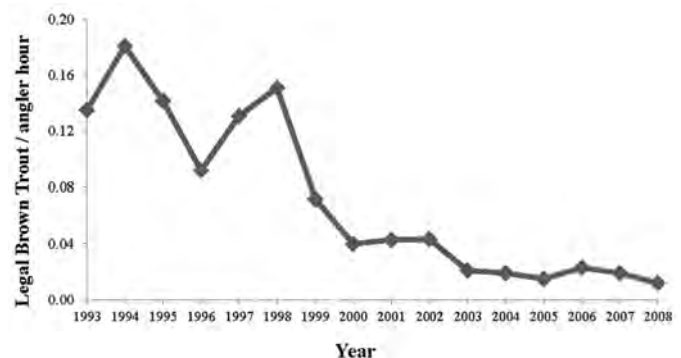
-- Francis C. Brautigam  
*Director, Division of Fisheries and Hatcheries*

### **Shawmut Telemetry Project: Investigations into a Once Renowned Brown Trout Fishery**

In 1983, an experimental brown trout (*Salmo trutta*) stocking program was initiated below the Shawmut Hydroelectric Project in Fairfield, ME on the Kennebec River. By the early 1990s, the experiment was a full-blown success, and the 'Shawmut' tailwater supported a nationally renowned brown trout fishery. Brown trout measuring 20—22" and 3—4 pounds were commonplace. However, the heyday was brief, and beginning in 1999, catch rates on legal (and even trophy) brown trout declined dramatically (Figure 22). By 2003, the fishery had essentially collapsed.

In response to a collapsed fishery that had once provided an important recreational opportunity and economic boom, MDIFW fisheries biologists began a 3-year radio telemetry project to investigate the potential reasons behind its demise. In 2013 and 2014, two strains (1,000 New Gloucester and 1,000 Sandwich River) of larger fall-yearling brown trout were stocked in the Shawmut Reach, and 54 (2013, n = 24; 2014, n = 30) of those fish were surgically implanted with body implant, trailing whip radio antennas with mortality switches. Tracking from shore and boats, the antennas allowed fisheries biologists to follow tagged brown trout for over a year, at large, in the ~7-mile reach. In addition, a stationary antenna was setup at the Hydro-Kennebec Project, to track those brown trout moving downstream and out of the Shawmut reach.

Movement data were similar between study years and revealed moderately high apparent survival during the first 4-weeks post-stocking. However, due to a combination of mortality, emigration, and other unidentified reasons, over-winter survival was low, as only 33.3% and 13.3% of



**Figure 22. Hourly catch rates, from volunteer angler books and creel surveys, of legal-sized brown trout caught in tailwaters of Shawmut Hydroelectric Dam, Kennebec River (1993-2008).**

brown trout remained at large after 24-weeks post-stocking in 2013 and 2014, respectively (Table 17). In addition, after 36-weeks, those percentages were reduced to 12.5% (n = 3 fish) and 6.7% (n = 2). After one year post-stocking, zero brown trout remained at large for both allocations of tagged brown trout. Although our study design did not provide details into the specific reasons for loss, the telemetry data strongly indicated that the environmental factors in the Shawmut reach, whether physical (e.g. temperature, flow) and/or biotic (e.g. competition, predation), were no longer suitable for either strain of stocked brown trout.

**Table 17. The number of stocked brown trout remaining at large in the Shawmut reach post-stocking, 2013-14 and 2014-15.**

YEAR	INITIAL # OF FISH	# OF TAGGED BROWN TROUT REMAINING POST-STOCKING									
		1-WEEK	2-WKS	3-WKS	4-WKS	5-WKS	6-WKS	24-WKS	30-WKS	36-WKS	52-WKS
2013-14	24	24	23	23	22	14	8	8	4	3	0
2014-15	30	21	21	20	19	18	16	4	4	2	0

Historically, the Shawmut fishery was established by stocking smaller, spring-yearling brown trout. However, in order to satisfy the recommended body mass to tag size ratio, larger fall-yearlings were employed for this study. And, although the telemetry data strongly supported a collapsed brown trout fishery, recent angling reports and brown trout collection efforts greatly contradict these findings. Over the past two years, the Shawmut brown trout fishery has rebounded considerably, and many larger, older-aged brown trout are now relatively common in Shawmut creels (Figure 23). Although fisheries biologists are unable to pinpoint the reason for its apparent resurgence, it appears that in stocking larger fish, brown trout are better able to compete with an increasingly diverse Shawmut fish community.



**Figure 23. Recently caught Shawmut brown trout.**

-- Jason Seiders, Wes Ashe, and Scott Davis  
Regional and Assistant Regional Fisheries Biologists, Region B

-- Tom Barrows  
Fisheries Contractor

### Estimating Smelt Drift through Brassua Dam into the Moose River

Rainbow smelt (*Osmerus mordax*) are the most important forage item for landlocked salmon (*Salmo salar Sebago*) and lake trout (*Salvelinus namaycush*), two of the most important coldwater gamefish in Maine. Smelt populations are notorious for natural fluctuations that can cause serious growth problems for these gamefish species, which typically inhabit the larger, more popular lakes in Maine. As fisheries managers, we have struggled to develop methods to predict and evaluate smelt abundance and the causes for sudden declines in abundance. On Moosehead Lake, Maine's largest lake, there are several studies underway to address some of these issues.

In most lakes in Maine, the smelt population is produced entirely within that lake. However, we have a unique situation on Moosehead Lake. Brassua Dam sits 3 miles upstream of Moosehead Lake on the Moose River. This 30-foot dam on the outlet of the 9,000 acre impoundment is a hydro-generating facility with the intake near the base of the dam. Rainbow smelt are present in Brassua Lake and are often found in the discharge, creating considerable smelt drift into the river and down to Moosehead Lake at certain times of the year.

We operated drift nets (Figure 24) for an entire year to capture a subsample of the discharge from Brassua Dam to estimate the total number and biomass of smelt passing downstream to Moosehead Lake. A series of six metal stakes were placed on each side of the river. Two 4'x4'x6' drift nets were attached to stakes. Stake selection was based on the flow. The nets were set for a 24-hour period on 1 day per week throughout the year, except when flows were too high to work in safely, and on two occasions when we operated the nets for an entire week to examine the range of catch.



**Figure 24. Deployed smelt drift nets below Brassua Lake Dam.**

Catch was moderately related to discharge from the dam (Figure 25). We saw a peak in May, likely associated with post-spawning movement and an increase in flow. There was another peak in January that was likely associated with an increase in flow. Overall, we estimated 355,397 smelt passed downstream into the Moose River from Brassua Lake. This would not include smelt that were too small to be seen or caught in our 3/8" mesh drift nets. It appears that young-of-the-year smelt became vulnerable to netting in mid-July.

It was interesting to follow the length frequency of smelt captured during the sampling. Most notable, smelt in the 50mm range were present throughout the year, suggesting a wide range in growth rates for young-of-the-year smelt or perhaps some delayed spawning.

This work will continue for at least another year as we try to determine the potential range of smelt drift into Moosehead Lake.

-- Tim Obrey

Regional Fisheries Biologist, Region E

Comparison of Estimated Weekly Smelt Drift vs Discharge at Brassua Dam

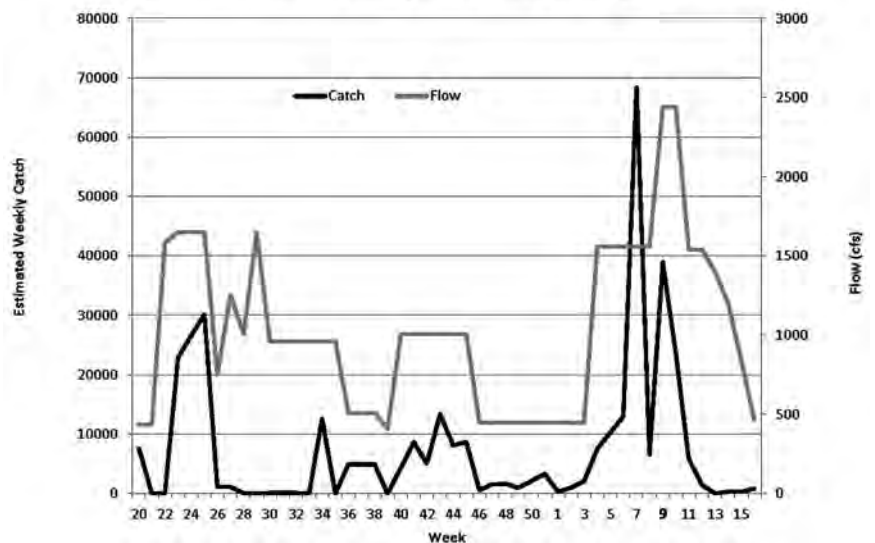


Figure 25. Catch of smelt and discharge by week. Week 20 correlates to mid-May.

### Investigations into interactions between Rainbow Smelt (*Osmerus mordax*) and Lake Whitefish (*Coregonus clupeaformis*)

Lake whitefish (*Coregonus clupeaformis*) have provided a small but popular fishery for Maine anglers for decades, but the species has experienced a significant decline in range and numbers over the past 40 years. Lake whitefish is a species of Special Concern in Maine and is listed as a Priority 2 Species of Greatest Conservation Need (SGCN) in Maine's Wildlife Action Plan (2015). Gaining a better understanding of the causes of this decline is essential to protect, restore, and enhance whitefish populations and the fishery they support.

Northern Maine lakes where whitefish populations are failing, or have become extirpated, share a common theme. Almost all have experienced introductions of rainbow smelt (*Osmerus mordax*). Though smelt provide a food source for large adult whitefish, their establishment has coincided with a lack of recruitment of juvenile whitefish, in many cases, causing the species to slowly disappear.

MDIFW Fisheries Biologists have begun to explore the mechanisms through which smelt are impacting whitefish recruitment in several headwater lakes in the Allagash River drainage of northern Maine. Past research has shown that smelt impact whitefish via two means: predation and competition. Adult smelt feed on young whitefish fry, and young smelt and young whitefish compete directly for similar food resources. A third, less explored factor is the changes smelt can make to the overall aquatic food web of a water body, and how that may impact other species.

We began a research project in 2015 to better understand the early life history of lake whitefish and make comparisons between lakes with and without smelt. We used surface trawls to collect larval whitefish and their primary food source – zooplankton (Figure 26). Early results are showing drastic differences in the abundance of larval lake whitefish and zooplankton among these lakes.

Larval whitefish rely on copepods – a type of zooplankton – to survive during the first few weeks of their life. We found extremely high copepod densities in waters without smelt, but in waters with high smelt numbers, copepods were almost nonexistent. Without these zooplankton available, most post-hatched larval whitefish quickly starve.

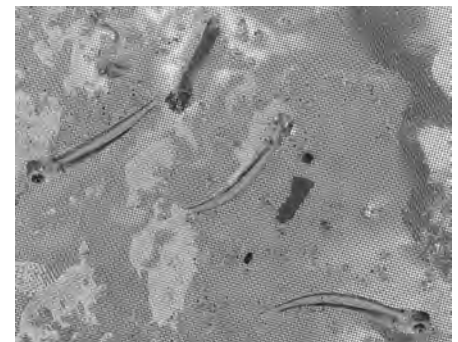


Figure 26. Larval lake whitefish collected in a surface trawl. (Photo by Jeremiah Wood)

Though rainbow smelt have provided huge benefits to the sport fisheries of many Maine lakes, it appears that they can impact lake food webs to a great extent. Abundant smelt populations have likely caused a crash in zooplankton populations in some waters, making it difficult for whitefish to successfully complete their life cycle and sustain healthy populations.

Continued research should provide a better understanding of smelt and whitefish population dynamics and help us craft management strategies to preserve and enhance lake whitefish in Maine for years to come.

-- Jeremiah Wood  
*Assistant Regional Fisheries Biologist, Region G*

**Fish Production Report, 2015**

The Hatchery Section stocked 1,211,141 fish weighing a total of 386,693 pounds during 2015 (Table 18). This represents the third highest yearly total pounds of fish ever produced for our statewide stocking program, only less than 2013 and 2014 levels. Fish were stocked from our eight state fish hatcheries and rearing stations: Wade Hatchery in Casco, Dry Mills Hatchery in Gray, Ela Rearing Station in Embden, Cobb Hatchery in Enfield, Governor Hill Hatchery in Augusta, Grand Lake Stream Hatchery, New Gloucester Hatchery, and Palermo Rearing Station. Supplemental fish were again provided from the Dead River Hatchery, where fry were transferred for further grow-out into this satellite facility, for a return of 11,700 fish weighing 4,996 lbs.

**Table 18. Stocking by Species, 2015.**

Species	# of Fish	Lbs
Brook Trout	911,037	259,833
Brown Trout	126,392	69,822
Landlocked Salmon	100,038	24,958
Splake	35,144	17,760
Rainbow Trout	19,680	12,113
Lake Trout	18,850	2,207

-- Todd Langevin  
*Superintendent of Hatcheries*

**IN MEMORIAM: DAVE BOUCHER, 1959 - 2016**



Dave Boucher with the Maine Department of Inland Fisheries & Wildlife watched over the Rapid River trout fishery. (Photo by Jim Collins)

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<http://northernwoodlands.org/articles/article/troubles-waters-preserving-a-world-class-trout-fishery-in-maine#.V44sUrn> [GqU.facebook](https://www.facebook.com/GqU).

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## **Main Office: #41 State House Station, Augusta, Maine 04333-0041**

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Check out our home page on the Internet at <http://www.maine.gov/ifw>.

### **Regional Headquarters (Game Wardens and Biologists)**

Ashland -- 435-3231

Bangor -- 941-4440

Gray -- 657-2345

Greenville -- 695-3756

Sidney -- 547-5300

### **Additional Regional Offices (Biologists)**

Enfield -- 732-4132

Jonesboro -- 434-5927

Strong -- 778-3324

### **Research and Assessment Section, Species Specialist Office**

Bangor -- 941-4466

If you cannot locate a Warden at the above numbers,  
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### **State Police Toll-free Numbers**

Augusta 1-800-452-4664 / Houlton 1-800-924-2261

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