

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

Research & Management Report

2012

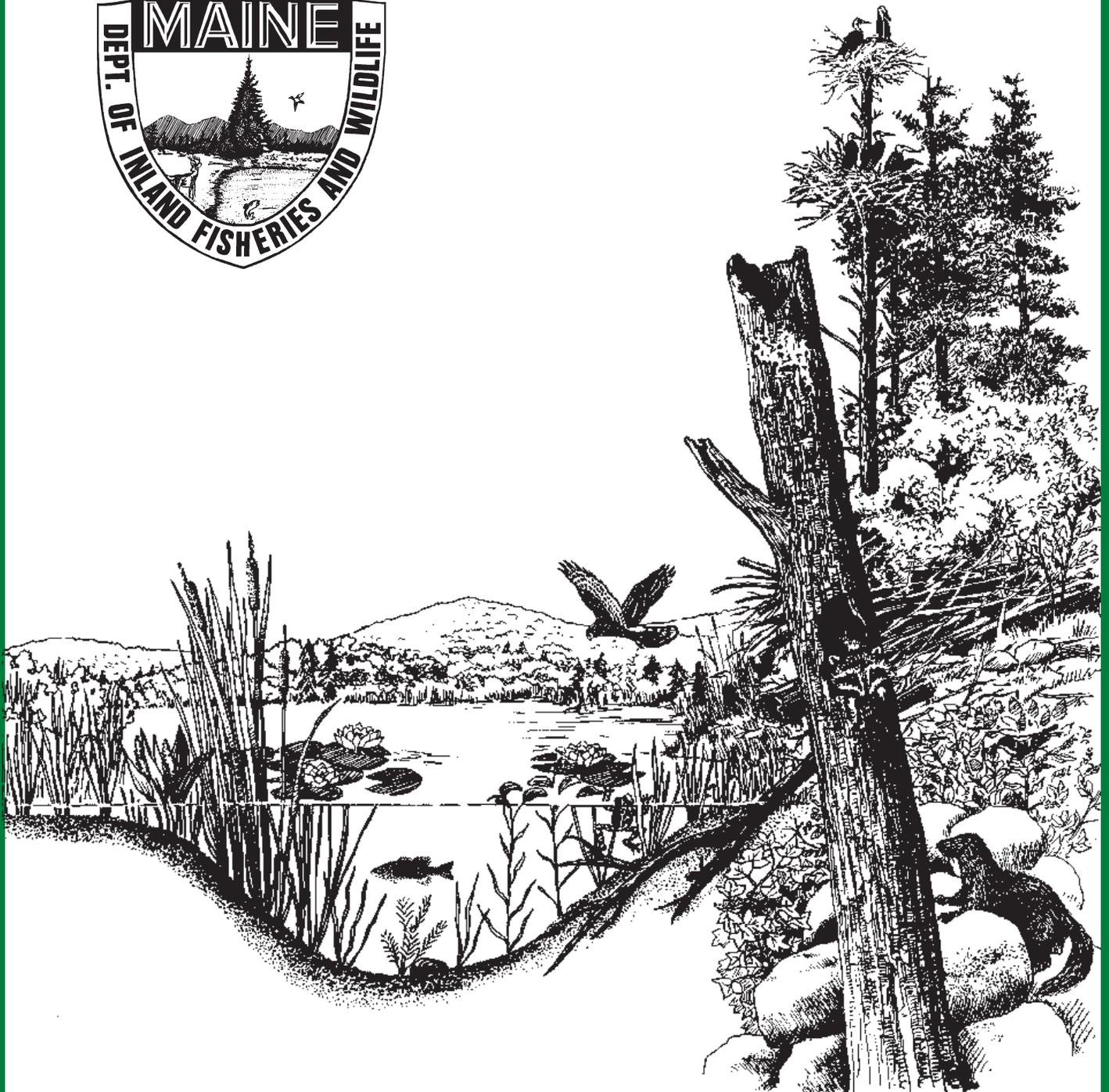


TABLE OF CONTENTS

FUNDING WILDLIFE AND HABITAT STEWARDSHIP	3
REGIONAL WILDLIFE MANAGEMENT	4
A MAINE WILDLIFE BIOLOGIST’S DEER SEASON	4
THE WILDLIFE DIVISION’S WINTER DEER WORK	5
MORE ON WSI DATA AND REGIONAL WINTERTIME ACTIVITIES FOR DEER.....	7
REGIONAL FISHERIES MANAGEMENT	8
MOOSEHEAD LAKE WEIR PROJECT	8
RESTORATION OF ARCTIC CHARR AND EASTERN BROOK TROUT AT BIG REED POND, MAINE	9
FIRST IMPRESSIONS.....	10
MAINE’S LANDOWNER INCENTIVE PROGRAM COMES TO A CLOSE	12
THE RESEARCH AND ASSESSMENT SECTION: AN IFW SOURCE FOR SCIENTIFIC INFORMATION	13
HABITAT CONSERVATION AND MANAGEMENT	14
Habitat Mapping	14
Pre-application Screening and Environmental Review.....	15
Oiled Wildlife Response	16
BIRD CONSERVATION AND MANAGEMENT.....	17
Effects of Waterfowl Impoundments on Rail Habitat and Productivity.....	17
S.H.A.R.P. - The Saltmarsh Habitat and Avian Research Project.....	18
Game Birds.....	19
Raptors: Recent Population Highlights.....	21
Piping Plovers Continue to Struggle on Southern Maine Beaches	22
Purple Sandpipers.....	23
Newly Described Virus Kills Thousands of Common Eiders Wintering Off Cape Cod	24
MAMMAL CONSERVATION AND MANAGEMENT	25
White-tailed Deer.....	25
Moose.....	31
Black Bear	34
Canada Lynx	37
Furbearers and Small Game Mammals.....	38
White-Nose Syndrome in Bats	39
New England Cottontail.....	39
REPTILE, AMPHIBIAN, AND INVERTEBRATE CONSERVATION AND MANAGEMENT.....	41
Amphibians and Reptiles.....	41
Invertebrates.....	44
Special Habitats for Reptiles, Amphibians, and Invertebrates.....	48
FISH CONSERVATION AND MANAGEMENT	50
A Large-scale Assessment of Wild Brook Trout Populations and Habitat in Maine	50
Ranking Subwatersheds for Habitat Protection and Restoration	51
A Preliminary Model for Prioritizing Sites for Habitat Restoration or Management Actions	52



These studies are financed in part through Federal Aid in Wildlife Restoration Funds under Projects 81D, 82R, and 83C, and through the Endangered Species Conservation Act.

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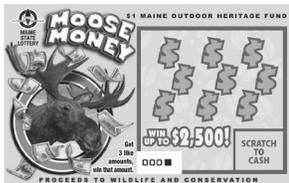
FUNDING WILDLIFE AND HABITAT STEWARDSHIP

Many staff salaries and most of the administrative costs of the Wildlife Division's management programs for game animals and furbearers are funded by federal Pittman-Robertson Funds [FY12 \$3,272,274]. Pittman-Robertson (PR) Funds are derived from an 11% excise tax on sporting arms, ammunition, and archery equipment, and a 10% excise tax on handguns. Pittman-Robertson Funds require state matching dollars, which come from a portion of the hunting license revenues.



The Wildlife Division also receives federal funding for endangered species and nongame wildlife management in the form of State Wildlife Grants [SWG; FY12 \$491,152], originating from royalty payments paid by petroleum industry operating on federal lands, and the so-called "Section 6" funds [FY12 \$75,000] from the U.S. Fish and Wildlife Service for the recovery of threatened and endangered species or to help recover a species before it becomes 'listed' under the Endangered Species Act.

Contributions to the Nongame and Endangered Wildlife Fund ("Chickadee Check-off"), and purchases of Conservation License (Loon) Plates provide the core "State" funding for Maine's nongame and endangered species programs [FY12 \$311,459]. All donated money is deposited into the dedicated Maine Endangered and Nongame Wildlife Fund - a special, interest-bearing account from which money can only be spent for the conservation of Maine's nongame wildlife that includes rare, threatened, or endangered species (Table 1). These funds are used to match and spend the federal SWG funds just as revenues from hunting licenses and tags are used to match and leverage PR fund \$s for the conservation and management of wildlife.

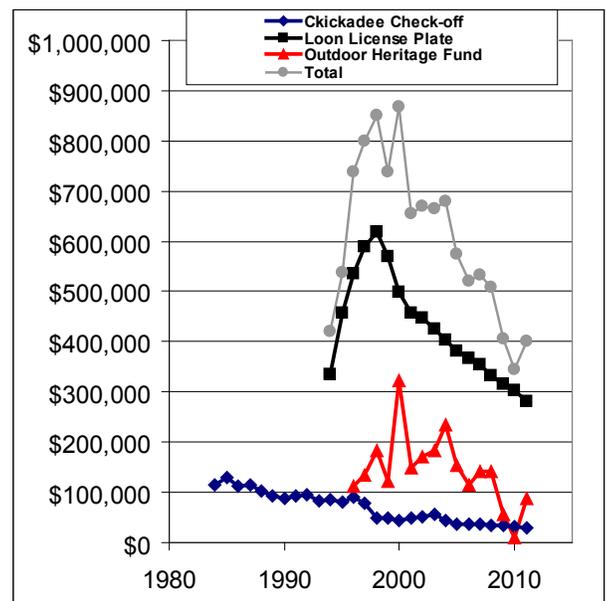


The Maine Outdoor Heritage Fund, derived from the sale of conservation instant-scratch lottery tickets, can also provide an important source of "State" funding for Maine's wildlife conservation programs, largely for nongame and endangered species. The Division also receives funding from the Oil Spill Conveyance Fund [FY12 \$112,806], which is used for oil spill preparedness and response.

Throughout the pages of the *2012 Research & Management Report* is a summary of last year's accomplishments with much help from our conservation partners. You will see how efficiently we can assess fish and wildlife resources and habitats using cooperative partnerships, volunteer assistance, and new technologies. There is always need to do more.

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

Year	Chickadee Check-off				Loon License Plate		Maine Outdoor Heritage Fund	
	Total Given	Number of Givers	Average Donation	% of Taxpayers Giving	Income to MDIFW	Number of Registrations	Income to MDIFW	Number of Projects Funded
1984	\$115,794	25,322	\$4.57	5.3%				
1985	\$129,122	29,200	\$4.42	6.0%				
1986	\$112,319	26,904	\$4.17	5.4%				
1987	\$114,353	26,554	\$4.31	5.2%				
1988	\$103,682	24,972	\$4.15	4.8%				
1989	\$93,803	20,322	\$4.62	3.6%				
1990	\$88,078	18,332	\$4.80	3.2%				
1991	\$92,632	19,247	\$4.81	3.4%				
1992	\$95,533	18,423	\$5.18	3.2%				
1993	\$82,842	15,943	\$5.20	2.8%				
1994	\$84,676	10,863	\$7.79	2.0%	\$335,042	59,829		
1995	\$81,775	10,014	\$8.17	1.8%	\$457,307	81,662		
1996	\$90,939	11,024	\$8.25	2.0%	\$535,679	95,657	\$112,232	3
1997	\$77,511	8,686	\$8.92	1.5%	\$588,364	105,065	\$133,971	5
1998	\$48,189	4,065	\$11.85	0.7%	\$617,484	110,265	\$184,109	7
1999	\$47,908	3,775	\$12.69	0.7%	\$569,610	101,716	\$121,436	5
2000	\$44,496	3,297	\$13.50	0.6%	\$499,486	89,194	\$323,884	11
2001	\$49,348	3,713	\$13.29	0.6%	\$458,057	81,796	\$148,408	5
2002	\$50,412	3,661	\$13.77	0.6%	\$446,342	79,704	\$172,191	8
2003	\$55,348	3,792	\$14.60	0.6%	\$425,147	75,919	\$184,129	5
2004	\$43,158	3,234	\$13.35	0.6%	\$402,695	69,615	\$234,126	10
2005	\$36,769	2,931	\$12.54	0.5%	\$381,948	67,814	\$154,656	7
2006	\$36,865	2,924	\$12.60	0.5%	\$367,791	65,677	\$116,121	6
2007	\$37,209	2,852	\$13.04	0.5%	\$355,180	63,425	\$141,526	6
2008	\$34,929	2,757	\$12.67	0.4%	\$333,536	59,560	\$141,059	7
2009	\$33,751	2,688	\$12.56	0.4%	\$316,148	56,455	\$56,128	3
2010	\$31,466	2,423	\$12.99	0.4%	\$303,121	54,237	\$10,906	2
2011	\$29,454	2,357	\$12.50	0.4%	\$282,005	50,358	\$88,398	8



WILDLIFE MANAGEMENT SECTION

The regional wildlife management staff of biologists is best described as the Wildlife Division's wildlife generalists or the "jack of all trades". The seventeen wildlife biologists who staff the Department's seven regional field offices constitute the majority of the Regional Wildlife Management Section (WMS). Their breadth of knowledge, activities, and job responsibilities range far and wide - often requiring the regional staff to juggle numerous public requests, inquiries, and wildlife management projects at the same time. In essence, the regional wildlife biologist represents the Department in a multitude of public participation arenas and serves as the "state's wildlife expert" within their assigned regional geographic area. They are responsible for implementing the Wildlife Division's management program within those regions.

The Wildlife Management Section administers a complex work program, which can vary seasonally. Much of our work program is driven by the timing of hunting and trapping seasons, seasonal shifts in wildlife behavior, and collection of biological data. Many of the species we manage or track require some degree of data collection and analysis. The type and quantity of data of course varies based on that species' management system. These data are then provided annually to our species specialist for analysis. That year's data along with previous years' are then used to guide management decisions. What follows is an example of the effort required to manage one of our more involved species. A little food for thought the next time you're daydreaming in a deer stand or watching two fawns playing under the apple tree.

--John Pratte

Wildlife Management Section Supervisor

REGIONAL WILDLIFE MANAGEMENT

A Maine Wildlife Biologist's Deer Season

Like many hunters who prepare for an upcoming season with scouting, gaining landowner permission, testing equipment and so on, the Department's Regional wildlife biologists have to prepare for the deer season also. We begin by making sure we have adequate sampling supplies and confirming our cooperative efforts with meat cutters and taxidermists across the state that handle deer, and regionally, can provide up to 75% of the deer we check.

Our objective is to physically see 15% of the deer harvested to accurately determine the breakdown of the harvest by sex and age. For any yearling bucks we encounter, we also measure the antler beam diameter as an indicator for carrying capacity of the habitat, and when the opportunity arises we collect weights.

Then throughout the winter months we measure winter severity at stations across the state. This information represents the impact of winter conditions on deer survival. Combing the biological data with these winter severity data and running them through a complex analysis we can determine total annual deer mortality and estimate population numbers. This information will be used by regional wildlife biologists in making regulatory proposals for the upcoming deer hunting season.

Since 2002 we have also been sampling about 800 hunter-harvested deer statewide for the presence of Chronic Wasting Disease (CWD). This is a fatal disease of the nervous system of members of the deer family. In recent years, CWD has been detected in New York and West Virginia. Our monitoring efforts to date have shown no evidence that CWD is present in any wild white-tailed deer or moose in Maine, or any captive farm deer (red, sika, fallow) or elk in Maine.

CWD data collection can be challenging, sometimes collecting our final sample after the close of firearms season. Since the sampling effort has remained fairly constant, the longer time required to get those samples is probably a reflection of the lower expected harvest and hunter effort. Several non-resident hunters I spent time with while collecting CWD samples from their deer noted far fewer hunters than years past.

In towns without meat cutters, we visit a Game Registration Station and look for deer recently registered. That part is easy. The increasingly difficult part of the process is contacting the hunter. Though a hunter must provide their address as part of the registration process, finding that person listed in a phone book is a challenge. I'd say we are successful in contacting about one in five hunters who register a deer. The good news is that nearly every hunter lets us collect samples from their deer if we contact them in time.

Through December we still have deer data to sort and organize before "our" deer season concludes. All the regional wildlife biologists, as well as our deer/moose biologist, invest a great deal of time and effort towards deer season. Over

a six week period we drive a lot of miles and work with a lot of people in order to collect important biological data and samples concerning Maine's deer population. This team effort with biologists, hunters, meat cutters and landowners ensures we have the best data available to manage a healthy deer population that's balanced with habitat conditions and publicly derived population goals.

--Chuck Hulsey
Strong Headquarters, Regional Wildlife Biologist

The Wildlife Division's Winter Deer Work

A question was recently posed to me from a member of the public. "What do wildlife biologists do for deer in the winter?" It's a reasonable question given the concern over the deer population in the last several years. The following is a summary of some of typical duties conducted by wildlife biologists over the winter months that help MDIFW to manage deer:

Winter Severity Index

This is a measure of how severe the current winter is on our deer population. Each week, biologists check several stations within their respective regions; there is usually one station within each of the 29 Wildlife Management Districts (WMDs). Biologists collect average snow depth and average deer sinking depths in both open and good softwood cover areas. There is also a temperature probe that records the temperature throughout the entire season. Biologists analyze and use these data to help determine deer losses due to winter conditions. These and other data are important information in determining Any-Deer Permit levels for the upcoming hunting season.

Ground and Aerial Deeryard Surveys

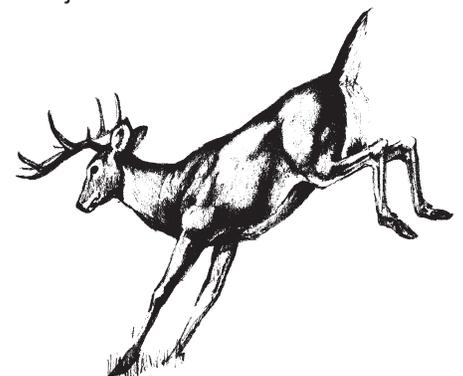
After about 12 inches of snow have accumulated in open areas, deer start using areas that have good conifer cover (cedar, fir, spruce, and hemlock species). This cover needs to be dense enough to provide at least 50% crown closure. Areas that provide upwards of 70% crown closure are considered to be the best. The Department has the majority of these areas mapped, but new areas are surveyed when they are identified. It is extremely important that these Deer Wintering Areas are identified, monitored, and managed to provide the deer with adequate winter shelter during moderate to severe winter conditions.

Ground surveys are usually conducted on snowshoes; biologists survey along transects through the DWA recording deer tracks, trails, pellet groups, beds, and evidence of browsing. Aerial surveys are usually conducted from a fixed wing aircraft and cover multiple DWAs over several towns. Biologists, in this case, are looking for established trails, tracks, and deer themselves. Areas that contain good conifer cover are also recorded.

Starting in early January, wildlife biologists in northern Maine begin planning for aerial deer wintering area (DWA) surveys. Regional Biologists were ready to initiate flying DWA surveys by mid-January, but the lack of major snowstorms and deep snow in early 2012 resulted in unrestricted travel conditions for deer. Subsequently, deer were not restricted to deeryards but remained spread out over large areas until early February when snow depths started restricting their travel. This resulted in a late start for initiating aerial DWA surveys, but also meant deer were dealing with only mild-moderate winter conditions for most of December and January.

The purpose or objective for flying deeryard surveys is multi-fold: (1) To know the location of major deer wintering areas and the approximate number of deer wintering in each deeryard; (2) To obtain information on the physical condition of deer in a deeryard and how well deer are faring during a particular winter; (3) To note any major issues or concerns with predation by coyotes; (4) To obtain the boundaries of deer wintering areas, including the core shelter area as well as the peripheral secondary shelter and feeding areas; (5) To obtain up-to-date deeryard information for cooperative DWA management programs. Wildlife biologists and forestland managers use this information to adequately plan for long-term forest management programs that will both benefit deer and meet forest management objectives.

The procedure used for aerial DWA surveys will vary by Wildlife Region. This is partly due to the variability in deer wintering behavior in different parts or regions of the state. For example, in northern Maine, deer generally winter in the lowland softwood forests that often occur along rivers and streams, however, further south in central Maine deer may also winter in large tracts of softwood forest, but not necessarily associated with a riparian corridor. Because of the more random nature of deeryards in the more southern regions of Maine, aerial survey procedures may require flying a grid pattern, covering more forest terrain and using GPS technology to setup a grid of flight lines at $\frac{1}{4}$ or $\frac{1}{2}$ mile intervals. This type of aerial survey results in a survey covering a large variety of terrain or topography and many different forest stand types.



In northern Maine (Wildlife Region G), aerial DWA surveys focus primarily on following riparian or stream corridors. However, particularly in the organized townships, we will also fly over large blocks of softwood stands located outside the riparian corridors. In both the organized and unorganized townships, we will always check active timber harvest operations, as they provide deer with large amounts of winter food and attract deer out of the surrounding deer wintering areas. GPS technology is often used to pinpoint our location when flying over unfamiliar terrain. Most of Wildlife Region G flying will be in the unorganized townships with the objective of providing the large forest landowners with updated deeryard information. Generally, we will be using Warden Service aircraft, relying heavily on the knowledge provided by Warden Service pilots. A major benefit of using local Warden Service pilots is their extensive knowledge of the terrain within the unorganized territories.

All of the large deeryards in northern Maine are well known by the Regional Wildlife Biologists. They have been identified, mapped, and zoned, or in some cases, managed through cooperative landowner agreements. Our deeryard records in Wildlife Region G (northern Maine) go back as far as the early 1950s and we have periodically updated these records through both aerial and ground surveys. One must keep in mind that a single flight over a deeryard in any given winter is only a snapshot of deer use for that particular winter, and additional aerial and ground surveys over many years are necessary to provide accurate information for both deeryard protection and management programs. These aerial winter deeryard surveys are just one of several deer management projects that will be undertaken by Regional Wildlife Biologists this winter, however, identifying and maintaining these critical wildlife habitats is crucial to maintaining deer populations in northern Maine.

Cooperative Agreements

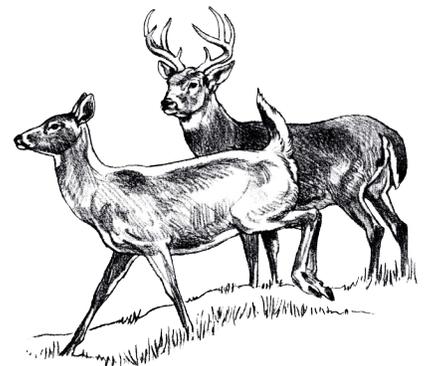
Once the areas where deer are wintering are identified, the next step is to work with the landowners to properly manage them. Most of these DWAs are on private land, so getting the landowners to cooperate is essential for proper deer yard management. Biologists review proposed harvest prescriptions, conduct site visits with foresters, and provide recommendations to ensure adequate cover remains for wintering deer after the timber harvest. We strive to make sure that at least 50% of the area remains in good winter shelter, major trails are buffered, and there is a minimum of road construction that could possibly fragment the area making it difficult for deer to move in deep snow conditions. We also look at the area at the landscape level and try to retain travel corridors so deer can move between areas of good cover that are nearby. Biologists are also looking at the regeneration of conifers that will provide future deer winter shelter. Some conifers, especially balsam fir, tend to start dying and falling out of the stand, which reduces the amount of winter cover. Proper timing of the harvest and protection of conifer regeneration are important factors in providing winter shelter for the deer now and in the future.

Wildlife Management Areas

The Department is responsible for managing about 100,000 acres of public land in Maine. Management area plans are developed for each of these areas. Any areas that have historic or current deer use in winter are managed to provide optimum winter shelter for deer. Any timber harvesting is designed to maintain and increase deer winter shelter.

Aerial Deer Population Surveys

This is a new survey that Department biologists are conducting to estimate deer abundance as we work toward re-calibrating the deer population model. There are two biologist observers that count deer independently from each other, another biologist that records the data and communicates with each observer, and a pilot. The Maine Forest Service is providing their Jet Ranger helicopter and pilots for this survey effort. The pilot flies along a 25-mile transect at 200 feet above the ground at about 40 miles/hour. The observers count any deer seen within a 200 foot area on the ground (we calibrated the viewing area prior to the survey; basically we placed tape on the helicopter window and any deer observed between the tape and the skid of the aircraft is counted). We fly 7 transects during the survey (175 miles) in a WMD; in some WMDs there are more than one survey depending on the size of the district. The reason for this type of survey is to have another input in our population estimate and to validate or invalidate the population models that we are currently using.



Other Activities

Some other activities related to deer that we are involved with include: deer/vehicle collision sites and warning signs, assisting with reduction of coyote predation on wintering deer and any nuisance deer issues that may arise (usually orchard owners or damage to ornamental shrubs, etc.). As you can see, wildlife division personnel are quite engaged with deer management activities throughout the winter months.

More on WSI Data and Regional Wintertime Activities for Deer

The change in seasons from fall to winter also means a change in wildlife management projects at many Regional Wildlife Offices, as biologists prepare for a variety of winter projects. As expected, most of the fall work programs are focused around the various hunting seasons and the collection of biological data on many wildlife species including moose, bear, deer, and migratory waterfowl. In December, all of this biological information will be compiled for further assessment by the respective species project leaders. At the Regional Offices, this is a transitional period of compiling fall biological data and preparing for the upcoming winter wildlife projects. In northern Maine this means preparing for aerial deer wintering area (DWA) surveys, winter ground surveys, setting up “deer snowstations” to assess the upcoming winter severity on deer, putting up deer crossing signs, overseeing the coyote management/control project, and working with landowners on timber harvest plans for deer wintering areas. Many other wildlife projects will continue throughout the year but, particularly in northern Maine where winter is a critical time for deer, emphasis is placed on deer management.

Some of these winter wildlife projects have been ongoing for many years, for example, in the Ashland Office, we have records of aerial and ground surveys of deeryards that date back to the early 1950s. The project for assessment of deer winter severity index (WSI) was initiated in the early 1970s. The information generated from this project allows wildlife biologists to assess the impacts of winter weather on Maine’s deer herd. For example, a winter with frequent snowstorms, resulting in long periods of deep fluffy snow, can be very detrimental to deer resulting in high deer mortality. Under harsh winter conditions we get increased deer losses or mortality from: starvation, vehicle road accidents, predation, and winter feeding of inappropriate foods. We have a variety of projects to address each of these issues but the WSI project will tell us the overall impact winter weather has on deer populations.

To collect the WSI data, approximately 26 deer snowstations are checked weekly across the state for a 20 week period. At each of these snowstations, data are collected on snow depths, snow profile or crust conditions, deer sinking depth, and air temperature. Generally, these snowstations have remained in the same locations for many years to allow yearly comparison of data on winter severity. Some of these snowstations are checked by regional wildlife staff, but because of travel distance and time, some are also checked by volunteers and private contractors. Many of these volunteers and contractors have faithfully worked on this project for many years. These employees provide a great deal of historical knowledge and are very helpful in filling informational gaps on a variety of local resource management issues and wildlife observations.

In comparison with the bleak deer hunting reports over the last few years, this past fall, reports coming into the Ashland Regional Office from deer hunters, foresters, and District Game Wardens indicated we have a “few” more deer in the North Maine Woods. The last couple winters have been relatively mild and deer are slightly rebounding from the major winter deer losses of 2007–2009. Deer populations have improved, however, we still have a long way to go to meet long-term deer management goals for northern Maine of approximately 8-10 deer/square mile. This winter, we will again initiate aerial deeryard surveys. We rely on WSI data from the various snowstations in northern Maine to tell us when deer are starting to yard-up and when to start the aerial surveys. For this project to be successful, we need long periods (weeks) of deep fluffy snow that force deer to yard or herd-up in softwood shelter. Generally, the aerial deeryard surveys will start in late January depending on weather severity. This results in some good information on the location of northern Maine’s deeryards, but because of the tough winter conditions, we may also see some significant winter deer mortality.

DWA aerial surveys not only help us in locating and managing deeryards, but also provide us with additional information on winter deer mortality and coyote predation. We will check for deer use and winter mortality in many deeryards, but we will also focus on flying over deeryards we’ve targeted this winter for additional coyote control. This will tell us where we need to direct hunters and trappers for coyote removal.

With the start of winter conditions, a greater emphasis is placed on composing winter deeryard harvest agreements with landowners. Because most deeryards are on private land, we put a significant amount of time into working with foresters on timber harvest plans in DWAs. Deeryards are not meant to be untouched wilderness, but carefully managed forests that are periodically harvested to maintain winter deer shelter for perpetuity. Generally, most harvest agreements or plans are put together in the summer or fall with the start-up of timber harvest operations on frozen ground conditions in early winter. However, we still do many DWA harvest plans, field visits, and timber harvest inspections with foresters during the winter months.

This is certainly not a complete list of projects within Region G that will be ongoing this winter. As time permits, other duties or projects may include: trap and relocate wild turkeys into northern Maine, update management plans for Wildlife Management Areas, and provide technical assistance or information on a variety of management issues to private landowners.

--Arlen Lovewell

Ashland Headquarters, Assistant Regional Wildlife Biologist

FISHERIES MANAGEMENT SECTION

Maine is blessed with 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 Inland Fisheries and Wildlife Department 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. This 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. Our 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 our fisheries biologists are conducting in support of this state's incredibly rich and diverse freshwater resources.

--Dave Boucher

Fisheries Management Section Supervisor

REGIONAL FISHERIES MANAGEMENT

Moosehead Lake Weir Project

The Maine Department of Inland Fisheries and Wildlife conducted a multi year study of the wild brook trout population in Moosehead Lake. Moosehead Lake is a 75,000-acre lake with wild brook trout, lake trout, and landlocked salmon fisheries. It is the largest wild brook trout lake east of the Great Lakes. The recreational fishery in this lake and its tributaries and outlets are of major economic value to the region and to the State.

The purpose of this study was to construct a fish weir on Socatean Stream and the Roach River, two important spawning tributaries to the lake, and capture wild brook trout. The trout would be tagged with Passive Integrated Transponder (PIT) tags or radio-transmitters to facilitate tracking. Basic biological data (i.e. length, weight, sex, and maturity) would be recorded on a large sample of Moosehead Lake brook trout. Tracking data would be used to assess post-spawning mortality, total annual mortality, and sanctuary areas and to locate spawning sites (stream fidelity).

While the original Maine Outdoor Heritage Fund study proposal was designed for just two years, additional funding has enabled the project to extend for several more years, including collecting additional tracking data on wild landlocked salmon in the Roach River in 2010 and 2011. However, that work is still ongoing; therefore, this report will summarize the findings to date for wild brook trout trapped in Socatean Stream and Roach River.

In 2009, we captured 370 wild brook trout in Socatean Stream. Below is a comparison to a similar effort in the late 1950s:

ALL Brook Trout	1956-1957	2009
Mean Length	12.8"	13.8"
Range in Length	4.0 – 22.0"	9.1 – 21.1"
Number of fish handled	1956 - 479 1957 - 1,265	370

We had several washouts in 2009 that resulted in missing fish. Washouts also reduced the catch in 1956. From this sample of over 300 fish, we implanted 49 radio-transmitters in mature male brook trout. These transmitters enabled us to track fish from the ground and from plane for a year to locate spawning sites and determine survival and habitat preference in the winter. These fish were all tagged in late September and October. Peak spawning occurred in mid-late October and was completed by November. Post-spawning mortality was high but comparable to other work completed at Socatean Stream and waters in the Allagash Wilderness Waterway.

By early December, 60% of the tagged mature male brook trout were dead. Six of the 13 surviving brook trout that made it back to the lake for the winter fishing season were located in areas closed to fishing. Therefore, about 46% of the fish in the lake were in protected areas and could not be harvested legally. Three of these 13 fish were harvested in the winter of 2010. Therefore, about 23% of the surviving trout (43% of the trout in areas vulnerable to fishing) in the lake were removed in the winter subsequent to spawning. Total annual mortality was estimated at 70%.

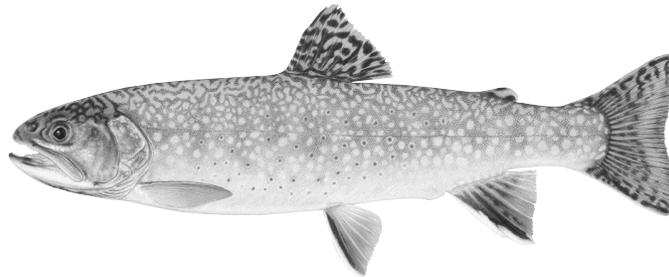
In 2010, we captured 596 brook trout and 681 landlocked salmon on the Roach River. We implanted 49 radio-transmitters and 182 PIT tags in mature brook trout. In addition, we were able to implant PIT tags into 139 adult male salmon.

Post-spawning mortality was similar for Roach River brook trout compared to Socatean Stream. Seventy-three percent of the surviving brook trout overwintered in sanctuary areas closed to ice fishing. Yet, total annual mortality was estimated at 80% for these legal-sized brook trout.

Only 10 of the radio-tagged trout were alive the following fall (2011), and just 6 (12%) returned to spawn in the Roach River. That figure was comparable to the PIT-tagged brook trout. Sixteen percent of the PIT-tagged brook trout returned, while no PIT-tagged salmon returned in 2010.

In summary, post-spawning mortality and annual mortality rates are very high on mature male brook trout in Moosehead Lake. Areas designed to protect overwintering post-spawning brook trout, such as Spencer Bay and Socatean Bay, are providing valuable protection to these vulnerable fish. The number of brook trout captured in Socatean Stream was less than anticipated based on a similar study in 1956/1957. Spawning sites in Socatean Stream were closely associated with upwelling ground water, and it is important to maintain the integrity of these sites. There did appear to be a strong homing mechanism for those few brook trout that survived to spawn in consecutive years. We anticipate collecting more data on brook trout and landlocked salmon over the coming year on the Roach River.

--Tim Obrey
Greenville Headquarters, Regional Fisheries Biologist



Restoration of Arctic Charr (*Salvelinus alpinus*) and Eastern Brook Trout (*Salvelinus fontinalis*) at Big Reed Pond, Maine

Big Reed Pond (BRP) is located in Township T8R10 WELS in northern Piscataquis County, Maine. The pond is surrounded by property owned by The Nature Conservancy (TNC), much of which has never been harvested for timber products and is classified by TNC as an ecological forest reserve. Nearly the entire watershed of BRP is protected within the reserve. Access to the pond is either by floatplane or a primitive hiking trail in excess of one mile.

Partnering with the Maine Department of Inland Fisheries and Wildlife (IFW) on the project is TNC, Bradford Camps (a long-time sporting camp outfitter on nearby Munsungan Lake), Mountain Springs Trout Farm (MSTF), Presque Isle High School's Aquaculture Facility, Maine National Air Guard, Maine Outdoor Heritage Fund, the University of Maine, and several private donors.

Arctic charr in Maine represent a very rare and unique resource, as they are the only endemic, viable populations of this species in the lower forty-eight states. Big Reed Pond supports not only one of these 12 endemic populations of charr but also a population of wild brook trout. These two fishes once provided a unique, back-country angling experience in northern Maine. Numerous invasive fishes once threatened the long-term viability of both salmonid species; the most recent, and likely the most harmful invaders were rainbow smelt *Osmerus mordax* and creek chub *Semotilus atromaculatus*, with their presence having been confirmed in 1991 and 1992, respectively.

A stakeholders group was formed in 2006 and charted a course of restoration outlined in a peer-reviewed plan. The restoration model we developed consisted of: 1) establishing a captive population for both Arctic charr and brook trout, 2) chemical reclamation with rotenone, and 3) reintroduction of the endemic fish group, which also included northern redbelly dace *Phoxinus eos*. Prior to rotenone treatment in October 2010, we completed an intensive, three-year effort to capture and relocate relict adult and juvenile Arctic charr and brook trout. These captive populations were managed by a private hatchery facility, Mountain Springs Trout Farm, a partner in the restoration project.

Reclamation

The remote location and lack of easy access presented logistical problems not normally encountered with ponds targeted for reclamation. Years of planning were needed to fully develop the peer-reviewed plan, acquire necessary permits, notify abutting landowners, allow for public comment, and organize a sizeable work crew to carry out the four-day treatment. The most challenging task was transporting the 6.1 tons of liquid and powder rotenone to Big Reed Pond. For nearly 8 months IFW worked with the Army Aviation Support Facility located in Bangor, Maine to organize the use of Army Black Hawk helicopters as a training exercise to air lift the rotenone to the pond. On September 29, 2010 nine crew members of the Army Facility at Bangor arrived with two Black Hawks and met Department biologists on a Seven Islands Land Company dead-end road about 3 miles south of BRP. The Aviation Unit crews proceeded to air-lift eight loads to BRP where IFW staff removed crating and temporarily secured the rotenone.

After years of planning by many fisheries biologists across the state, the week of October 3, 2010 finally arrived when 17 biologists, 4 contractors, and 7 volunteers met at various staging locations to begin the four-day treatment process of the pond, its tributaries, and the outlet. The main goal was to use the minimum amount of rotenone needed to remove all fishes within the pond upstream of a natural falls on the outlet (which would prevent the migration of invasive fishes back into the pond). The treatment of BRP was also the debut of a totally revamped reclamation program that featured new equipment, several new licensed applicators within the Fisheries Division, and new personal safety measures and equipment. With a stretch of ideal weather conditions during October 3 and 6, 2010 - cool, dry, and calm winds - the rotenone application went flawlessly. Fish recoveries during the treatment process showed the desperate situation at BRP firsthand – thousands of rainbow smelt, white sucker, creek chub, and various minnow species. We recovered no Arctic charr, but we were able to locate approximately 40 brook trout. Thirteen of these trout were revived in fresh water and flown to MSTF, several of which were spawned later in the month.



Reintroduction

Numerous individuals of charr and trout were captured, reared, and artificially spawned between 2007 and 2011. Reintroduction began in June 2011 when 600 yearling charr and 1,950 trout fry were released. An additional 300 charr were released in October 2011, with 10 affixed with acoustic tags to allow future tracking. IFW divers documented light spawning activity by charr on the suspected spawning shoal on November 16, 2011; a few days later, 130 charr that were 2–4 days from spawning were released from the hatchery on this shoal. The pond iced over about 5 days later.

Restoration efforts have continued in 2012 with an additional 3,180 trout fry released in May. A fall stocking of charr is planned as well as another effort to artificially spawn all trout and charr currently being held at the hatchery.

--Frank Frost

Ashland Headquarters, Regional Fisheries Biologist

First Impressions

As a new member of the Fisheries Division for a little over a month, I have been able to quickly interact with most of the regional biologists, research staff in Bangor, the administration in Augusta, and various members of the public. I have been impressed with the workload all our staff undertake, their commitment to responsibly collecting and analyzing scientific data, and how and why fishing regulations are developed and implemented. Fisheries biologists may work on fish passage and habitat enhancement projects, fish stocking programs, evaluating impacts of exotic species, reclaiming waters for native species, conducting scientific SCUBA diving surveys, and constantly reviewing and developing new techniques to better study and manage Maine's aquatic resources. On any given day our biologists can be found responding to data requests from the public, giving presentations to school groups, collecting angler information, and working with other state and federal agencies and non-profit organizations on a myriad of important fisheries issues

throughout the New England region. To put things into perspective, approximately 20 fisheries staff are responsible for Maine's 6,000+ ponds and lakes and 32,000 miles of rivers and streams. They systematically collect data via truck, boat, plane, snowmobile, ATV, and on foot. They work in all weather conditions, on weekends, and through holidays. And they do this all for Maine's citizens and anglers that visit our state from around the world.

I have equally been impressed with the level of interest and involvement the public has in the management of Maine's fisheries resources. Many anglers are keenly aware of the department's work; they review and analyze our extensive data sets, ask many questions, and generally want to be involved in how the resources are managed. Anglers are actively involved in public meetings that are held throughout the state, hold discussions informally via blogs, and are quick to interact one-on-one with department biologists in the field. Many fishermen in Maine know who the regional fisheries biologists are, what work is being done on what water body, and may often volunteer their time submitting angler log books or conducting remote pond surveys. Many anglers in Maine do this because they care about the resource and want to preserve fishing opportunities for years to come.

A fishery may be defined as a social system that includes fish, harvesters, and the entire support industry; the long-term success of the fishery relies upon the sustainability of the fishery resources. It is important for managers to identify stakeholders who will be affected by possible management changes intended to modify the fishery. Fisheries biologists and managers must be prepared to weigh conflicting viewpoints in their decision making processes because the number and diversity of economic factors in a fisheries resource often receives the most consideration. Our department is very aware of public desires when it comes to managing fisheries resources, and our doors are always open to the public. In addition to many of our public outreach approaches, our department is currently managing several working groups for brook trout and landlocked salmon, among other species. The public members on these groups represent anglers, commercial baitfish dealers, guides, lodge owners, non-governmental organizations, and the general public. The working group meetings are held regularly (usually monthly) and are open to the general public for observation.

--Dana DeGraaf
Augusta Headquarters, Coldwater Fisheries Biologist



MAINE'S LANDOWNER INCENTIVE PROGRAM COMES TO A CLOSE

Beginning in 2004, with the help of over \$3.5 million in competitive grant funds awarded by the U. S. Fish and Wildlife Service over four years, the Maine Department of Inland Fisheries and Wildlife implemented the Landowner Incentive Program. This Program was developed to provide financial incentives and technical assistance to private landowners for the protection of habitat of Maine's at-risk plant and animal species and exemplary natural communities.

With approximately 95% of Maine's landscape in private ownership, the protection of nearly all of our rare plants and animals depends on the good will of private landowners. With limited staff resources and a finite amount of funds, MDIFW and its partners from various state, federal, and non-governmental organizations took a highly targeted approach, focusing efforts in areas of the state with concentrated occurrences of at-risk animal and plant species.

Specifically, Maine used funding provided by the Landowner Incentive Program (LIP) to implement conservation measures (conservation easements, cooperative management agreements, and other tools) critical to 3 initiatives:

- o Habitat protection in 22 species-at-risk focus areas;
- o Conserving priority shorebird nesting, feeding, and roosting areas; and
- o Piping Plover and Least Tern nesting sites.

Due to a lack of funds, 2012 marks the end of this program. Here are a few highlights of the Program's successes:

- **Landowner Outreach:** Outreach to thousands of landowners and dozens of conservation partners in the 22 targeted Beginning with Habitat Focus Areas was conducted regarding the rare, threatened, endangered, and special concern plant and animal species documented on or near their property and voluntary land management measures they could employ to protect and enhance habitat for these species.
- **Conservation Easements:** LIP funds were used to provide financial assistance to private landowners for the sale of conservation easements that would permanently protect habitat for at-risk species. By targeting funds to specific areas in the state, we were able to see success at a broader scale, rather than the scatter-shot approach of isolated parcels with no real connectivity to the habitats used by a particular species, or group of species. This is best illustrated in the 3 projects that were completed in the Upper Saco River Focus Area. Three different landowners participated in the program in this region, selling and donating conservation easements on a total of 2,654 acres in three different towns along the Saco River corridor, including the flood plain forests and wetlands associated with the river. A large portion of this land is on the opposite shore of the Saco River to the Department's Brownfield Bog WMA.
- **Seabird Habitat Restoration:** Stratton Island, owned by the National Audubon Society, is located in Saco Bay and supports 19 species of nesting waterbirds, more than any other Maine island, including federally endangered Roseate Terns and several species of wading birds that are nesting at the northern edge of their range. LIP funds allowed Audubon's Seabird Restoration Program to clear bittersweet from about 50% of the heron nesting habitat on Stratton Island and to remove all of the purple loosestrife from the island. Effective management of bittersweet and loosestrife on Stratton Island will require an active long-term management program.
- **Piping Plovers and Least Terns:** Maine's population of piping plovers has been monitored annually since 1981. About 75% of the piping plovers nesting in Maine nest on 17 privately-owned beaches in the state. Many of these beaches are highly developed, and management of these endangered birds requires careful negotiations with landowners. The number of pairs of piping plovers has fluctuated between 7 pairs at 4 sites in 1983 to 66 pairs at 20 sites in 2002. Unfortunately due to recent habitat loss from devastating spring storms, coupled with higher predation rates and greater presence of unleashed dogs on plover beaches, plover numbers in Maine declined at an alarming rate to only 24 pairs nesting in 2008. Increased management and outreach efforts supported by LIP during the nesting seasons 2009–2012 reversed the downward trend to one of increase with 33 nesting pairs in 2011 producing 70 fledglings, which was the highest nesting success since 1995. Each year, over 90% of landowners give wildlife biologists permission to fence and sign areas of their land to benefit plovers. On several beaches, the MDIFW and the U. S. Fish and Wildlife Service have developed beach management agreements to address beach management issues (esp. garbage removal and beach sweeping). LIP funds were used to increase the capacity to better manage piping plover and least tern habitat on privately-owned land and to promote private stewardship of rare and endangered beach-nesting birds.

LIP was a one-of-a kind program in Maine, which leveraged partnership from state and federal agencies, private landowners, and Maine's conservation community, to secure habitat for some of Maine's most at-risk species, while ensuring land would remain privately-owned and managed for timber production, agricultural uses, and recreational enjoyment.

--Sarah Demers
former LIP Coordinator

THE RESEARCH AND ASSESSMENT SECTION: AN IFW SOURCE FOR SCIENTIFIC INFORMATION

Many readers of this annual report are probably aware that IFW recently went through a reorganization process. Some changes were subtle in effect, and I would like to describe one here. IFW's Wildlife Division formerly held a Wildlife Resource Assessment Section (WRAS), responsible for tracking the status of and recommending management actions for inland vertebrates - mammals, birds, reptiles, amphibians - and for priority invertebrates such as rare mussels, mayflies, dragonflies, butterflies, and moths. You can find past annual reports and highlights of activities for these species on IFW's website, where the function of WRAS was explained in more detail on page 5 of the 2011 Research and Management report: http://www.maine.gov/ifw/wildlife/surveys_reports/research_management/index.htm.

In the reorganization, WRAS was removed from the Wildlife Division to report directly to IFW's Bureau of Resource Management. What changed? Quite simply, the Section now considers an additional group of aquatic vertebrates – fish. WRAS has become RAS. We have also taken this opportunity to change the “Resource” back to “Research”, and thus we are IFW's Research and Assessment Section. This formally acknowledges both the scientific training of the RAS biologists and the applied nature of their projects. Science is a method to discover truth in nature, and scientists are often recognized by their ability to publish research papers in peer-reviewed scientific journals and books. RAS biologists have published dozens of such articles and are often looked to as the State's species' experts by private landowners, land trusts, towns, state and federal agencies, and other conservation partners.

IFW's new RAS will continue to do what we did before, and that is primarily to: 1) provide reliable information, 2) identify information needs with the help of public input and IFW's Regional biologists, and 3) try to satisfy those needs – all done as efficiently and effectively as possible. RAS' Habitat Group writes analytical tools for databasing occurrences of priority species and high-value habitats, thus supporting conservation and management for both fish and wildlife species. RAS' Bird, Mammal, Fish, and Reptile-Amphibian-Invertebrate Groups conduct population assessment surveys and research to help inform management plans that guide conservation efforts for Maine's native fish and wildlife.

We will continue informational support to several of IFW's core programs such as species population planning, endangered species recovery, species' harvest and scientific collections management, Beginning with Habitat outreach, and interagency environmental review to name a few. Not much has changed, except for the first time in the 23-year history of this particular report, you will find a fish section – all about research efforts to identify, conserve, and improve quality of habitats for Maine's iconic brook trout. You may have already noticed the contribution from the Bureau's Fish Management Section of the Fisheries Division, and we hope you enjoy the integration of fish research and management efforts into this annual report that was previously produced by the Wildlife Division alone.

There is one more thing that I should mention. During this past legislative session 'An Act To Revise The Income Tax Return Check-offs' was passed. This Act establishes an increasing minimum amount of donations for a fund to remain on the tax form, such that, if a fund is below \$25K in annual donations by 2017 and thereafter, it will be considered unviable. If you turn back to Table 1 on page 3 of this report, you can see that the Chickadee Check-off is trending in a way that it may be less than \$25K by 2016. This Check-off took a real hit in 1998 when it was moved from the main tax form to a supplemental sheet. It has been declining pretty steadily since then. It is important not to lose even this relatively meager source of funding because these state-side dollars are used to match and 'put to work' other sources of funds such as the federal State Wildlife Grants that require such matching funds. If you don't buy a hunting or fishing license, this Check-off is one way you can contribute to the conservation and management of Maine's fish and wildlife resources. You'll see in the pages to come that it's not just about deer and trout. We're always thinking about new ways to fund conservation and management of non-game species, and let us know if you have an idea too. Enjoy.

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

“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)

HABITAT GROUP

Donald Katnik, Ph.D., Habitat Group Leader - Supervises Group activities and coordinates habitat-related projects with other Division and Department staff and other State and Federal agencies.

MaryEllen Wickett, Ph.D., Wildlife Biologist and Programmer/Analyst - Develops computer applications to facilitate access to habitat data by MDIFW staff and other users. 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.

Dana DeGraaf, Oil Spill Biologist - Coordinates oil spill response planning efforts for the Division, including sensitive area identification and wildlife rehabilitation plan design and implementation. (currently vacant)

HABITAT CONSERVATION AND MANAGEMENT

Habitat Mapping

The Habitat Group uses GIS (Geographic Information System) software to map observations of wildlife and their associated habitats. Many of these habitats are defined and protected by state or federal law. Besides conservation, this information also is used for species assessment and management plans. More and more people outside MDIFW are using these data, particularly with internet mapping services like *GoogleEarth*. Keeping these data current and accurate is a constant challenge. New information is continually being added and existing information updated. Aerial photos are our primary means of mapping habitat, which causes some concern among our data users who want “boots on the ground” verification of every mapped area. Although field validation plays an important role in mapping habitat, the availability and quality of aerial photos has increased dramatically in recent years. In most cases, large habitat areas like wetlands are easily identifiable from photos, and aerial photography provides a unique landscape perspective.

We are continuing to work on updating MDIFW's Tidal Waterfowl/Wading bird Habitat areas that were last mapped over 10 years ago from National Wetlands Inventory and Coastal Marine Geologic Environments data. These coastal habitats are part of the Environmental Vulnerability Index (EVI) maps published by the Maine Department of Environmental Protection for responding to marine oil spills. These EVI maps guide spill responders in determining where best to put limited response resources to protect the most sensitive areas of Maine's coastline. We are using low-tide aerial photos to map salt marshes and mudflats. We are then ground-truthing a subset of the mapped areas with access by roads or in some cases by boat. During our mapping efforts, we have found that fresh water inflows to coastal marshes and mudflats are important to waterfowl and other wildlife, so we are now mapping those inflow points also.

Computer programming is not often thought of as a wildlife biologist's job, but to effectively maintain our numerous wildlife habitat databases, it is essential. This year the Habitat Group developed several new computer programs to regularly test the integrity of our databases (by looking for missing or incorrect values, for example) and to update exported versions of our datasets for use outside MDIFW. These programs can be scheduled to run overnight to save staff time and help us ensure that our data are as current, complete, and accurate as possible.

The Habitat Group GIS Coordinator maps and enters all surveyed vernal pools into a database that is used by the Maine Department of Environmental Protection. This year, the GIS Coordinator developed a tool in the database that auto-generates a notification letter for each pool, complete with the landowner's address and the determined significance (or non-significance) of the pool based on State criteria.

Every year the Habitat Group assists other MDIFW staff with a variety of projects that involve databases, wildlife habitats, and/or geographic analyses. Some examples include:

- Cataloging 40 years of black bear data
- Creating a variety of maps including 2011 Piping Plover nests, Salt Marsh Tiger Beetles, Blanding's Turtle, Wading Bird Colonies, Hunting & Fishing information, harvest data, wildlife-vehicle collision data, and many more
- Revising MDIFW's Wildlife Division web page
- Remapping Deer Wintering Areas

We also assist with a variety of wildlife field surveys.

The Habitat Group maps things besides wildlife habitat. In 2007, MDIFW received a grant from the U.S. Environmental Protection Agency to map development (buildings and paved roads) in Maine's organized townships. Development maps can help municipalities align their planned growth areas, based on available infrastructure and town zoning, with where new development is actually occurring. From a habitat perspective, development maps tell us where critical connections exist between habitat blocks, allowing wildlife to move from one area to another with less risk of vehicle collisions. Long-term trends of development patterns and assessment of cumulative impacts can benefit all wildlife species if this information can be put to good use. This ambitious project included all residential and commercial structures mapped from 2004 and "new" development between 2004 and 2007. The project was completed in 2011, but in the meantime additional aerial photos for 2009 and 2011 have become available. We are continuing to map "new" development for these additional time periods.

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

--Don Katnik



Pre-application Screening and Environmental Review

Many state agencies, including MDIFW, conduct "permit reviews" relative to the resources they are mandated to protect. These reviews first determine whether any permits are needed for the proposed activity ("pre-application screening"). Each agency then recommends how the applicant may best avoid, minimize, or mitigate for specific resource loss according to Maine law.

MDIFW's environmental review process has evolved considerably. In the 1990s, the state was divided into a series of 150-acre Consultation Areas that were coded to show existence of any habitat concerns. MDIFW staff then used a GIS tool called "HCAMP" (Habitat Consultation Areas Mapping Project) to query the Consultation Area to determine the nature of the specific habitat concern. An advantage of this approach was that habitat mapping only needed to be accurate enough to identify overlap with a given Consultation Area. It also protected sensitive habitats because detailed habitat information including specific locations and species was not distributed outside MDIFW. The HCAMP tool eventually became outdated, however, with advances in GIS technology and the underlying computer language used to build such custom tools. Further, other state agencies and the public wanted access to the detailed habitat information behind the Consultation Areas.

In 2002, the Habitat Group replaced HCAMP with HMAP (Habitat Mapping Application) using the newest GIS technologies. As with HCAMP, HMAP provides reporting and map-making functions to make reviews easier for staff who are not GIS experts. Consultation Areas are no longer used; instead the actual points and polygons representing wildlife observations and habitats are directly available for reviews both inside and outside MDIFW, which has created a need for much greater accuracy in mapping. Users outside MDIFW do not use HMAP but instead add MDIFW's GIS data into whatever system they use internally, which has created challenges with ensuring consistent use of the most current and complete habitat data and interpretation of MDIFW's GIS-based fish and wildlife data.

Environmental Review tracking—recording the status, habitat concerns, and recommendations for each project—is something else we're improving. Some MDIFW staff and regional offices created their own spreadsheets and paper files for tracking reviews, but there has been no mechanism for comprehensive tracking within MDIFW, much less across

other state agencies. Last year the Habitat Group created an Environmental Review database to make MDIFW's reviews more consistent, transparent, and efficient. The database stores information for each project including the applicant, project type, habitat concerns, issues and recommendations raised by species specialists and regional biologists, and the final agency recommendation. The database can be searched for precedents (previous recommendations made on similar projects) and to analyze trends. A report can be generated to show the current status of every ongoing review. Cumulative impacts to specific habitat resources can be assessed. The Environmental Review database is connected to HMAP with a new GIS Search Tool that automates overlaying project footprints with habitat data, summarizes the results in a detailed report, creates a map, and writes the initial draft recommendation. Because the GIS Search Tool is programmed to run overnight, no staff time is needed for the initial work of determining habitat concerns. This greatly increases the capacity of MDIFW to process reviews and eliminates the need for other agencies to conduct their own screenings with MDIFW's fish and wildlife data.

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

--Don Katnik

Oiled Wildlife Response

As a state Natural Resource Trustee, MDIFW is obligated to respond to oil spills that affect wildlife or wildlife habitat. In June 2011, a small spill of diesel fuel occurred in the Pleasant River in eastern Maine. The brook floater (a state-threatened species of mussel) is known to occur in that stretch of the Pleasant River. Because mussels live on the stream bottom, conducting a survey to determine potential effects may require snorkeling/scuba diving and therefore is more complicated than surveys for other wildlife species. Fortunately, a river survey after the spill detected no mussel mortalities. In November 2011, approximately 600 gallons of #2 heating oil was spilled at Portland Jetport. The oil exited a building into an underground storm drain, went through two retention ponds, and eventually was discharged into the Fore River. Two oiled birds—common snipe—were discovered in one of the retention ponds. Despite efforts to rehabilitate them, both birds expired. A Natural Resource Damage Assessment claim is underway. A number of other spills were investigated throughout the year and determined to have no impacts to wildlife or wildlife habitats.

During the Deepwater Horizon spill in the Gulf of Mexico, response efforts were hampered by confusion over which natural, cultural, and economic resources were most important to protect. Particularly during the early part of a response, resources such as boom are in limited supply. We have been working with the Maine Department of Environmental Protection (DEP), Department of Marine Resources (DMR), and National Oceanic and Atmospheric Administration (NOAA) to prioritize Maine's coastal natural resources for spill protection. The outcome of this process will be a set of "grab-and-go" maps for spill responders that rank areas for protection based on their ecological importance, vulnerability to oiling, and irreplaceability. The GIS tools used to create these rankings also will be available during a spill to re-rank areas as needed if the situation changes.

Many MDIFW staff participate in oil spill response. Regional biologists often are closest to spill incidents and have the local expertise to respond quickly. They frequently assist with surveys for affected wildlife and habitats. Species specialists in the Research & Assessment Section (RAS), such as biologists responsible for mussel or waterbird assessments, provide their expertise on particular species to help assess threats and determine an appropriate response. The Habitat Group Leader and RAS Supervisor have training to assist with response planning and Natural Resource Damage Assessment (NRDA), particularly in large spills where an Incident Command Post is established. NRDA claims can take many years to resolve. The key staff member in MDIFW for spill response is the Habitat Group Oil Spill Biologist, who coordinates the response of MDIFW staff and works with responders from the DEP, DMR, and U.S. Fish and Wildlife Service. Unfortunately, this position was been vacant for several extended periods over the last ten years and as of June 2012, is vacant again. Funding for this position and all of MDIFW's oil spill response training and equipment comes from the Maine Coastal & Inland Surface Oil Clean-up Fund that has been in severe decline.



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

--Don Katnik

BIRD GROUP

The breadth of the Bird Group's programmatic responsibilities involve stewardship of 223 bird species that nest in Maine, and many more that migrate through or winter in Maine. Several of Maine's birds occur statewide, but others occur only in portions of the state. Maine has a very diverse landscape and, consequently, a myriad of habitats suitable for various bird species. At least 29 inland breeding species of birds reach the northern limits of their breeding distribution in Maine, 28 species at their southern limits, and 2 species at their eastern limits. In addition, many of Maine's island-nesting seabirds reach their southern breeding terminus on Maine's islands, like Atlantic puffins and razorbills. The peregrine falcon and wild turkey have been reintroduced in Maine. The peregrine population is slowly increasing, and the wild turkey has expanded into areas beyond our expectations. Other species, such as the turkey vulture, blue-winged warbler, evening grosbeak, American oystercatcher, sandhill crane and several species of wading birds, have expanded their breeding range into Maine at various times over the past century.

Brad Allen, Bird Group Leader – Brad oversees group activities and budgets and currently is conducting a common eider survival study. Brad also coordinates Department interests in seabird research and management activities.

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

Thomas Hodgman, Wildlife Biologist – Tom develops and implements programs and surveys to assess the status of songbirds in Maine and coordinates several priority bird research programs. Tom's recent focus is working with two graduate students studying saltmarsh sharp-tailed sparrows and rusty blackbirds. Tom routinely provides technical assistance and advice to the Wildlife Management Section regarding bird migration and the ever-expanding windpower development.

Kelsey Sullivan, Wildlife Biologist – Kelsey coordinates 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.

Charlie Todd, Wildlife Biologist – Charlie has devoted 30 years of his professional career to the recovery of bald eagles in Maine, culminating in the delisting of bald eagles three years ago. Charlie also leads MDIFW's peregrine falcon recovery program. Charlie's experience makes him a valuable advisor to other staff on all Endangered and Threatened bird species issues.

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 the ecology of purple sandpipers wintering in Maine and her primary survey responsibilities include all shorebirds and harlequin ducks.

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: Scott Hall, Maine Warden Service pilots: Charlie Later and Dan Dufault, John Drury, Glen Mittelhauser, Dave Hiltz, Chris West, Don McDougal, Jim Dyer, Bill Hanson, Chris DeSorbo, Wing Goodale, Lucas Savoy, Bruce Connery, Lesley Rowse, Joe Wiley, Margo Knight, Don Mairs, Ron Joseph, Patrick Keenan, Bill Johnson, Diane Winn, Bill Sheehan, Thomas Cochran, Marc Payne, Maine Audubon, Linda Welch, Don Reimer, Scott Kenniston, Dick Hutchinson, Libby Mojica, John Sewell, many Heron Observation Network volunteers, many private landowners who have granted us access to their property for surveys and monitoring, and MDIFW regional staff.

BIRD CONSERVATION AND MANAGEMENT

Effects of Waterfowl Impoundments on Rail Habitat and Productivity

Rails such as the sora (*Porzana carolina*) and Virginia rail (*Rallus limicola*) are secretive marsh birds that are more often heard than seen. They are among several other marsh bird species that are thought to be declining at rates proportional to wetland habitat loss. Rails nest just above the water surface in wetlands with shallow water and emergent vegetation, and forage in the muddy substrate for invertebrates and plant seeds. While their nests are sensitive to water fluctuations, rails also depend on hydrological variation to create their preferred nesting and foraging habitat.

Rails are found in wetlands that also host nesting waterfowl. Impoundments are typically used to increase water levels and the length of the period of inundation for the benefit of waterfowl. Management of impoundments often includes

increased flooding during late spring and summer months and draw-downs in the early spring or fall to increase seed production of emergent vegetation. While impoundments are known to be beneficial for creating waterfowl habitat, it is unclear how the change in hydrology affects nesting habitat for rails as well as rail productivity.

Over the past two years, this relationship was examined by Brian Olsen, Assistant Professor at University of Maine, and graduate student Ellen Robertson, in cooperation with MDIFW, Moosehorn National Wildlife Refuge, and University of New Hampshire. They compared the hydrologic variation and rail breeding productivity on wetlands with and without waterfowl impoundments. By tracking the survival of 75 Virginia rail and 22 sora nests in 10 Maine wetlands, they identified the mechanisms for nest failure and characteristics of wetlands that predict reproductive success.

They found that greater hydrological variation resulted in greater rail nest survival among the wetlands. Hydrological variation also positively predicted rail density. Rails nest close to the water surface and are able to respond to water level variation by building up their nests, sometimes as high as 18 cm (7 in). Most nest failures (90%) were from predation and were in areas where water was unchanging or becoming shallower.

The presence of a waterfowl impoundment did not affect nest survival or clutch size. However, the water levels of the impounded wetlands they studied were not actively managed during the course of the study; thus, different management techniques could provide different results. The strong and consistent relation between nest success and water-level variability suggests that increases in rail nest success might be achieved with some level of manipulation. More research is needed to determine the timing and duration of draw-downs and flooding of impoundments that may positively affect rail productivity. Whether impounded or not, wetlands with large edges of low sloped bottoms, shallow depths, and abundant emergent vegetation are important for the conservation of rails.

Another aspect of their research was to determine how rail density, breeding stage, call type, and sex differences affect marsh bird response to broadcast call survey methods. Because of the secretive nature of rails, the best method for detecting their presence is to broadcast their calls and listen for a response. They found that as rail density increased, so did the probability that they would respond to the broadcast. Rails responded similarly to broadcasts during egg laying, incubation, and hatching. After hatching and after nest predation events, probability of rail response decreased. They also found that paired and unpaired birds tend to use different call types, which may be helpful for determining presence versus active breeding. Male Virginia rail calls tended to be louder, longer, and faster than female calls, and may be detected by surveyors more often. Their study indicates that large-scale marsh bird population trend estimates should take density and sex detectability issues into account and recognize that wetlands with low response rates may underestimate populations more than those with high response rates due to differences in actual bird densities, sex ratios, and breeding stage.

Funding and equipment was provided by volunteer assistance, USFWS Webless Migratory Game Bird Program, Moosehorn National Wildlife Refuge, Biodiversity Research Institute, Maine Natural History Observatory, Association of Field Ornithologists, University of Maine Graduate Student Government, federal State Wildlife Grants program, and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

--Danielle D'Auria

S.H.A.R.P. - The Saltmarsh Habitat and Avian Research Project - Preliminary Data

The Atlantic Coast of North America possesses the largest expanse of tidal salt marsh and the highest concentration of endemic marshbirds in the world. This ecosystem, however, presents unique challenges to the conservation of its inhabitants, often requiring a regional and collaborative approach to conservation. In 2010, MDIFW partnered with four other states to examine the conservation of birds using tidal marshlands in the northeastern U.S. The states of Maine, Connecticut, Delaware, and Maryland, working in cooperation with the University of Maine, University of Delaware, and the University of Connecticut, began field work on this 3-year multi-faceted study in May 2011. This project includes two major components: 1) a survey of the birds nesting in coastal marshlands from Virginia through Maine to assess current populations and to gauge changes from historical data, as well as, 2) a series of in-depth nesting studies.

Surveys

As a multi-state team, we participated in bird surveys visiting a total of 660 points between May 1 and July 23, 2011, spanning the entire coastlines of Maine, New Hampshire, and Massachusetts. We allotted most survey effort to marshes in Maine with 308 individual points visited, followed by Massachusetts with 299 points, and New Hampshire with 53 points. We also spent considerable time assembling historical data on saltmarsh bird populations from 14 sources, spanning 10 states, and totaling 3,006 points. In 2011, we resurveyed 223 historical points with 126 falling in Maine, 24 in New Hampshire, and 53 in Massachusetts. No final analyses have been completed to date.

Nesting Studies

MDIFW, together with its out-of-state partners, established sites for intensive nesting studies in Maine, Connecticut, and New Jersey. Working together in Maine, the University of Maine and MDIFW established three 10.5 ha plots for detailed study at Scarborough Marsh Wildlife Management Area in Cumberland County. A two- to three-person crew searched

all plots for nests on a regular basis from mid-May through late August 2011. We found a total of 111 nests of 4 species during the 2011 breeding season. Of these, we identified nine Nelson's, 33 Saltmarsh, and 64 "sharp-tailed" sparrow nests. In addition, we found two Savannah Sparrow nests and three Willet nests. Of the 111 nests found, 76 were located in the study plot on the Scarborough River, 25 in the Nonesuch River plot, and 10 in the Libby River plot. The same crew also systematically operated mist-nets three times during the breeding season to capture all breeding sparrows on the plots. We spent 45 days mist-netting at Scarborough Marsh in 2011. We banded only Saltmarsh, Nelson's, Song, and Savannah Sparrows. In total, we banded 315 individual birds from the 4 species. Of these, 257 were after-hatch-year adults (28% female) and 58 were hatch-year birds (Table 2). We captured 61% of the female sparrows attending nests that we found, and 84% of the females whose nests survived to hatching. We recorded 146 recaptures of birds marked either, earlier in the 2011 breeding season (by our crew), or in previous years by other projects (Table 3).

Table 2. Number of birds banded, by species and age, at Scarborough Marsh, Cumberland County, Maine, 2011.

Species	After Hatch Year				Hatch Year	GRAND TOTAL
	Female	Male	Unknown Sex	Total		
Sharp-tailed Sparrow spp.	26	75	5	106	18	124
Nelson's Sparrow	13	39	8	60	8	68
Saltmarsh Sparrow	27	50	1	78	28	106
Savannah Sparrow	3	9	0	12	4	16
Song Sparrow	0	1	0	1	0	1
TOTAL	69	174	14	257	58	315

Table 3. Number of birds recaptured, by species and age, at Scarborough Marsh, Cumberland County, Maine, 2011.

Species	After Hatch Year				Hatch Year	GRAND TOTAL
	Female	Male	Unknown Sex	Total		
Sharp-tailed Sparrow spp.	11	27	2	40	4	44
Nelson's Sparrow	5	23	0	28	5	33
Saltmarsh Sparrow	17	33	2	52	14	66
Savannah Sparrow	0	2	1	3	0	3
TOTAL	33	85	5	123	23	146

This work is supported by the federal State Wildlife Grants program, as well as state revenues from the Loon Conservation Plate, Chickadee Check-off Fund, and the University of Maine.

--Thomas P. Hodgman

Game Birds

Migratory Game Birds

MDIFW contributes to several programs that assist the USFWS in assessing migratory game bird populations and harvests. To assess 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 harvest numbers, active hunters, and days afield; 2) the Wing-Collection Survey where hunters contribute wings of harvested birds that serve as a measure of productivity (or recruitment); and, 3) analysis of band recoveries from numbered bands placed on birds prior to the fall hunting season that can provide estimates of overall survivorship of a species.

American Woodcock

Nationally, American woodcock management is divided into two units, east and west of the Appalachian Mountain Chain. These are known as the Eastern and Central Management Units or EMU and CMU. Maine is one of the most important states for breeding woodcock within the Eastern Management Unit (EMU).

Each spring, beginning in 1968, a coordinated survey called the Singing Ground Survey (SGS) is conducted across all woodcock states. Each survey participant records the number of singing male woodcock they hear in the spring on specific routes distributed throughout Maine and their breeding range. 52 routes were run in Maine in 2012 by MDIFW staff, USFWS staff, and a number of other volunteers. The long term trend (1968 to 2012) indicates a decline in American woodcock numbers across their range; however 2012 is the ninth year in a row that the EMU population appears stable. In 2012, the average number of males heard on Maine's SGS routes was 3.64. Last year the average number of males heard on Maine routes was 3.68. The 10-year average is 3.66.

Woodcock hunting season - October 1, 2011 to November 15, 2011

As a result of several years of cooperative work between State and Federal biologists, the frameworks for a woodcock hunting season were changed. It was determined that more of the population could sustain additional hunting opportunity. Therefore the woodcock hunting season was extended from 30 to 45 days beginning in 2011.

Based on data from HIP, approximately 4,100 woodcock hunters harvested 11,900 woodcock in Maine last year. This was a large decrease in harvest compared to the previous year. The recruitment rate of 1.7 immature (young of the year) to one adult female in the 2011 harvest was the same as the long term average of 1.7 (1963–2010). Recruitment rate is a measure of the ratio of immature woodcock per adult female derived from the Wing-Collection Survey described above. Maine hunters provided 1,322 wings from the 2011 hunting season for that survey.

Waterfowl

Waterfowl harvest metrics are also derived from the same Harvest Information Program used to assess woodcock harvest. Harvest information for the 2004 to 2011 waterfowl seasons are listed below in Table 4.

Table 4. Maine Waterfowl Harvest 2004-2011.

Species	2004	2005	2006	2007	2008	2009	2010	2011
American Black Duck	5,765	7,623	5,387	5,000	4,683	5,364	3,377	2,133
Mallard	12,218	16,855	12,231	12,700	11,265	12,711	8,379	7,441
Green-Winged Teal	2,750	3,077	4,309	6,100	7,872	4,923	3,189	2,042
Wood Duck	4,231	6,224	5,577	5,400	3,461	7,641	8,567	5,989
Ring-necked Duck	529	699	1,300	300	747	1,763	1,688	454
Common Goldeneye	1,745	3,777	2,091	1,600	2,307	1,469	313	318
Total	27,238	38,255	29,895	31,100	30,335	33,871	39,100	31,500
Canada Goose	7,000	7,826	9,800	9,100	13,800	4,700	9,194	3,717
Sea Ducks								
Common Eider	14,736	10,842	18,133	13,100	11,143	4,355	4,505	6,400
Long-tailed Duck	1,754	690	1,779	1,000	4,305	656	2,321	2,695
Scoter	4,210	2,168	2,288	1,700	4,052	890	1,092	674
Total Sea Duck Harvest	20,700	13,700	22,200	15,800	19,500	5,901	7,918	9,769
Total Waterfowl Harvest	54,938	59,781	61,895	56,000	63,635	44,472	42,625	44,986

Based on these HIP data, an estimated 4,700 active waterfowl hunters shot an estimated 44,986 waterfowl in Maine in 2011 (a total that includes puddle ducks, diving ducks, sea ducks, and geese). The 2011 total harvest was above the 2010 harvest of 42,625 waterfowl.

Non-migratory Game Birds

Game birds, such as wild turkey and ruffed grouse, are birds that spend their annual life cycle within the state of Maine. This management responsibility remains solely with MDIFW.

Wild Turkey

The wild turkey program is a great success story in wildlife restoration and has allowed MDIFW to provide hunters the opportunity to harvest wild turkeys during both spring and fall hunting seasons in Wildlife Management Districts (WMDs) that meet specific population and harvest levels and certain habitat criteria. Spring turkey hunting is the season of choice for the majority of turkey hunters when male turkeys are responsive to hunter’s calls. Although spring wild turkey hunting license sales have declined in recent years, the harvest success rate remains high at over 30%. The fall harvest remains low, but spiked in 2007 with the introduction of a week-long shotgun season in certain WMDs (Table 5).

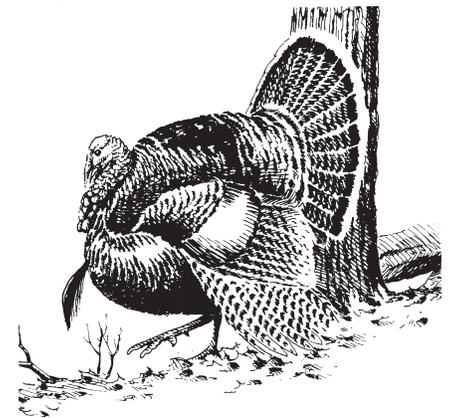


Table 5. Wild Turkey Spring (1999-2011) and Fall (2002-2011) Harvest.

Season	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Spring	890	1,559	2,544	3,391	3,994	4,839	6,236	5,931	5,984	6,348	6,043	6,077	5,445
Fall	NA	NA	NA	151	246	204	157	198	1,843	685	712	1,205	667

The 2011 spring wild turkey hunting season marked the second year that hunters could purchase a combination spring/fall wild turkey hunting permit for \$20. This permit allows the holder to take one bearded bird in the spring and one bird

(either a male or female turkey) in the fall. Hunters may choose to take an additional bearded bird in the spring if they purchase a second tag. Youth hunters with a valid junior hunting permit are not required to purchase a separate wild turkey hunting permit. The spring 2011 turkey harvest (5,445) was lower than the 2010 harvest (6,077). The 2011 spring harvest resulted in 4,803 hunters registering one bird, with 642 hunters registering two birds.

Additional wildlife management districts opened to wild turkey hunting

MDIFW continues to increase wild turkey hunting opportunity in WMDs with stable or increasing wild turkey numbers. As a result, WMD 9 was opened beginning in the spring of 2012. In addition, the spring harvest in WMDs 24 and 25 reached levels that allowed for additional fall hunting opportunity. These two districts are now open to a 4 week bow and 1 week shotgun fall season. MDIFW uses registration results from the spring harvest to determine when and where a fall hunting season can occur.

Ruffed Grouse

Beginning in 1994, moose hunters are asked to report the number of grouse (partridge) they and their party see or shoot 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 6). This past season (2011), observed grouse numbers per region were slightly below the 2010 observations, with the exception of the Northeast region where the number of grouse observed was at the 15-year high.

Table 6. Grouse Seen or Harvested/100 hours of Moose Hunter Effort in Maine for the last 15 years (1997-2011).

Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Northeast	24	42	41	30	53	23	35	27	11	26	37	31	48	47	59
Northwest	33	48	47	50	55	43	50	56	24	45	44	51	101	101	81
Eastern Lowlands	22	27	30	25	55	29	29	24	8	20	53	23	34	34	30
West & Mountains	26	41	29	28	30	25	26	30	13	25	44	19	36	36	32
Downeast	-	-	-	-	-	13	21	20	9	22	19	28	30	29	15
Statewide	25	43	37	33	48	31	34	33	13	24	39	27	47	46	43

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

–Kelsey Sullivan

Raptors: Recent Population Highlights

Bald Eagle

A statewide inventory of nesting bald eagles is planned for 2013. If you have knowledge of an eagle nest location or strongly suspect one, please contact MDIFW to share that information. Such assistance can boost the efficiency of aerial surveys and reduce program costs. More than 150 hours of flight time with Maine Warden Service and Maine Forest Service pilots is planned to evaluate eagle residency, breeding activity, and reproductive outcomes during March – June, 2013. The nesting inventory of bald eagle nests not only tracks population trends; it also supports the needs of landowners, conservation planners, development concerns, and researchers.

Next year’s survey will be the first statewide monitoring effort since 2008. In recent years, MDIFW has monitored between 30% and 50% of known nests annually for environmental reviews, project licenses, and special research. More than 750 intact nests are mapped, and the actual breeding population in 2012 likely exceeds 600 nesting pairs.

Decades of special monitoring and management of bald eagles followed their 1978 designation as an Endangered Species in Maine. Some special protections afforded by endangered species law and policies ceased after federal delisting in 2007 and state delisting in 2009. A federal law, the Bald Eagle – Golden Eagle Protection Act (see Internet link <http://www.fws.gov/northeast/EcologicalServices/eagle.html>) is now the primary legal standard. Contact USFWS at the Maine Field Office in Orono if you have further questions. MDIFW will continue to work with landowners of eagle habitat and conservation partners to promote acquisitions, conservation easements, and cooperative management agreements to bolster the “habitat safety net” for eagles and safeguard a lasting recovery of bald eagles in Maine.



Golden Eagle

We are working with individuals from other eastern states and provinces to examine genetic relationships of golden eagles in the east, study movement patterns, conduct a winter census using bait stations and trail cameras, and monitor the primary source population nesting in Quebec. The Eastern Golden Eagle Working Group identifies both information gaps and emerging conservation concerns. By all indications, the population nesting in northern Quebec and Labrador account for the increasing numbers seen during fall hawk watch stations in the Atlantic Flyway. However, the small isolated population on the Gaspé Peninsula in southern Quebec (adjacent to Maine) remains in jeopardy. We hope golden eagles in this nearby region can maintain themselves and possibly help repopulate Maine in the future. Despite occasional sightings and extensive information from one transmitter-equipped female that has summered mostly in Maine since 2009, we have no breeding records in the state since 1996. Please continue to relay your sightings, but note carefully the subtle details that distinguish golden eagles from the much more abundant subadult bald eagles.



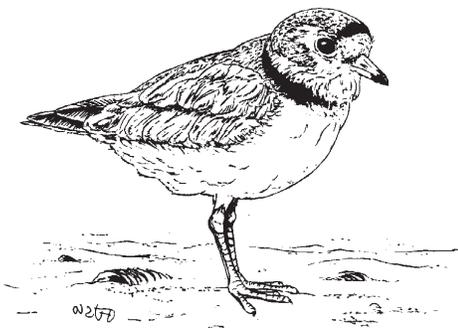
This work is supported by the federal State Wildlife Grants program and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

--Charlie Todd

Piping Plovers Continue to Struggle on Southern Maine Beaches

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. Until recently, the overall population trend had been one of increase.

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; municipalities, landowners, government agencies, and private organizations combined efforts to protect nesting piping plovers and attempt to reverse the declining population trend. MDIFW, Maine Audubon, Maine's Bureau of Parks and Lands, Rachel Carson National Wildlife Refuge, 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 committed to managing their beaches using guidelines established with MDIFW that provide recreational opportunities for beachgoers and still protect plover broods. These towns have included funds in their budgets to hire plover volunteer coordinators. Plover volunteer coordinators recruit and coordinate volunteers who monitor and help protect plover nests and chicks during the nesting season.



Intensive management efforts and dedication by the "plover community" in 2008 saw a reverse in the declining trend of plover productivity. Despite a 17-year low in nesting numbers, breeding success rose and a total of 24 nesting pairs successfully fledged 41 young. In 2011, 33 pairs of piping plovers returned to Maine and successfully fledged 70 young, which was the highest productivity experienced in Maine since 1993! In 2012, 42 pairs of piping plovers returned to Maine's beaches for another nesting season.

MDIFW is asking for help from all beachgoers to protect these remarkable birds by observing these simple guidelines:

- Avoid fenced areas marked with "Restricted Area" signs.
- Observe birds and chicks only from a distance, with binoculars.
- Keep pets off the beach or leashed from mid-April to 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; it attracts 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, funds from USFWS Landowner Incentive Program and federal Section 6 Funding, as well as state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

--Lindsay Tudor

Purple Sandpipers

The purple sandpiper (*Calidris maritima*) breeds in the high Arctic from eastern Canada through Greenland and Iceland to eastern Russia, and has the most northerly wintering distribution of any shorebird. In contrast to most other shorebirds that spend a delightful winter on warm southern beaches in the Caribbean and South America, purple sandpipers tough it out wintering along offshore, wave-exposed, rocky shorelines along the Atlantic coast in Atlantic Canada and the Gulf of Maine.

The purple sandpiper is identified in the U.S. Shorebird Plan as a species of high concern because each breeding population is thought to have small population sizes and restricted breeding ranges. However, there was considerable uncertainty about the actual status of North American purple sandpipers, and The Plan highlighted the need for accurate status and trend information for purple sandpipers.

In Maine, the purple sandpiper is identified as a Priority 2 Species of Greatest Conservation Need. Implementation of a monitoring plan is identified as a species specific conservation action in Maine's Wildlife Action Plan and is one of 10 focal species identified for conservation in the Atlantic Flyway Shorebird Conservation Strategy.

Because nesting purple sandpipers are difficult to locate and are dispersed throughout the expansive Arctic tundra, it was evident that monitoring purple sandpipers on their wintering areas, despite severe winter weather challenges, was the only way to address the important information gap regarding the population size, trends, and interchange between wintering and breeding populations.

During 2002–2007, MDIFW partnered with Maine Natural History Observatory and Acadia National Park to collect baseline information on population abundance, distribution, winter movements, and site fidelity of purple sandpipers wintering in Maine. This information was needed to develop a monitoring strategy.

To estimate the number of purple sandpipers wintering along the coast of Maine and identify key wintering areas, we systematically surveyed six watershed complexes, representing the entire coastline from York County to Washington County. Focusing on a particular region each winter, this effort consisted of 66 winter boat surveys conducted between 2002 and 2007.

Purple sandpipers can be difficult to detect and count when surveyed from a boat, especially during less than ideal wind, wave, and lighting conditions. These counts underestimate the actual number of birds because all sandpipers present during our surveys were not detected. Using a double observer approach, we estimated that we did not detect 13% of purple sandpiper flocks during our surveys, and all undetected flocks had fewer than 10 birds.

It is important to assess the degree of site fidelity and local movements of purple sandpipers, both within winter and return rates during subsequent winters, in order to assess the validity of our regional population surveys. To assess patterns of movements and site fidelity, 68 purple sandpipers wintering on rockweed covered ledges, located in Frenchman Bay and outer Jericho Bay, were captured using a net gun and outfitted with radio transmitters. Birds were tracked for an average of 92 days. Sixty percent of marked individuals moved less than 5 km between the two most distant relocations and no birds moved more than 25 km during the 2–4 month tracking period. Using this information each coastal region was surveyed using a single boat survey per 25 km section of coastline within a single winter season, thus covering the estimated home range of individuals and minimizing the chances of double-counting individuals within a single survey.

We detected and recorded 13,318 purple sandpipers wintering on the coast of Maine with over 7,000 sandpipers wintering in the midcoast region between Vinalhaven and Milbridge. Correcting for detection rates we estimate that 14,000 to 17,000 purple sandpipers were present in Maine during the winters of 2002–2007. Previous estimates for purple sandpipers wintering in all of eastern North America, based on an assessment of Christmas Bird Count Data, were estimated at 16,000. Our results clearly demonstrate that Christmas Bird Count is not a true indicator of purple sandpiper abundance and that Maine has a high proportion of conservation responsibility for this species.

This study not only provided information needed for conservation of this species, but also during the course of our investigation significant field and laboratory techniques were developed (in a sometimes hostile winter environment). MDIFW and Maine Coastal Observatory are currently sharing this information with the Canadian Wildlife Service, provincial biologists in Nova Scotia and New Brunswick, and Acadia University to establish a region-wide monitoring and genetics research program for this tough winter resident.

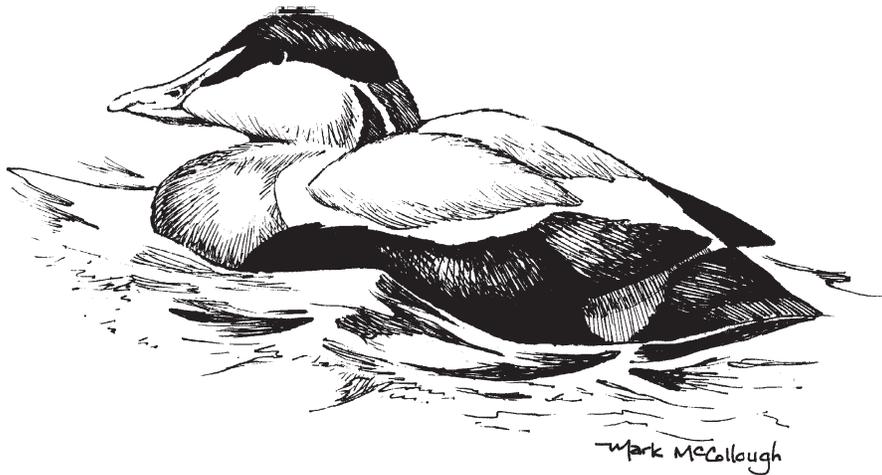
This work was supported by funds from National Park Service, Maine Outdoor Heritage Fund, federal State Wildlife Grant fund, State Surface Water Funds, and state revenues from the Loon Conservation Plate and Chickadee Check-off Funds.

-- Lindsay Tudor

Newly Described Virus Kills Thousands of Common Eiders Wintering Off Cape Cod

Wildlife disease management is an on-going challenge for wildlife biologists. Action is required when humans or domestic animals may be at risk, when it involves the deaths of highly valued wildlife species, or when our constituents demand that “something be done”. Recently, Bird Group biologists had been involved in a great deal of monitoring for Highly Pathogenic Avian Influenza (Bird Flu), a naturally occurring influenza virus found in some species of waterfowl and shorebirds. This virus is a particularly dangerous virus due to its potential impact on wild birds, domestic poultry, and human health should this virus be introduced into the United States. Our surveillance and samples revealed that some Maine birds carried a small number of relatively benign bird viruses. Thankfully, we never encountered the most deadly virus, known to researchers as H5 N1!

Today, we are faced with another intriguing bird disease issue. This too involves a bird virus, but, paradoxically, a virus never described before. This summer, Department biologist Brad Allen will oversee field collections of blood and eggs from healthy eiders to aid researchers trying to further our understanding of the possible routes of transmission (perhaps through the bite of a tick) of this killer virus and if some members of the eider population are carrying antibodies to the disease. But first, some background information on this disease.



Between 2006 and 2011, several common eider mortality events involving from 30–2,800 birds were observed along the coast of Massachusetts near Cape Cod, particularly Wellfleet Bay. The death toll from this virus may now be in excess of 6,000 eiders. Initially, the cause of the mortality was unknown. From 2009–2011, the Southeastern Cooperative Wildlife Disease Study (SCWDS) received a total of 17 birds from three of these events for diagnostic evaluation. Gross and microscopic findings revealed necrosis of the liver, kidneys, and spleen, which is consistent with multi-systemic disease. In late 2009, SCWDS diagnosticians isolated a previously undescribed orthomyxovirus, which was tentatively named the Wellfleet Bay Virus (WFBV), from three of these birds. Orthomyxoviruses are a group of RNA viruses that affect a wide range of species. Other viruses in this group include influenza viruses. Working in collaboration with multiple partners, efforts are currently underway to further characterize the virus. The potential population impacts related to these mortalities remain unknown.

Meanwhile, the USGS National Wildlife Health Center (NWHC) has been collaborating with SCWDS, the U.S. Fish and Wildlife Service (USFWS) and the Maine Department of Inland Fisheries and Wildlife (MDIFW) by providing diagnostic support and conducting experimental inoculation trials in captive eiders in order to further characterize this disease. The exact relationship of this new common eider virus to previously described orthomyxoviruses will not be known until the viral genetic sequencing is complete. While the genetic data will provide a better understanding of WFBV, much about WFBV remains unknown, including its host range, its temporal and geographic distribution, and its epidemiology.

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

--Brad Allen

MAMMAL GROUP

The Mammal Group is one of 5 groups in the Research and Assessment Section (RAS), in the Bangor Office. We develop and oversee the implementation of all management systems for Maine's mammals, conduct surveys, and collect a variety of biological information. We address public and Departmental informational needs through the development of research programs, monitoring protocols, species assessments, and public presentations. Finally, we assist in the formulation of harvest regulations by analyzing biological data, meeting with regional biologists in the Wildlife Management Section, and making recommendations to the Department's upper administration.

Wally Jakubas, Ph.D., Mammal Group Leader – Supervises mammal group personnel, oversees all group activities, coordinates group activities within and outside of the Department, writes grant proposals, manages the group's budgets, serves as the lead biologist on New England cottontail, wolf, cougar, and lynx ITP development, and is an external member of the graduate faculty for the University of Maine and University of New Hampshire.

Randy Cross, Wildlife Biologist – Supervises bear field crews in radiocollaring bears and collecting biological information; assists in analyzing bear data; oversees the processing and aging of moose, deer, and bear teeth; and gives numerous talks to the public during bear den visits. Randy is a highly experienced field biologist who has worked for the Department for 30 years.

John DePue, Wildlife Biologist – Oversees furbearer and small mammal management, annually reviews and proposes changes to Maine's trapping regulations, designs small mammal and furbearer surveys, writes grant proposals, assists with lynx ITP development, monitors white-nose syndrome in bats, assesses the impact of windpower projects on small mammals, and serves as Departmental spokesperson on furbearer and small mammal issues.

Lee Kantar, Wildlife Biologist – Oversees the management of Maine's white-tailed deer and moose populations. This includes developing and conducting aerial surveys, collecting biological data, making annual recommendations on the allocation of Any-deer and moose hunting permits, organizing IFW's monitoring effort for chronic wasting disease, and writing grant proposals. Lee is the Departmental spokesperson on deer and moose issues.

Jennifer Vashon, Wildlife Biologist – Oversees black bear and lynx programs, including collecting and analyzing biological data, writing grant proposals, making annual recommendations for black bear hunting and trapping, providing technical support on nuisance bear issues, developing and implementing lynx surveys and research, responding to incidentally caught lynx, and assisting with lynx ITP development. Jen also serves as the Departmental spokesperson on lynx and bear issues.

2011-12 Contract Workers & Volunteers – Bear Project: Lisa Bates, Landon Knittweis, Matt O'Neal, Joe Roy, Dan Wagner, John Wood; **Deer Project (including CWD):** Joe Bailey, Holly Bates, Lisa Bates, Jerry Collier, Philip Dumond, Wendall Harvey, Dan Kramer, Eldon McLean, Matt O'Neal; **Lynx Project:** Lisa Bates, Erica Johnson; **Moose Project:** Lisa Bates, Scott Belair, Dan Bergeron, Sarah Ann Boyden, Matt Crandall, Christi Dimon, Jennifer Dionne, Darryl Ann Giradin, Dan Hansche, Dave Hentosh, Joe Roy, Brock Sanborn, John Wood; **New England Cottontail Project:** Melissa Bolton, Jeff Feaga, and Brad Zitske.

We deeply appreciate the dedication and hard work we receive from our contract workers and volunteers!

MAMMAL CONSERVATION AND MANAGEMENT

White-tailed Deer

2011 Deer Harvest

Season Dates and Structure

Maine Deer hunters could hunt white-tailed deer for 79 days within the structure of five different hunting seasons during 2011; expanded and special (October) archery, rifle, muzzleloader, and youth day.

2011 Doe Quotas, Any-Deer Permits, and Applicants

During 2011, doe quotas (the number of does that can be harvested within population objectives in a Wildlife Management District [WMD]) ranged from 0 in 17 WMDs (1-12, 14, 18, 19, 27, and 28), to 630 does in WMD 21. Among the 12 WMDs in which a doe harvest was desired, the doe quota totaled 2,961. An expansion factor (the estimated number of permits required to harvest 1 adult doe) is applied to the doe quota to ensure that doe harvest objectives are met for

Table 7. Sex and age composition of the 2011 deer harvest in Maine by season type and week, statewide.

Season	Sex/Age Class				Total Deer	Total Antlerless Deer
	Adult		Fawn			
	Buck	Doe	Buck	Doe		
Archery	668	851	194	215	1,928	1,260
Expanded	365	466	107	125	1,063	698
October	303	385	87	90	865	562
Youth Day	208	204	70	55	537	329
Regular Firearms	11,368	2,767	736	596	15,467	4,099
Opening Saturday	1,018	302	92	71	1,483	465
Oct 31-Nov 5	2,434	692	186	145	3,457	1,023
November 7-12	2,301	480	140	112	3,033	732
November 14-19	2,759	410	123	95	3,387	628
November 21-26	2,856	883	195	173	4,107	1,251
Muzzleloader	542	182	54	44	822	280
Nov 28-Dec 3	279	60	23	16	378	99
December 5-10	263	122	31	28	444	181
Crossbow	12	13	2	3	30	18
Total	12,798	4,017	1,056	913	18,784	5,986

Records corrected for season omissions

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

55 Records missing season type

each WMD. Applying the expansion factor, permit levels for 2011 totaled 26,390 representing a 46% decrease in antlerless deer hunting opportunity compared to 2010 (48,825 permits). Permit allocations ranged from zero in 17 WMDs, to 5,670 permits in WMD 21. The top 5 WMDs receiving any-deer permits on a per 100 mi² basis were WMD 21 (1,178 permits), WMD 24 (935 permits), WMD 20 (620 permits), WMD 22 (526 permits), and WMD 23 (425 permits). Maine residents drew 18,378 permits (69.6%), landowners drew 6,599 permits (25%) nonresidents drew 1,181 any-deer permits (4.4%) and Superpack permittees won 232 permits. Overall, 67,157 people applied for any-deer permits during 2011 (62,692 residents, 8,557 landowners, 4,465 nonresidents, and 1,983 Superpack). Superpacks were all counted as part of resident applicants. This was an increase in applicants by 5% from 2010.

Statewide Statistics for 2011

Overall, 18,839 deer were registered during 2011, of which 1,928, 537, 15,467, and 822 were taken during the expanded archery and regular archery, youth day, regular firearms, and muzzleloader seasons, respectively (Table 7). There were 1,224 less deer harvested in 2011 than in 2010 (20,063 deer vs. 18,839), which represents a 6% decrease from the 2010 season.

Buck Harvest

The statewide harvest of antlered bucks (12,862) in 2011 is a 2% increase from the previous year (12,272; Table 8). The top 5 buck-producing (per mi² basis) WMDs in 2011 were (in descending order), districts 21, 24, 20, 22, and 23 (excluding 29), all in central and southern Maine. Among the antlered bucks taken in 2011, roughly 6,945 (54%) were 1 ½ year-olds (yearlings) sporting their first set of antlers, while more than 1,286 (10%) were mature bucks (4 ½ to 15 ½ years old). Male fawns are reported with antlerless deer.

Antlerless Deer Harvest

The statewide harvest of adult (yearling and older) does during 2011 was 3,783 which was 27% above the pre-set quota (~2,961 adult does; excluding WMD 29). During 2011, any-deer permittees also tagged 1,430 fawns, while archers and youth day hunters tagged 534 young of the year. Overall, 5,977 antlerless deer were registered by hunters during the 2011 season.

Table 8. Sex and age composition of the 2011 deer harvest in Maine by Wildlife Management District¹.

Wildlife Management District	Sex/Age Class				Total	
	Adult		Fawn		Antlerless Deer	All Deer
	Buck	Doe	Buck	Doe		
1	48	1	1	0	2	50
2	49	0	0	0	0	49
3	82	1	1	0	2	84
4	85	2	2	0	4	89
5	121	1	2	0	3	124
6	221	2	2	0	4	225
7	342	6	7	2	15	357
8	207	1	3	0	4	211
9	99	0	2	0	2	101
10	63	0	0	0	0	63
11	243	1	1	0	2	245
12	486	38	13	7	58	544
13	349	48	22	13	83	432
14	259	5	5	1	11	270
15	856	367	98	81	546	1,402
16	868	313	96	68	477	1,345
17	1,503	213	74	48	335	1,838
18	246	6	5	1	12	258
19	87	0	3	0	3	90
20	903	459	103	107	669	1,572
21	1,008	709	167	169	1,045	2,053
22	621	270	75	62	407	1,028
23	1,039	429	96	94	619	1,658
24	445	353	79	84	516	961
25	772	304	54	59	417	1,189
26	1,003	254	64	60	378	1,381
27	321	0	6	0	6	327
28	184	0	0	0	0	184
29	352	235	64	58	357	709
Statewide	12,862	4,018	1,045	914	5,977	18,839

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

Table 9. Deer registrations by season type and residence of successful hunters, statewide in Maine during 2011.

Season & Week	Deer Registrations By:			Percent by Residents
	Residents	Nonresidents	Total	
Archery	1,881	47	1,928	98
Expanded	1,036	27	1,063	97
October	845	20	865	98
Youth Day	528	9	537	98
Regular Firearms	14,145	1,322	15,467	91
Opening Saturday	1,483	0	1,483	100
Oct 31-Nov 5	3,181	276	3,457	92
November 7-12	2,718	315	3,033	90
November 14-19	2,956	431	3,387	87
November 21-26	3,807	300	4,107	93
Muzzleloader	790	32	822	96
Nov 28-Dec 3	358	20	378	95
December 5-10	432	12	444	97
Crossbow	30	0	30	100
Total	17,374	1,410	18,784	92

55 Records missing season type

Harvest by Season and Week

In 2011, approximately 91% of the total deer harvest occurred during the 4-week firearms deer season (Table 9). Total archery harvest increased (22%), while the muzzleloader harvest decreased (23%). The tenth youth day took place on Saturday, October 22nd. Due to the impacts from the severe winters, youth were relegated to bucks-only in buck-only WMDs but maintained either-sex opportunity in WMDs where any-deer permits were allotted.

Harvest By Hunter Residency

Residents tagged 92% (17,374 deer) of the total harvest during 2011 (Table 9). Among seasons, the proportion of the harvest registered by Maine residents was highest for the archery (98%) and youth day (98%), followed by muzzleloader (96%), and firearms (91%).

Regional differences occurred in the distribution of the harvest by residents and visitors to Maine. In the more populous central and southern WMDs, most successful deer hunters were Maine residents. In 2011, non-residents harvested fewer deer than in the past. The proportion of deer harvested by non-resident hunters was highest in WMD 4, along the Canadian border, where 44% of the harvest went to non-residents. At the other end of the spectrum, 99% of the deer killed in heavily populated WMD 22 (southern Maine) were registered by Maine residents (Table 10).

Hunter Participation and Success Rate

During 2011, 198,107 licenses that permit deer hunting were sold in Maine; of these 89% were bought by residents. Hunter density, therefore, averaged about seven per square mile, statewide, and these hunters expended an estimated 1.08 million hunter-days effort pursuing deer over Maine's 79-days of deer hunting.

Compared to the regular firearms season, which attracts over 170,000 participants, the expanded archery and special muzzleloading seasons attract far fewer hunters. In its 15th year, the expanded archery season attracted nearly 10,000 participants (over 90% residents). Participation in the special muzzleloading season continues to be strong with the sale of 15,186 permits.

Deer hunting success (based on total number of estimated hunters and registered harvest) in Maine during the regular firearms season was estimated at 11% in 2011. The success rate for hunters who drew an any-deer permit (range 20%–48%) is typically higher than for hunters who were restricted to "bucks-only" during the regular firearms season (range 7%–22%).

Prospects for the 2012 Deer Season

In 2012, we will offer 5 separate deer hunting seasons in Maine. The expanded archery season will open September 8th and run until to December 8th (79 days). This season is limited to WMDs 24 and 29 (formerly WMD 30 Northeast to Vinalhaven), as well as 10 other locations, primarily in residential-suburban sprawl areas with firearm discharge ordinances. Hunters with a valid

Table 10. Deer registrations by Wildlife Management District and hunter residence, 2011.

Wildlife Management District	Deer Registered By:				Total
	Residents		Nonresidents		
	Number	Percent	Number	Percent	
1	33	66	17	34	50
2	42	86	7	14	49
3	79	94	5	6	84
4	50	56	39	44	89
5	92	74	32	26	124
6	212	94	13	6	225
7	213	60	144	40	357
8	127	60	84	40	211
9	75	74	26	26	101
10	53	84	10	16	63
11	194	79	51	21	245
12	484	89	60	11	544
13	379	88	53	12	432
14	199	74	71	26	270
15	1,273	91	130	9	1,403
16	1,300	97	45	3	1,345
17	1,654	90	184	10	1,838
18	230	89	28	11	258
19	79	88	11	12	90
20	1,485	94	90	6	1,575
21	2,011	98	39	2	2,050
22	1,004	99	14	1	1,018
23	1,530	92	127	8	1,657
24	964	98	16	2	980
25	1,157	97	40	3	1,197
26	1,340	97	44	3	1,384
27	314	97	9	3	323
28	177	96	7	4	184
29	662	96	31	4	693
Statewide	17,412	92	1,427	8	18,839

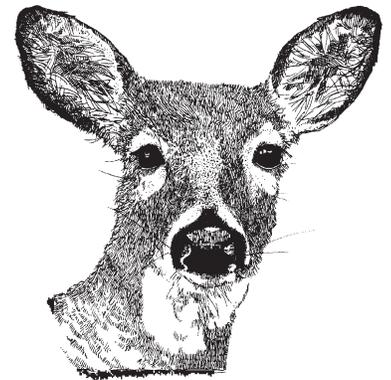
archery license may purchase multiple antlerless permits for \$12.00 each and one buck permit for \$32.00. This amount of bowhunting opportunity is aimed at increasing the harvest of does and fawns in order to meet population density objectives for areas that are difficult to access for hunting. In the 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 deer.

The regular (statewide) archery season will run from September 27th - October 26th (26 days). Youth day will be Saturday, October 20th, and is reserved for hunters between 10 and 15 years old, who are accompanied by a licensed adult (who is not allowed to carry a hunting weapon). The 25-day regular firearms season opens for Maine residents on Saturday, October 27th, and for nonresidents the following Monday. This season ends the Saturday following Thanksgiving (November 24th). Finally, the muzzleloader season will begin in all WMDs on November 26th, but will end on December 1st (6 days) in WMDs 1 – 11, 14, 19, 27 and 28. Elsewhere, the muzzleloading season will continue until December 8th (12 days). Crossbow archery season will coincide with modern firearms.

Availability of any-deer permits among our 29 WMDs is directly related to our deer management objectives. Very conservative doe harvests are required in eastern and northern WMDs where we are trying to increase deer densities. In contrast, does must be more heavily harvested in WMDs where current objectives are to stabilize deer populations to the 15 or 20 deer/mi². Abundance targets were set following input from a Public Working Group whose task was to formulate Maine's deer management goals.

To accomplish deer management objectives in 2012, we have set doe harvest quotas ranging from zero to 901 among our 29 WMDs. Totaling 4,398 does statewide, the 2012 doe quota is 9% above the doe harvest we achieved in 2011. The increased doe quota in 2012 reflects new information collected on deer abundance from aerial surveys, as well as to ensure attaining population objectives in south-central WMDs. A total of 34,160 any-deer permits will be issued statewide ranging from 175 permits in WMD 12 to 7,660 in WMD 21. No permits will be allocated in WMDs 1-11, 14, 18, 19, 27 and 28.

The allocation of 34,160 any-deer permits, along with the archery and youth seasons, should result in the statewide harvest of roughly 4,650 does and an additional 2,370 fawns in 2012. Antlered buck harvests should approximate 13,847, which is about a 8% increase from the 2011 buck kill of 12,862. If normal hunting conditions and hunter effort take place the statewide deer harvest in Maine should be in the vicinity of 20,865 deer.



Disease Monitoring in Maine's Deer and Moose

Chronic Wasting Disease:

Chronic Wasting Disease (CWD) is a fatal disease of the nervous system for members of the deer family, including white-tailed deer, elk, moose, and potentially caribou. The disease belongs to a family of diseases known as transmissible spongiform encephalopathies (TSEs). Other TSEs include scrapie in sheep, BSE or Mad Cow Disease in cattle, transmissible mink encephalopathy (TME) in captive mink, Feline spongiform encephalopathy (FSE) in cats, Creutzfeldt-Jakob disease (CJD) in humans, and variant CJD in humans (i.e., associated with Mad Cow Disease). Although similar in some respects, there is no known causal relationship between chronic wasting disease and any other TSE of animals or people.

Currently, CWD is known to infect free-ranging deer and elk in portions of Colorado, Illinois, Kansas, Maryland, Nebraska, New Mexico, New York, North Dakota, South Dakota, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming, Alberta, and Saskatchewan. In addition, CWD has been found in captive/farmed elk or white-tailed deer herds in Colorado, Kansas, Minnesota, Missouri, Montana, Nebraska, New York, Oklahoma, South Dakota, Wisconsin, Wyoming, Alberta, and Saskatchewan. Free-ranging moose have been detected with CWD in Colorado and Wyoming.

There is no evidence that CWD is present in wild white-tailed deer or moose in Maine, or in any captive member of the deer family in Maine (i.e., elk, red, sika, and fallow deer). In addition to our CWD monitoring program each year, Department of Inland Fisheries and Wildlife (DIFW) biologists examine 6,000 to 8,000 hunter-killed deer and 2,000 to 3,000 moose for management purposes. While conducting other fieldwork, wildlife biologists observe hundreds of live deer during a typical year. Biologists also respond to hunters who contact us when they kill apparently ill or injured individuals. To date, DIFW biologists have not observed symptoms consistent with CWD in Maine.

No sick animals that may fit the clinical profile for CWD have ever been brought to the attention of the Department of Agriculture (DOA) or private veterinarians from among Maine's licensed deer farms. Since autumn of 2001, more than 1,900 farmed-raised elk and deer slaughtered in Maine have been tested for CWD. To date, all tests have been negative for CWD. In a 1999 cooperative study, DIFW, DOA, and Center for Disease Control officials tested 299 hunter-killed white-tailed deer from the western mountains and foothills of Maine. All deer tested negative for CWD. From 2002 to

2011, DIFW biologists have collected samples and had tested over 8,100 hunter-harvested deer across the state. All deer tested negative for CWD. **At this time, we consider Maine to be CWD-free, based on available evidence. However, we are stepping up surveillance for wild deer and captive/farmed cervids to better evaluate CWD status in Maine, as is being done throughout the U.S.**

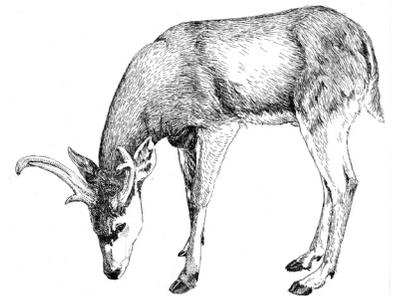
An abnormally-shaped protein called a CWD prion ('pree-on') causes certain other brain proteins to change to a diseased form. CWD prions then accumulate in the brain and other nervous tissues, where they physically damage affected nerve cells. Although the disease agent mainly targets nervous tissue, it occurs in most tissues of an infected animal, including muscle tissue. Infected individuals shed CWD prions in urine, feces, saliva, and eye fluids. There is no scientific evidence that CWD can be naturally transmitted to species outside the deer family, including cattle, horses, sheep, goats, or swine. There is currently no scientific evidence that CWD can infect humans. Nevertheless, public health officials recommend avoiding exposure to the CWD disease agents. Recently, CWD prions were found in the muscle tissue of infected mule deer. Therefore, muscle tissue from an infected animal should be considered a potential source of prion infectivity.

Chronic wasting disease is a slowly progressive disease; signs of sickness are usually not seen for 5 to 36 months after the disease agent enters the animal. Individuals showing symptoms of CWD tend to be 18 months of age or older. CWD damages the brain of infected animals, causing them to display unusual behavior, lose bodily functions, become very thin, and die within 1 to 12 months after symptoms of the illness first appear. Clinical signs identified in captive/farmed deer and elk include excessive drooling, excessive thirst, frequent urination, sluggish behavior, isolation from herd, teeth grinding, holding the head in a lowered position, and drooping ears. Although rare in cervids, rabies may produce some symptoms in common with CWD, such as erratic behavior and drooling.

CWD prions are very hardy; they are not easily destroyed by environmental factors, heat, or disinfection solutions. Therefore, CWD prions can remain in contaminated environments for many years. In mule deer, scientists have demonstrated that CWD prions are efficiently passed on from does to fawns. Furthermore, they suspect that this mode of transmission is important in sustaining CWD epidemics. The prions causing CWD occur in saliva, urine, feces, and eye fluids. Therefore, CWD is likely transmitted by direct contact with infected individuals, or by contact with contaminated soil, leaves, bedding, feed, or water. Frequent contact with other deer, such as what occurs when deer congregate around winter deer feeding stations or are kept in fenced-in enclosures increases the risk of transmitting diseases like CWD. Contact between wild and fenced cervids along fence lines can spread CWD in either direction. In addition, sites where CWD-infected cervids had died (or were placed) may become contaminated as tissues decompose. Predators and scavengers also transmit CWD prions after consuming infectious parts of CWD-infected cervids and may influence the spread of CWD in the environment.

Winter feeding of deer

If supplemental feeds are free from CWD infectivity, the practice of feeding deer in winter cannot cause a CWD outbreak. However, the close contact and crowding typically seen among deer at winter feeding sites can greatly accelerate the spread of infectious diseases like CWD if an outbreak occurs from other sources. Because of the long incubation period for CWD, an outbreak among white-tailed deer at feeding sites may spread to a large area long before clinically-ill individuals are observed. This would greatly hamper efforts to control the disease. Discontinuing the practice of winter feeding of deer makes great sense as a measure to prevent the spread of CWD. If you feed wild deer in Maine, please consider phasing out of the practice as soon as possible, as a disease prevention measure. IFW has produced an excellent video highlighting the pitfalls involved in feeding wild deer. It is available at nominal cost at the [online store](#).



Are urine-based deer lures safe?

In most cases, the urine used to formulate commercial "doe-in-heat" or other buck lures is collected from captive deer or elk farms. If CWD prions are passed in the urine of CWD-infected deer and elk, the infective agent may be present in these lures. If present, then CWD prions may inadvertently be placed where susceptible Maine deer may contact and ingest them. Depending upon how the lure is handled, CWD contaminated deer lures could also be a source of exposure (and inadvertent ingestion) by people. Researchers are demonstrating that once prions are in the environment they may contaminate the area by remaining in the soils for years to come.

To date, deer lures are not being checked for the presence of CWD prions. Until more is known about whether commercial deer lures pose a realistic risk of spreading CWD, we recommend that hunters use caution in spreading urine-based lures in the environment, and avoid placing the lures on their clothing or skin. Avoid placing deer lures on the ground or on vegetation where deer can reach them. Deer lures can be safely placed above deer height, allowing air circulation to disperse the scent. We would also strongly recommend using synthetic, non-urine based lures that have become available on the market.

The Departments of Agriculture, Human Services, and Inland Fisheries and Wildlife are coordinating efforts to prevent CWD from entering the state. The activities cover 3 key areas that are: 1) preventing introduction of CWD; 2) monitoring wild and farmed deer for CWD; 3) public outreach.

Preventing introduction of CWD: The Maine Department of Agriculture revised its cervid importation rules in 2010, lifting an embargo that had been in place since 2002. Cervid importations are now permitted in conformance with the Department's rules which require that animals come from 5-year CWD certified herds as well as from tuberculosis accredited-free herds.

Monitoring Wild Deer and Moose: The Department of Inland Fisheries and Wildlife has issued advisories covering:

1. Safe ways to import hunter-killed cervids (deer, elk, moose or caribou) from other states;
2. Cautious use and placement of urine-based deer hunting lures, while the safety of these products can be evaluated;
3. Voluntarily modifying or ending the widespread practice of feeding deer in winter, as a preventive measure.

Public Outreach: Good communication is important to disease prevention. Advisories to hunters, meat processors, taxidermists, deer farmers, and the public, suggesting ways to lessen the risks of introducing CWD into Maine, and providing basic facts about the disease will be issued.

More information about the 125th Legislature's resolves regarding winter feeding and risk of CWD in urine products and deer feed can be found here: http://www.maine.gov/ifw/hunting_trapping/hunting/MainesGamePlanForDeer.htm.

What can deer, moose, elk and caribou hunters do to avoid CWD risks?

If you plan to hunt deer, moose, caribou or elk in a state/province known or suspected to harbor CWD (see above for list of states and provinces), there are some commonsense precautions you should take to avoid handling, transporting, or consuming potentially CWD-infected specimens. The following precautions are adapted from the Wisconsin Department of Natural Resources:

General precautions:

- Do not eat the eyes, brain, spinal cord, spleen, tonsils, or lymph nodes of any deer.
- Do not eat any part of a deer that appeared sick.
- If your out-of-state deer is sampled for CWD testing, wait for the test results before eating the meat.

Field dressing and processing:

- Wear rubber or latex gloves while handling the carcass.
- Minimize contact with the brain, spinal cord, spleen, and lymph nodes (lumps of tissue next to organs or in fat and membranes) as you work. If removing antlers, use a saw designated for that purpose only.
- Use a hunting knife, not knives used at the dinner table, clean knives and equipment of residue and disinfect in a 50/50 solution of household chlorine bleach and water for 1 hour.
- Do not cut through the spinal column except to remove the head. Use a knife or saw designated only for this purpose.
- Bone out the meat from the deer and remove all fat and connective tissue (the web-like membranes attached to the meat). This will also remove lymph nodes.
- Remove all internal organs, dispose of feet, hide, brain and spinal cord, bones, and head by burial, or other means that prevents contact by live deer.

Can I bring intact deer, moose, caribou or elk carcasses from other states into Maine?

To prevent the introduction of CWD into Maine and pursuant to 12 MRSA Part 12, Chapter 903, Subchapter 2, §10103 sub-§2 and §10104 sub-§1, and in an attempt to eliminate or minimize the risk of introducing chronic wasting disease [CWD] into Maine, it is illegal for individuals to bring into Maine cervid carcasses or parts, except that the following carcass parts may be imported and possessed: boned-out meat, hardened antlers, skull caps that have been cleaned free of brain and other tissues, capes and hides with no skull attached, teeth, and finished taxidermy mounts.

Cervid carcasses or parts from the State of New Hampshire and the Provinces of New Brunswick, Labrador, Newfoundland and Quebec are exempt from this transportation restriction. The Commissioner may, pursuant to the statutory authority above, issue a permit to a person or institution for the purpose of importing other cervid carcass parts into Maine for possession in Maine. The Commissioner may set special conditions on the permit to mitigate potential disease-related impacts. This transportation restriction applies to both any cervid wild by nature and to any cervid killed in a commercial hunting preserves, that are taken in any state, province, or country outside of Maine.

Any person who imports into Maine any cervid carcass or parts described above and is notified that the animal has tested positive for Chronic Wasting Disease must report the test results to the Department within 72 hours of receiving the notification. In order to facilitate the proper disposal of any infected material, the Department may take into possession any imported carcass or carcass part of an animal if the animal has tested positively for Chronic Wasting Disease.

Can I get my Maine deer, caribou, moose or elk tested for CWD?

Although our system can accommodate enough samples (less than 1,000) from farm-raised and wild deer to scientifically monitor for CWD, we are not able to routinely test hunter-killed deer, moose, caribou, or elk in Maine at this time.

What if I see a deer or moose showing signs of CWD in Maine?

Early detection of diseased individuals provides the best means we have of controlling or eradicating the disease. Therefore, if you observe a deer or moose that clearly shows symptoms of CWD, do not kill or handle the deer. Report the sighting to an Inland Fisheries and Wildlife biologist or game warden (see back page of this report for phone numbers). Again report only deer showing all or most of these CWD symptoms: extreme thinness, unaware or unafraid of people, shaking or unable to walk normally, drooling, can't raise the head, and ears drooping.

For more information:

The following websites are good sources of information about Chronic Wasting Disease:

www.state.me.us/agriculture www.aphis.usda.gov/oa/cwd www.cwd-info.org www.cdc.gov www.scwds.org

If you have questions about CWD prevention efforts in Maine, the following contacts are suggested:

Hunting, monitoring of wild deer:

Information Center, Dept. of Inland Fisheries and Wildlife, 284 State Street, 41 SHS, Augusta, ME 04333-0041
(207) 287-8000, ifw.webmaster@maine.gov

Regulation of Captive/Farmed Deer or Elk:

Dept. of Agriculture, Food, and Rural Resources, Deering Bldg, AMHI Complex, SHS #28, Augusta, ME 04333-0028
(207) 287-3701

Questions about CJD, variant CJD, or other Human TSEs:

Maine Dept. of Human Services, Bureau of Health, SHS #11, Augusta, ME 04333-0011
(207) 287-7087

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--Lee Kantar

Moose

2011 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 2011. The September season ran from September 26th to October 1st, while the October season ran from the 10th through the 15th. For the second year, a third week of hunting was offered in the North Country (Wildlife Management Districts [WMDs] 1-8, and 11) from November 7th through November 12th. In 2011, WMDs 22 and 25 were added to the southern Maine moose hunt that also includes WMDs 15, 16, 23 and 26. The southern Maine moose hunt runs concurrently with the November deer season from October 31st to November 26th and opened for Maine residents on October 29th.

Moose Permits and Applicants

The annual allocation of moose permits is a function of the WMD's specific management goals. Moose management goals are categorized as either recreational, compromise, or road safety. Permit levels changed in 8 management districts between 2010 and 2011 providing an overall increase of 722 permits. This included increased antlerless permits in WMDs 1-8, as well as the opening of WMDs 22 and 25 with 65 Any-moose permits. The number of moose permits allocated in 2011 was 3,825, while 3,903 permits were issued. Excess 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 2011, Antlerless-only Permits (AOPs) ranged from zero in 4 WMDs (districts 9, 14, 27 and 28) to 300 in WMD 2. Among the 15 WMDs in which a cow harvest (and AOPs) was desired, the permit allocation totaled 1,547. The number of AOPs allocated in a given district is a reflection of a harvest level that will either grow, decline, or stabilize the WMD's population. Consequently, WMDs that can sustain



only limited cow mortality are allocated relatively few antlerless permits. 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. Since moose densities are low in southern Maine, an Any-moose permit was allocated for these areas, which enables a hunter to take a bull, cow, or calf. 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, 49,889 people applied for a moose permit during 2011. This included 36,535 residents and 13,354 non-residents. Out of those applicant pools, 9.5% of the residents and 2.8% of the non-residents were selected for permits.

Statewide Statistics for 2011

Overall, 2,582 moose were registered during 2011 (Table 11). 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 statewide harvest of antlered bulls during the Sept/Oct/Nov season (1,593) in 2011 marked a 5% decrease from the previous year (1,680). Among the antlered bulls taken in 2011 (and aged by tooth-cementum annuli = 1,414), 127 (9%) were 1½ year-olds (yearlings) sporting their first set of antlers, while 341 were 2½ years old (24%). Yearling bulls typically appear under-represented in the harvest, likely due to hunter selection. Mature bulls (4½ to 14½ years old) comprised 67% of bulls older than 2½ years.

On average, breeding bulls lose approximately 15% of their body mass during the rut. Because of this and the timing of the fall harvest, bull weights reflect a decrease in body mass from September to October. Average bull weights (yearling and older) in the 2011 harvest for September were 736 pounds versus 674 pounds in the October harvest (an 8% decline). The heaviest bull weighed in at 1,045 dressed (no digestive tract, heart, lungs, or liver) and was killed in WMD 4 during the September season (8.5 years old). The largest antler spread was 64 inches on a 10.5 year-old bull harvested in WMD 3. Two bulls with the greatest number of antler points (28) were recorded in WMD 19 and WMD 3. Among 1,593 antlered bulls examined in the harvest, 15% of the bulls sported cervicorn antlers (antlers without a defined palm), and 38% of these animals were yearlings; 15% were mature bulls (>4 years old) including the oldest at 10.5 years-old.

Antlerless Harvest

The statewide harvest of adult (yearling and older) cows during 2011 increased by 36% over the 2010 harvest (849 vs. 622, respectively); during 2011, antlerless-only permittees tagged 124 calves (66 males and 58 females). Overall 973 antlerless moose were registered by hunters during the 2011 season. This increase included the antlerless moose taken as part of the 135 Any-moose permits issued within the southern zones. The antlerless moose harvest in the southern zones was comprised of 14 adult cows and 5 calves (2 males and 3 females).

Moose Reproduction Data

Antlerless permits during the November season in WMDs 1-8 allowed us to collect reproductive data on moose that are critical to assessing and monitoring population health and growth. In 2011, hunters removed and brought in 192 sets of ovaries for examination by biological staff. Of the cow moose with age and weight data, 86% were pregnant including 10% of yearlings. Typically, moose do not become pregnant for their first time until 2-years old, since pregnancy status is closely tied to body weight and condition.

'Corpora lutea' are identifiable structures within the ovaries that provide an indication of ovulation and potential pregnancy rates. Overall, there were 1.13 corpora lutea / cow for cows older than 3.5 years. This may be an indication that moose in the northern portion of the state are near ecological carrying capacity, since the amount of available forage is what allows cows to attain the body weight necessary for reproductive success. We anticipate that additional sampling of female moose will provide a clearer picture of this relationship across northern Maine as well as regionally.

Hunter Participation, Residency and Success Rate

In 2011, 3,508 residents and 395 non-residents won permits to hunt moose. A total of 311 non-residents were successful in their hunt providing a 79% success rate. Out-of-state hunters came from 34 states (as far away as Alaska) and 4 provinces (New Brunswick, Nova Scotia, Ontario and Quebec). The majority (18%) of out-of-state hunters came up from Massachusetts. Resident success rates were 65% and when combined with the outstanding success by out-of-staters, the total success rate was 66% statewide. Success rates over the last 9 years have been around 79%. The temperatures during the 2011 moose season were historically warm. All three 6-day seasons suffered from unseasonably warm conditions, including temperatures >20°F above normal. Moose hunters provide important sighting-rate data through volunteer surveys that aid in moose population management.

Table 11. Moose harvest by season, permit type (BOP: Bull-only; AOP: Antlerless-only; and, AMP: Any-moose) and success rate in 2011 statewide, Maine.

WMD	Season	Permit Type	2011 Registrations			WMD	Season	Permit Type	2011 Registrations		
			Number of Permits	Kill	Success Rates				Number of Permits	Kill	Success Rates
1	Sept.	BOP	93	79	85%	12	Oct.	BOP	36	30	83%
	Sept.	AOP	5	3	60%		Oct.	AOP	20	10	50%
	Oct.	BOP	60	53	88%	WMD Subtotals			56	40	71%
	Oct.	AOP	15	13	87%	13	Oct.	BOP	36	16	44%
	Nov.	AOP	55	43	78%		Oct.	AOP	11	7	64%
WMD Subtotals			228	191	84%	WMD Subtotals			47	23	63%
2	Sept.	BOP	90	86	96%	14	Oct.	BOP	35	29	83%
	Sept.	AOP	50	40	80%		WMD Subtotals			35	29
	Oct.	BOP	42	40	95%	15	Nov.	AMP-B		11	
	Oct.	AOP	75	65	87%			AMP-C		3	
	Nov.	BOP	22	22	100%	WMD Subtotals			25	14	56%
	Nov.	AOP	176	121	69%	16	Nov.	AMP-B		3	
WMD Subtotals			455	374	82%			AMP-C		7	
3	Sept.	BOP	103	103	100%	WMD Subtotals			20	10	50%
	Sept.	AOP	101	56	55%	17	Oct.	BOP	30	10	33%
	Oct.	BOP	52	51	98%		Oct.	AOP	30	5	17%
	Oct.	AOP	91	63	69%	WMD Subtotals			60	15	25%
	Nov.	BOP	50	35	70%	18	Oct.	BOP	69	27	39%
	Nov.	AOP	100	83	83%		Oct.	AOP	20	11	55%
WMD Subtotals			497	391	79%	WMD Subtotals			89	38	43%
4	Sept.	BOP	194	164	85%	19	Sept.	BOP	61	24	39%
	Oct.	BOP	64	54	84%		Sept.	AOP	10	5	50%
	Oct.	AOP	32	24	75%		Oct.	BOP	21	13	62%
	Nov.	AOP	96	63	66%		Oct.	AOP	10	7	70%
WMD Subtotals			386	305	79%	WMD Subtotals			102	49	48%
5	Sept.	BOP	100	85	85%	22	Nov.	AMP-B		0	
	Oct.	BOP	31	26	84%			AMP-C		1	
	Nov.	AOP	63	41	65%	WMD Subtotals			20	1	5%
WMD Subtotals			194	152	78%	23	Nov.	AMP-B		1	
6	Sept.	BOP	123	98	80%			AMP-C		1	
	Sept.	AOP	72	28	39%	WMD Subtotals			45	2	4%
	Oct.	BOP	51	43	84%	25	Nov.	AMP-B		6	
	Oct.	AOP	85	62	73%			AMP-C		4	
	Nov.	BOP	50	30	60%	WMD Subtotals			45	10	22%
	Nov.	AOP	127	61	48%	26	Nov.	AMP-B		2	
WMD Subtotals			508	322	63%			AMP-C		6	
7	Oct.	BOP	125	91	73%	WMD Subtotals			45	8	18%
	Nov.	AOP	64	39	61%	27	Oct.	BOP	25	5	20%
WMD Subtotals			189	130	69%		WMD Subtotals			25	5
8	Oct.	BOP	237	177	75%	28	Oct.	BOP	35	16	46%
	Nov.	AOP	118	74	63%		WMD Subtotals			35	16
WMD Subtotals			355	251	71%	OVERALL WMD TOTALS			3,903	2,582	66%
9	Oct.	BOP	50	44	88%						
	WMD Subtotals			50	44	88%					
10	Oct.	BOP	101	45	45%						
	Oct.	AOP	10	7	70%						
WMD Subtotals			111	52	47%						
11	Sept.	BOP	77	33	43%						
	Sept.	AOP	30	6	20%						
	Oct.	BOP	50	24	48%						
	Oct.	AOP	40	16	40%						
	Nov.	BOP	35	16	46%						
	Nov.	AOP	50	15	30%						
WMD Subtotals			282	110	39%						

Changes for the 2012 Moose Season

In 2012, we will offer 4 separate moose hunting periods in Maine during September, October, and November. The September season will run from September 24th to September 29th in WMDs 1-6, 11 and 19. The October season will run from October 8th through the 13th and include WMDs 1-14, 17-19, 27, and 28. In WMDs 15, 16, 22, 23, 25, and 26, the season will coincide with November's deer season running from October 29th through November 24th; opening day for Mainers will be on Saturday, October 27th. The month-long November hunt in southern Maine will again include WMDs 22 and 25 for a total of 200 permits allocated for any moose (bull, cow, or calf). Also for 2012, WMDs 1-8 and 11 will have an additional moose hunt in November from the 5th through the 10th. In total, Maine's moose hunt will offer 3,725 permits for 2012.

A New Era of Information on Moose

In the winter of 2010-11, the MDIFW implemented a new aerial survey technique to estimate moose abundance in three northern WMDs. Results from these surveys proved reliable and cost-effective. Last winter we continued our aerial survey work completing estimates of moose numbers in 6 additional management units. We also implemented aerial moose composition surveys that allow us to count the number of bulls, cows, and calves in each management unit that was flown. These surveys provided IFW with the most reliable estimate of moose (~76,000), to date, across Maine's core moose range (essentially the commercial forestlands). With the reproductive data we collected on female moose (ovaries), summer-autumn calf recruitment rates evidenced by winter-time aerial surveys, and the information on bull and cow age structures and general survival rates obtained from moose teeth, we are developing a more complete picture of our moose population. Overwinter survival of moose calves may be an issue to investigate further, and we are doing what we can at this time to investigate potential influences of parasites such as winter tick and lungworm.

Winter Tick and Lungworm Monitoring in Moose

Winter tick (*Dermacentor albipictus*) is a large tick that spends most of its life cycle on the back of moose. The larval stage ticks quest (search) for unsuspecting hosts (moose) during the fall and once attached to the moose overwinter within the moose's hair. Sometime in March or April adult winter ticks mate and take a blood meal that in some moose with heavy tick loads can result in extensive blood loss. Heavy infestations in moose, especially overwintering calves, can result in their death, especially when combined with other parasites including lungworms.

Winter tick infestations on moose occur across the state each winter, but the annual severity of these infestations, geographical distribution, and effect on specific age groups is not clear. MDIFW has been monitoring winter tick abundance on moose at moose registration stations during the October season since 2006. The department has also been working with New Hampshire and other jurisdictions to gain a better understanding of the role winter tick and lungworm play in calf mortality and population growth or decline. In addition Wildlife Biologists and Game Wardens routinely monitor and assess moose that are found dead in the woods, hit by vehicles or euthanized. Gross necropsies are performed on some of these moose to further evaluate the presence of lungworm and other potential pathogens/diseases that may affect moose in the state. We continue to work closely with the Animal Health Laboratory at the University of Maine and fully recognize the importance of disease surveillance and monitoring in order to firmly understand the impacts of disease on Maine's population of moose.

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

--Lee Kantar

Black Bear

The expansive forest of northern, eastern, and western Maine supports the largest black bear population in the eastern United States (Figure 1). Historically, bears were considered a pest and indiscriminately hunted, which along with forest clearing for agriculture, virtually eliminated bears in a portion of the state. Today, black bears are highly valued by hunters, outdoor enthusiasts, and the general public. Conflicts between foraging bears and people still occur as bears seek out high calorie rewards. Our management strives to conserve bears and provide hunting and viewing opportunities while minimizing conflicts with people. For more than 35 years, the Department has monitored bears in 3 different areas to ensure our management decisions are based on current and sound information. Recently, we began an effort to update and improve our bear population estimates by equipping a sample of bears with Global Positioning Systems (GPS) collars. These collars provide us with data on a bear's locations throughout the year, which helps us estimate the density of bears within each habitat type. We are also evaluating other techniques that may help us monitor Maine's bear population more efficiently. One method requires a successful hunter to submit a tooth from the bear they

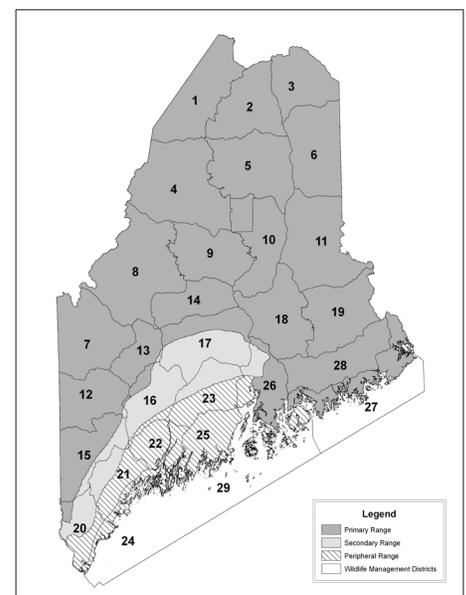


Figure 1. Maine Black Bear Range.

harvest. These teeth allow us to determine how old each harvested bear is to help us understand the age structure (i.e., proportion of bears in each year class) and survival rates of the broader population. This, in turn, allows us to determine whether the population is increasing, decreasing, or remaining stable (population trend). After several years of collecting teeth, we will have sufficient information to determine the population trend and estimate the minimum number of bears present in the population.

Living with Black Bears

The abundance of natural resources, including wildlife, is what makes life in Maine special and enjoyable. In fact, more than 90% of Maine is forested, which has allowed Maine's bear population to thrive. Despite a large population of bears, conflicts between people and bears are relatively few. However if you live in a community that is experiencing problems with bears, this may not seem to be the case. Every spring, bears emerge from their winter dens and begin searching for food. Some bears encounter food odors that attract them to people's homes. Often, when berries begin to ripen in late summer, bears return to wooded areas to forage, which reduces nuisance activity. When 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 odors, more bears will continue to visit your backyard.

All of us can take a few simple steps each spring to reduce undesirable encounters with black bears in our backyards:

- Bring your bird feeders in by April 1 and do not resume feeding birds until late fall.
- Store bird seed in a secure location and remove waste seed from the ground.
- Keep your garbage secure in a building.
- Bring your trash to the curb on the morning of pick-up, not the night before.
- Keep dumpster lids secure 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, agriculture crops, and livestock because trapping and moving bears 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 other areas. Relocated bears are at greater risk of mortality as they encounter more roads, other bears, and people. However, it may be appropriate to move a bear in some situations to provide a temporary solution. But after the bear is moved, attractants must be removed or secured to prevent future problems. To avoid enticing bears to your backyard or field, the best solution is to remove/secure common bear attractants every spring before you experience problems. To learn more about what you can do to minimize conflicts with bears visit www.bebearaware.com.

The 2011 Black Bear Hunting and Trapping Season

The Department's management of Maine's black bears includes regulating the harvest by setting the season length, bag limit, and legal methods of hunting. We require that hunters report their harvest so we can monitor harvest levels. The Department can make adjustments to these 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. 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 hounds for a 6-week period that overlaps the last 2 weeks of the bait season.

Trappers can harvest a bear in September or October. In 2011, 355 residents and 40 non-residents bought trapping permits and took 52 and 18 bears, respectively. This is the highest number of trappers purchasing a bear permit since trappers were required to purchase a permit to trap a bear (2008). A new law that took effect in late September of 2011 allowed a trapper to take a second bear – before or after taking one by other methods. Seven bears were trapped in 2011 by hunters who harvested another bear by other methods. Starting in 2012, a trapper may take a bear in a trap (September 1-October 31) and a second bear harvested by other methods (August 27-November 24). Trappers must use a cable foot snare or cage style trap.

Most bears in Maine are harvested by hunting over bait. In 2011, 75% were taken over bait, 12% with hounds, 6% by deer hunters, 4% by still-hunting or stalking prior to deer season, and 3% in traps. 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.

The 2011 harvest of 2,400 bears is 22% lower than the previous year's harvest of 3,062 bears and is the lowest harvest since 1997. Many factors influence the harvest of black bears in Maine with the abundance of natural foods during the baiting season being first and foremost. The weather during the 4 week season, especially during the first 2 weeks, also impacts the final tally. Abundant natural foods in the late summer and

Table 12. Number of bears harvested in Maine in 2011 by Wildlife Management District (WMD).

WMD	Method of Take				Total Harvest	Assisted by Guide	Resident	Non-resident	
	Hunting with Bait	While Deer Hunting	Hunting with Dogs	Trapping Unknown					
1	81	3	15	0	8	107	98	17	90
2	86	3	17	0	8	114	95	22	92
3	168	4	11	12	11	206	138	73	133
4	121	4	2	0	4	131	100	38	93
5	106	0	15	3	4	128	120	15	113
6	144	13	13	3	13	186	114	78	108
7	71	7	11	8	1	98	65	29	69
8	92	12	33	11	4	152	94	67	85
9	53	7	5	1	2	68	44	26	42
10	62	1	11	1	2	77	56	15	62
11	183	12	30	3	3	231	170	65	166
12	58	7	26	4	5	100	39	58	42
13	29	9	13	2	1	54	22	35	19
14	37	4	10	2	2	55	37	26	29
15	27	11	11	2	1	52	6	45	7
16	3	1	1	1	1	7	1	6	1
17	42	8	9	1	5	65	20	45	20
18	109	8	14	1	5	137	70	64	73
19	92	4	23	8	7	134	99	27	107
20	6	0	1	0	3	10	0	10	0
21	0	1	0	0	0	1	0	1	0
22	0	0	0	0	0	0	0	0	0
23	2	6	0	0	0	8	1	7	1
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	37	4	0	0	7	48	4	44	4
27	25	8	6	3	1	43	5	36	7
28	126	4	20	4	3	157	114	47	110
29	26	3	1	0	1	31	15	21	10
Totals	1,786	144	298	70	102	2,400	1,527	917	1,483

early fall reduced bait interest and activity by bears, and as a result 2011 was the worst year in many years for hunting bears over bait. Hunters and guides reported fewer bears visiting bait sites and many bears delayed visits until after legal shooting hours. Because the bait harvest comprises the greatest portion of the overall harvest it has the greatest effect on the final harvest figures. This, combined with the poor economy, resulted in the lowest number of early-season bear hunters (prior to deer season) since we began requiring a permit in 1990; 8,881 permits were sold, of which 4,138 were residents and 4,743 were non-residents. 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 2011 resident success rate = 18% and non-resident success rate = 30% during the early season). In 2011, 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 bear hunters and accounted for 62% of the bears harvested by Maine residents. Although few bears are taken during the firearms season for deer or in traps, Maine residents harvested the majority of bears taken by these methods (85% and 74% respectively in 2011; Table 12).

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. This downward trend in participation rates



is especially significant for non-resident hunters. The downturn in the U.S. economy has likely contributed to recent lower bear hunter participation, especially among non-residents. 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 process teeth from harvested black bears to monitor the age structure of Maine's bear population and trends in bear numbers. In 2011, 782 non-resident bear permits for deer season and 395 trapping permits were sold.

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

--Randy Cross and Jennifer Vashon

Canada Lynx

The lynx is a medium-sized cat and can be distinguished from a bobcat by its completely black-tipped tail, longer ear tufts, and larger paws. Lynx populations are influenced by the numbers and distribution of snowshoe hare -- their primary prey. Maine is at the southern extent of the lynx range where forests transition from spruce-fir to hardwood and where winter snow depths lessen. When compared to historic records, snow track surveys initiated in 2003 indicate that lynx distribution has not changed substantially over the last 100 years. Lynx remain common north of Moosehead Lake and west of Route 11 and increasingly rarer in the rest of the state as one moves away from this core area. Canada lynx are federally-listed as a threatened species, and Maine is home to the only known breeding population of Canada lynx in the eastern United States, although breeding lynx may now exist in northern New Hampshire too (Figure 2).

A History of Lynx in Maine

Snowshoe hare are most numerous in young stands of spruce and fir and forests with a dense understory of young conifers. Historically, it appears that lynx have persisted in low numbers with brief periods of abundance. Lynx were likely relatively common in the mid-1800s following a major spruce budworm outbreak and subsequent harvest of spruce and fir. As the forest matured again, lynx again became less common by the mid-late 1900s. By the late 1970s, mature spruce and fir reached record levels, which helped trigger another major budworm outbreak. The extensive clearcutting that followed created record levels of lynx habitat by the late 1990s and into this current century.

State and Federal Protection

A statewide bounty was offered on all wildcats until 1967, and hunting and trapping seasons on lynx were also closed at that time. In 1997, lynx were designated as a species of special concern by the State of Maine. The special concern designation is given to species that may become endangered or threatened and thus warrant special attention. In 2000, the US Fish and Wildlife Service (USFWS) listed lynx as a threatened species in 14 states including Maine. Although federally listed, lynx did not meet the State's threatened or endangered listing requirements. Information gathered from snowtrack surveys and telemetry studies in northern Maine were critical in making this determination. In 2005, the USFWS drafted a recovery outline for lynx that serves as an interim guide for recovery, and in 2009 the USFWS designated 9,500 mi² of private forest in northern Maine as habitat critical to lynx recovery.

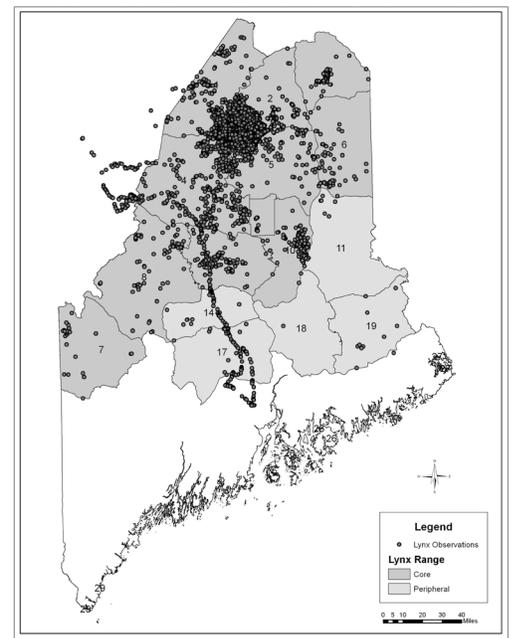


Figure 2. Lynx observations and geographic range in Maine.

As a federally-listed species, lynx are protected from intentional and accidental harassment (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 takes of lynx in Maine. In 2008, the Department submitted an incidental take plan that would allow a low level of incidental take of lynx by fur trappers by providing measures to minimize the accidental catch of lynx in traps to the maximum extent practicable. The USFWS is currently reviewing this plan. Since altering upland trapping regulations in 2008 specifically to protect lynx, there has been zero lynx known to be killed in legal trap-sets in Maine; there are a few lynx released unharmed from foothold traps each year, and State biologists are required to examine as many of these animals as possible prior to release.

From Research to Management

Biologists at IFW have been in the process of building a lynx management system that involves collecting field data, analyzing what it means, getting input on management goals, and developing a management system. The process started in the winter of 1999 with the first radiotelemetry study on Canada lynx in Maine. 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, we prepared an assessment of lynx habitat and population levels in Maine to guide future management decisions. This document is available on the Department's website and describes what is known about Canada lynx in the northeastern U.S.

The Lynx Assessment relied heavily on our 12-year study of lynx in northern Maine. From 1999-2011, Department wildlife biologists captured and radiocollared 85 lynx and documented the production of 42 litters of kittens on 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 a productive source population this past decade, producing an excess number of animals available to further increase local population abundance or disperse into new areas. Dispersal behavior was evident in some collared lynx.

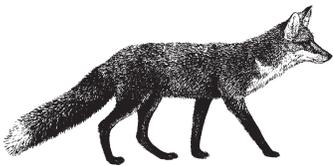
The spruce budworm outbreak and extensive salvage logging of spruce and fir led to an abundance of optimal foraging habitat (young spruce/fir forest cover for hare) for lynx over the last decade. By 2006, the number of lynx in northern Maine's spruce/fir forest reached a historic high of at least 750 to 1,000 adults. However, this level of cutting was not sustainable (e.g., ~50% of Maine's spruce and fir is classed as young forest). Future sustainable management of northern Maine's spruce/fir forest probably cannot produce similarly high levels of snowshoe hare and lynx habitat but may result in a more stable lynx population even if that future population has fewer animals than what currently exists. Forest management that maintains connected patches of dense to moderately dense young spruce/fir will benefit lynx. Conversely, forest management that harvests younger trees, particularly sapling spruce and fir, does not promote moderate to dense regenerating of spruce and fir, or fragments lynx habitats may be detrimental to lynx.

Because lynx have a competitive advantage over other predators in deep snow, predictions of winters with more rain may cause lynx to retract northward. Consequently, efforts to maintain connectivity between neighboring lynx populations in Quebec and New Brunswick may allow lynx to persist longer in more northern portions of the state. Regardless of climate change, Maine's lynx population may never be as abundant again as it was recently. Thoughtful planning and continued monitoring is needed to ensure conservation of a reduced, but more stable, population of lynx in northern Maine.

To learn more about lynx in Maine, visit: http://www.maine.gov/ifw/wildlife/management/lynx_theMaineStory.htm.

This work is supported by the federal State Wildlife Grants and Pittman-Robertson Funds programs, and state revenues from the Loon Conservation license plate, Chickadee Check-off, and sales of hunting and trapping licenses.

--Jennifer Vashon



Furbearers and Small Game Mammals

Furbearers include all mammals harvested primarily for their pelts. In Maine, these include 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 species (i.e., fox, coyote, bobcat, raccoon, and skunk) are also hunted. Small game that can be hunted includes snowshoe hare, gray squirrel, woodchuck, porcupine, and red squirrel.

Overview of Trapping Season

Very mild weather during the 2011-2012 trapping season helped trappers pursue certain species but also made it difficult to catch others (Table 13). In general, for many species, the fur prices were higher than they have been in previous years. The lack of snow, relatively mild temperatures, and abundance of natural foods were likely factors in the low marten and fisher harvests. With little snow on the ground it was difficult for hunters to track bobcats, likely contributing to the low bobcat harvest. The lack of snow cover however, allowed trappers greater access to areas to trap for beaver, otter, mink and coyotes, which all experienced higher harvest this past season.

Muskrat Pelt Data

In December, we collected biological data from muskrat pelts and trapping effort data from trappers at the Dixmont and Wells fur auction. This year, we looked at over 1,200 muskrat pelts; 147 adult females, 424 juvenile females, 168 adult males, 556 juvenile males. On average, it took trappers 19 trap-nights to capture 1 muskrat (one trap night is equal to one trap set for one night). It took 32% more effort to catch a muskrat in 2011 than it did in 2010. In 2011, 3.1 juveniles were captured per 1 adult, whereas in 2010, 3.4 juveniles were captured per 1 adult. These data suggest that muskrat recruitment may have stabilized. There are limitations to what these data can tell us, but this index could provide important information for muskrat management in the future. Thanks to all the trappers that allowed us to count their muskrat pelts and a special thanks to the Unity College students for their great help counting muskrat pelts.

Table 13. Harvest of furbearing animals in Maine. Harvest records are from pelt-tagging records collected from the 2004-2005 to 2011-2012 trapping seasons. Pelt-tagging records may under-represent the harvest of coyote and beaver. Harvest figures followed by an “h” superscript were significantly (alpha = 0.05) higher than the mean harvest the previous 5 years for that species. Harvest figures followed by an “L” superscript were significantly lower than the mean harvest for that species the previous 5 years.

Species	11-12	10-11	09-10	08-09	07-08	06-07	05-06	04-05
Beaver	15,769 ^h	6,976	10,765	9,119	6,357	12,635	11,094	10,436
Bobcat	239 ^L	305	281	407	410	344	344	376
Coyote	2,037 ^h	1,623	1,743	1,901	1,819	1,521	2,077	2,175
Fisher	925 ^L	1,207	1,078	1,456	993	1,968	1,810	2,174
Red fox	989	922	932	893	1,030	1,245	1,067	1,413
Grey fox	308 ^h	332	250	163	161	107	67	125
Marten	1,317 ^L	3,559	2,613	2,291	2,401	2,350	3,873	2,248
Mink	2,339 ^h	1,926	1,465	1,297	1,888	2,280	1,108	1,224
Otter	1,234 ^h	754	696	528	493	968	1,041	1,113

This work is supported by volunteer assistance, the federal Pittman-Robertson Funds program, revenue from the sales of hunting and trapping licenses, and funds from the Loon Conservation Plate.

--John DePue

White-nose Syndrome in Bats

White-nose syndrome (WNS) is a disease that affects winter hibernating bats and is associated with a newly discovered fungus, *Geomyces destructans*. The disease was named white-nose syndrome because when first discovered, infected bats had white fungus on their muzzles. WNS was first documented in New York in 2006 and has since spread throughout the Northeast and Canada, including Maine. WNS causes hibernating bats to awaken more often during hibernation and prematurely use up fat reserves needed to survive the winter. The USFWS estimated that WNS has already killed more than 5 million bats.

To date, there have been no known illnesses to humans attributed to WNS. Scientists are still learning about WNS, but the fungus lives in cold damp environments, and we know of no risk to humans from contact with infected bats.

In March 2012, IFW biologists conducted bat surveys at hibernacula in Maine. Unfortunately, the sites that were infected in 2011 had dramatic declines of hibernating bats from 2011, including a 94% decline in one cave. However, one of the sites in Maine that showed no signs of WNS in 2011 continued to have no evidence of WNS during the 2012 survey. MDIFW is partnering with other state and federal agencies, non-governmental organizations, and environmental consulting companies to monitor bat populations using pre- and post-pup rearing surveillance and maternity emergence counts.

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

--John DePue

New England Cottontail

About the Rabbit

The New England cottontail (NEC; *Sylvilagus transitionalis*), or cooney, was listed as state endangered species in Maine in 2007 and is Maine’s only endangered terrestrial mammal. In 2010, Maine’s NEC population was estimated to be less than 200 rabbits. The number of NEC in Maine was determined by conducting intensive winter searches for fecal pellets throughout southern Maine for several years. The DNA in these pellets was analyzed to determine whether the pellet was deposited by a snowshoe hare (*Lepus americanus*) or NEC and to distinguish individual rabbits. New England cottontails apparently declined in numbers after several severe winters and no longer occur in 10 out of the 18 towns in which they were found in Maine in 2004. The US Fish and Wildlife Service (USFWS) considers the species to be warranted but precluded from listing under the federal Endangered Species Act. Although NEC are currently considered warranted but precluded for federal listing, the USFWS must make a final determination on their federal listing status by 2015 as the result of a court settlement (2011 Multi-District Litigate Agreement) that directed the USFWS to greatly speed up their listing process.

The region-wide decline of the NEC population has been attributed to habitat loss, in particular, the loss of old field and shrubby habitat. Outside of Maine, NEC must compete with the non-native eastern cottontail rabbit (*Sylvilagus floridanus*) for limited habitat. Unfortunately the eastern cottontail uses a wider diversity of habitat and is better at avoiding predators than the NEC. Most people have a hard time believing that an animal that “breeds like a rabbit” could become endangered. The fact that a species, with a high reproductive rate like the NEC’s, is endangered (state listed in Maine and New Hampshire) begs the question -- if New England’s only native cottontail is endangered, what does it say about the status of other wildlife that live in brushy/early successional habitats or the health of the ecosystem in which they live?

Today, NECs only occupy about 20% of their former range and exist in three known populations in Maine: 1) Cape Elizabeth / Scarborough, 2) Wells, and 3) Kittery/York/Elliot. These populations are not only separated by distance but also by a landscape fragmented with roads and unsuitable habitat. Landscape fragmentation and the physical distance between NEC populations prevent NEC from moving between populations. Consequently, Maine's NEC populations are losing their genetic diversity and have a high risk of becoming extirpated (locally extinct), unless management actions are taken.

Management Strategies

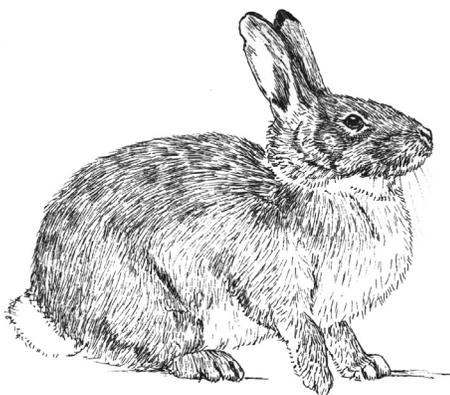
While IFW oversees NEC recovery efforts in Maine, much of the recovery work on NEC is accomplished by governmental and non-governmental partners working with IFW through Maine's NEC Working Group. In particular, the National Fish and Wildlife Foundation (NFWF), through its Keystone Initiative program, has provided essential support for NEC conservation in Maine. As a result of this program, over 600 acres have been brought under management for NEC habitat. Although this is an excellent start, IFW and its partners have set a goal of creating over 3,600 acres of NEC habitat by 2020 in an effort to restore Maine's NEC population. Recognizing that many state agencies do not have the personnel capacity to dedicate staff to NEC habitat restoration, NFWF, working with the Natural Resources Conservation Service (NRCS), initiated the Private Landowner Technical Assistance Program (PLTAP). Under this program, biologists are hired to work under the direction of the NRCS and state wildlife agencies to assist landowners interested in managing their land for NEC. Under the federal Farm Bill, the NRCS provides incentive programs to private landowners who are interested in managing their land for wildlife. These programs provide a win-win situation for landowners and wildlife. The incentive program that is the most applicable to NEC habitat restoration is the Wildlife Habitat Incentives Program (WHIP). This program provides planning assistance and cost sharing to private landowners who agree to manage their lands for wildlife. Currently, NEC projects are being given special priority for WHIP funding.

On a larger scale, Maine is a participant in the Regional New England Cottontail Initiative that is made up of representatives from state wildlife agencies in CT, MA, ME, NH, NY, and RI, along with representatives from the federal agencies that work with NEC. The members of the Initiative drafted a regional conservation strategy for NEC, which should be finalized this summer. In this strategy, Technical Committee members set state habitat restoration goals for 2030 totaling more than 42,000 acres. This amount of additional habitat should support a NEC population of 22,000 rabbits. Each state has identified focal areas in which to concentrate their restoration efforts. Each state's restoration goals and objectives are incorporated into a detailed conservation strategy that outlines administrative tasks, habitat management actions, population monitoring, research, and the public outreach needed to achieve each objective. One of the immediate research needs is being undertaken with the help of the Roger Williams Park Zoo in Rhode Island. The Technical Committee is working with the Zoo to determine whether rabbits bred in captivity, and reared on islands, can be reintroduced successfully to the mainland. Another high priority research need is determining whether NEC populations can be increased in areas where eastern cottontails occur with NEC. We need to determine if creating additional rabbit habitat in those areas will only result in higher eastern cottontail populations.

Funding this large scale restoration initiative is the ultimate challenge. To date, conservation organizations like NFWF and federal agencies like the NRCS have stepped up to the plate and have pledged millions of dollars. Even with these funds, states will be challenged to secure the necessary funds for the personnel needed to implement and administer the proposed conservation strategy. Because IFW has been proactive in NEC conservation for well over a decade, we have been able to build the partnerships necessary to be at the forefront of NEC conservation. We hope to continue these partnerships and procure the necessary funds to achieve our habitat restoration goal and secure the future of NEC in Maine.

This work is supported by volunteer assistance, the federal State Wildlife Grants program and Pittman-Robertson Funds program, state revenues from the Outdoor Heritage Fund, Loon Conservation Plate, Chickadee Check-off, the sales of hunting and trapping licenses, and other support from the NFWF, the Wildlife Management Institute, USFWS Partners Program, Rachel Carson National Wildlife Refuge, NRCS, Wells National Estuarine Reserve, Kennebunkport Conservation Trust, and many other private and public landowners and organizations.

--Wally Jakubas



REPTILE, AMPHIBIAN, AND INVERTEBRATE GROUP

Maine is home to 18 species of frogs and salamanders (amphibians), 16 species of turtles and snakes (reptiles), and over 16,000 species of terrestrial and freshwater invertebrates, from beetles and butterflies to mayflies and mussels, to name just a few. Coordinating survey, research and conservation priorities for such a diverse suite of organisms is challenging! One of the Group's highest priorities is to address the protection and recovery needs of the large number of reptiles and invertebrates currently on the state's official list of Endangered and Threatened species (21 of 46 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. The Reptile, Amphibian, and Invertebrate Group works to ensure that these and other less familiar but ecologically important species remain a part of Maine's rich natural heritage.

A recent poll confirms that a majority of Maine citizens believe the Department is funded largely from State general revenues. This is not the case. In fact, almost no Department revenue is provided by State general funds. This is unsustainable given MDIFW's mandate to serve a much broader constituency than license-paying sportsmen, including all of those citizens who benefit from and appreciate nonconsumptive wildlife services. Some of the Department's efforts with nongame wildlife that help conserve public trust wildlife resources include: a) survey and research of State priority species, b) protecting and recovering endangered and threatened species, c) providing habitat and viewing opportunities on >100,000 acres of protected State Wildlife Management Areas, and d) informing well-planned development practices in proximity to sensitive wildlife habitats. The Reptile, Amphibian, and Invertebrate Group is one of the Department's few units devoted entirely to nongame and wildlife diversity services and is wholly dependent on nontraditional sources of revenue; mainly the Loon Conservation License Plate and Chickadee Check-off. Unfortunately, both of these funding sources are in steep decline and a more dependable revenue stream is critical if the Department is to 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".

Phillip deMaynadier, Ph.D., Wildlife Biologist & Group Leader – Phillip supervises Group activities and serves as the Department's lead biologist on issues related to amphibians, vernal pools, butterflies, damselflies, and dragonflies. He also represents the Department on several wetland nongame wildlife state and regional working groups.

Beth Swartz, Wildlife Biologist – Beth serves as the Department's lead biologist on aquatic invertebrate issues, with recent efforts devoted to the survey and conservation of Clayton's Copper butterfly, freshwater mussels, and rare mayflies. Beth also helps coordinate the Department's vernal pool data review responsibilities.

Jonathan Mays, Wildlife Biologist – Jonathan serves as the Department's lead biologist on reptile issues where he coordinates survey and research on several rare turtle and snake species. Jonathan is also coordinating efforts to document the distribution and status of all reptiles, amphibians, spiders, snails, and tiger beetles.

Seasonal Staff – The RAI Group could not have studied and helped conserve such a diverse suite of taxa without contracting the professional and voluntary services of the following expert biologists in 2011-2012: Paul M. Brunelle, Dr. Ron Butler, Dustin Colbry, Tom Ferrari, Ken Hotopp, Dr. Marilyn Mayer, Ethan Nedeau, Trevor Persons, Bronco Quick, Justin Schweitzer, Marcia Siebenmann, Mark Ward, Dr. Reggie Webster, and Dr. Herb Wilson.

REPTILE, AMPHIBIAN, AND INVERTEBRATE CONSERVATION AND MANAGEMENT

Amphibians and Reptiles

Partners in Amphibian and Reptile Conservation (PARC)

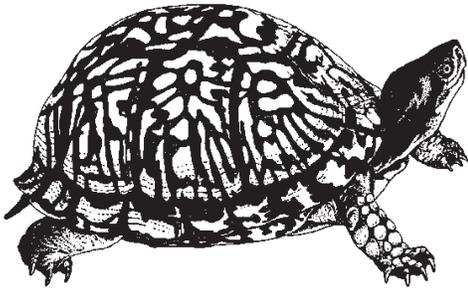
MDIFW continues to cooperate with an initiative entitled Partners in Amphibian and Reptile Conservation (PARC). Modeled partly after the successful Partners in Flight (PIF) bird conservation program, PARC's mission is to forge partnerships among diverse public and private organizations in an effort to stem recent declines of amphibian and reptile (herpetofauna) populations worldwide. MDIFW regularly participates in northeastern chapter PARC meetings where discussions focus on conservation initiatives for priority amphibians, reptiles, and habitats.

To date, PARC-Northeast has made progress on a) drafting model state herpetofauna regulations, b) compiling a list of regional species of conservation concern, c) publishing management recommendations for important habitats, and d) designing guidelines for identifying high value focus areas entitled Priority Amphibian and Reptile Conservation Areas (PARCAs). For more information on national PARC conservation efforts, or to join the northeastern chapter, visit the PARC website at www.parcplace.org.

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 the Information Center, MDIFW (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 34 amphibian and reptile species. Though most of this work is opportunistic, as of Summer 2012, over 6,500 entries from 647 volunteers have been logged. There is much still to learn regarding 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 the 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) -- to MDIFW (phillip.demaynadier@maine.gov or call 207-941-4239).**

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

--Jonathan Mays and Phillip deMaynadier

Amphibian Monitoring

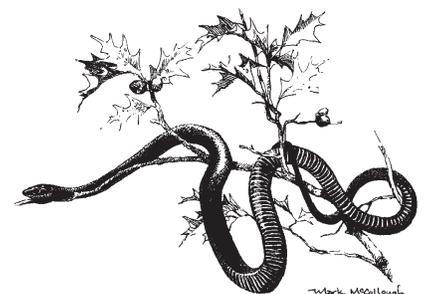
Since 1989, scientists have been concerned that frogs, toads, and salamanders (amphibians) may be declining worldwide. Unfortunately, a recent scientific analysis confirms these suspicions with fully 32% of the world's amphibian species now considered threatened with extinction, which is a rate exceeding that for birds or mammals. Maine, like many other states, had little data to assess trends in its amphibian populations. In 1996, MDIFW and Maine Audubon received an Outdoor Heritage Fund grant to initiate a statewide amphibian-monitoring program, launched in 1997. Maine's Calling Amphibian Survey is part of a nationwide effort organized by the U.S. Geological Survey. Sixty-one road-monitoring routes were randomly established across the state. Each spring and summer season, volunteers drive their individually assigned route three times, recording the diversity and intensity of calling frogs and toads. Some vacant routes still exist, with new volunteers especially needed in northern Maine. Participants are provided training materials to assist them with the identification of each of Maine's nine species of frogs and toads. With 15 years of data collected (through 2011), we anticipate the ability to analyze preliminary population trends for several species of frogs and toads soon. Currently Leopard Frogs, listed as a Special Concern Species in Maine's Comprehensive Wildlife Conservation Strategy, and Mink Frogs are among the state's least commonly reported species. Those interested in participating in this citizen-science initiative should contact Maine Audubon's Susan Gallo at 207-781-6180 (ext. 216) or visit the website at: www.maineaudubon.org/conserves/citsci/mamp.shtml.

Funding for this work comes from volunteer assistance, the federal State Wildlife Grants program, Maine Audubon Society, Loon Conservation Plate, and Chickadee Check-off funds.

--Phillip deMaynadier

Rare Snakes

Maine is currently home to at least nine species of snake, one of which is state Endangered (Northern Black Racer) and two of which are state Special Concern (Ribbon Snake and Brown Snake). The Timber Rattlesnake was historically native but is now thought to be extirpated from the state. The Maine Amphibian and Reptile Atlas Project (MARAP) continues to provide location records for all snakes, but more detailed research is needed in order to assess movements, habitat requirements, and potential threats to our rare snakes.



To determine home range size, over-wintering sites, and habitat use, MDIFW conducted a radio telemetry project on Black Racers in southern Maine. Racers are long, slender snakes, jet black in color with a white chin and gray belly. Black Racers reach the northern extent of their range in southern Maine. At present, less than 30 sites in Maine are known to host Black Racers, and only six of these locations have had racers observed at them within the last five years. Fourteen racers were implanted with radio transmitters and data analysis has shown that these animals are using very large home ranges in early successional habitat (ca. 250 acres of predominantly scrub/shrub habitat and surrounding grasslands and open forests). Knowledge gained from this study is informing protection efforts and habitat management for Maine's longest and fastest reptile.

Historically, snakes have been misunderstood, feared, and persecuted. Some have stated that snakes are among the least appreciated of Maine's wildlife. While this may be true, snakes fill an important place in the environment and provide balance: preying on small mammals, insects, and other reptiles and amphibians, and providing food for various predatory birds and mammals. Snakes are fascinating creatures and our state is richer with them here.

Funding for this work comes from the federal State Wildlife Grants program, Maine Department of Transportation, Loon Conservation Plate, and Chickadee Check-off Funds.

--Jonathan Mays

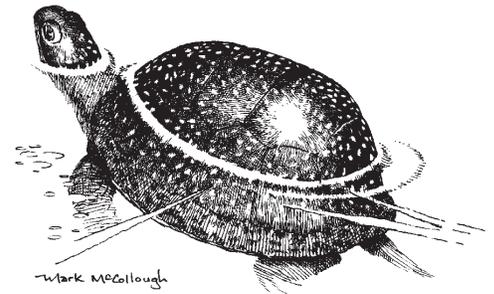
Rare Turtles

For nearly 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 movements between wetlands.

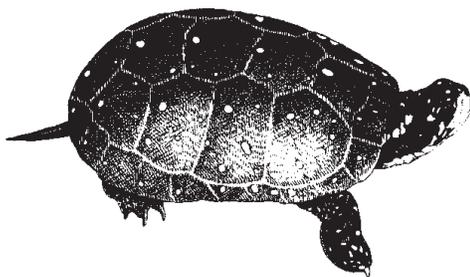
Despite the attention these turtles have received, habitat loss and fragmentation continue to threaten both species' persistence in Maine. As the human population expands, road mortality becomes an ever increasing threat. The turtle's shell has provided sufficient protection from predators for millions 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 2-3% 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.



Mark McCollough



MDIFW is currently involved in three active conservation projects benefitting Blanding's and Spotted Turtles in Maine:

- o 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 were 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 project is now in its 7th year.
- o Conservation of Blanding's Turtle in the Northeast: MDIFW along with four other Northeastern states were awarded a Competitive State Wildlife Grant to develop a regional model and plan for Blanding's Turtles. This work, including a genetic assessment facilitated through Dr. Rhymer at the University of Maine, began spring 2012 and will continue through 2013. To date Maine biologists have systematically surveyed eight Blanding's turtle sites and obtained over 30 genetic samples for population analysis.

- o **Wildlife Road Watch:** Partnering with Maine Audubon and Maine DOT, a volunteer initiative to report wildlife-road interactions (both alive and dead) was launched in 2010. Data generated from this project may help in planning future projects and identifying mitigation efforts (e.g., additional signage areas, critter crossings, exclusionary fencing). In addition to incidental sightings, participants may also choose to adopt a road segment for repeated monitoring. For more information on the Wildlife Road Watch, please visit: <http://www.wildlifecrossing.net/maine>.

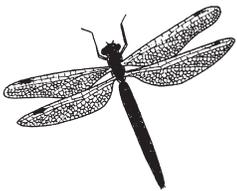
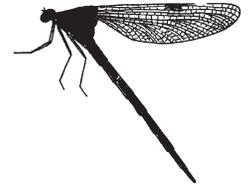
This work is supported by volunteer assistance, The Nature Conservancy, the federal State Wildlife Grants program, and revenues from the Loon Conservation Plate, Chickadee Check-off funds, the Maine Outdoor Heritage Fund, and the Maine Department of Transportation.

--Jonathan Mays

Invertebrates

Stalking Rare Damselflies and Dragons

Insects in the Order Odonata, damselflies and dragonflies, are a conspicuous component of Maine's wildlife diversity. Presently, 158 species have been documented in the state, comprising nearly 36% of the total North American fauna. Several of Maine's odonate species are of national and global conservation concern. Maine currently lists three species as Endangered or Threatened and 25 species as Special Concern. While several odonates are highly sensitive to freshwater habitat degradation, baseline information for the group had been lacking in Maine, until recently.



In 1998, MDIFW initiated the Maine Damselfly and Dragonfly Survey (MDDS), a multi-year, citizen-science atlasing initiative designed to improve our knowledge of the distribution, status, and habitat relationships of damselflies and dragonflies statewide. In addition to accumulating a tremendous amount of scientific data, the MDDS engaged over 200 of Maine's non-game enthusiasts and raised public awareness of invertebrate conservation generally. Survey's results exceeded expectations and are best summarized by the following:

Public Outreach and Involvement:

Volunteer participation statewide:	>200
Volunteers trained in MDDS seminars:	95
Major press articles covering the MDDS project:	5
Website hits (http://mdds.umf.maine.edu/~odonata/):	>20,000

Scientific Contributions:

Total records submitted (% increase over 1999 baseline):	17,264 (229%)
New state species records:	10
New U.S. species records (Quebec Emerald & Canada Whiteface):	2
Scientific publications completed or in progress:	5

With the volunteer atlasing component of the MDDS project coming to closure, MDIFW recently contracted Paul M. Brunelle, an odonate expert and graphic design artist from Nova Scotia, to assist with authoring and designing the project's capstone product: *An Atlas and Conservation Assessment of Acadia's Damselfly and Dragonfly Fauna*. Populated largely with data contributed by MDDS volunteers, this atlas will serve as the first authoritative publication on the distribution and natural history of odonates from Maine and the Canadian Maritime Provinces.

Funding for this work comes from volunteer assistance, the federal State Wildlife Grants program, U.S. Environmental Protection Agency, and state revenues from the Loon Conservation Plate, Chickadee Check-off funds, and the Maine Outdoor Heritage Fund.

--Phillip deMaynadier

The Maine Butterfly Survey: Keeping Track of Scaled Jewels

Hessel's Hairstreak, Purple Lesser Fritillary, and Crowberry Blue 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, conspicuous, 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 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 assemble the first baseline atlas and database of Maine's butterfly fauna – an essential step toward conservation of the group. The baseline atlas project compiled nearly 9,000 records and added 11 previously undocumented butterflies to the state list, which now stands at 120 species. Of special note is the relatively high proportion (~20%) of Maine butterflies and skippers that are extirpated (5 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) or visit <http://www.state.me.us/ifw/wildlife/wildlife.htm> to download a pdf copy of Maine's first baseline butterfly atlas.

Finally, we are pleased to announce that a statewide volunteer butterfly atlas took flight in 2007. Sponsored by MDIFW, in partnership with the University of Maine at Farmington (Dr. Ron Butler), Colby College (Dr. Herb Wilson), and Dr. Reginald Webster of New Brunswick, the Maine Butterfly Survey (MBS) is a multi-year, statewide, volunteer survey effort. Following in the tradition of previously successful state-sponsored wildlife atlas projects, including the Maine Damselfly and Dragonfly Survey, data generated from the MBS comes primarily from trained citizen scientists. The survey will help fill information gaps identified during the baseline assessment on butterfly distribution, flight seasons, and habitat relationships for one of the state's most popular insect groups. To become involved in this project or to learn more about Maine's butterflies, contact the volunteer coordinator, Dr. Herb Wilson, at whwilson@colby.edu, or check the MBS website at: <http://mbs.umf.maine.edu>.

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

--Phillip deMaynadier

Clayton's Copper Butterfly

The Clayton's Copper (*Lycaena dorcas claytoni*) is a small, orange-brown butterfly known only from a handful of sites in Maine and New Brunswick. It is found only in association with its larval host plant, the shrubby cinquefoil, which also serves as the primary nectar source for adults. This uncommon shrub rarely occurs in stands large enough to support viable populations of the butterfly. Where it grows best is in circumneutral fens (peatlands rich in calcium carbonate or limestone) – a rare habitat type in Maine. Not found everywhere its host plant grows, the Clayton's Copper is even rarer. Currently, this endangered butterfly is known from just 9 or 10 sites in northern and eastern regions of the State (Figure 3).

Clayton's Copper takes one year to complete its life cycle. In late July and August, when shrubby cinquefoil is blooming, females lay their eggs singly on the underside of cinquefoil leaves. Leaves and eggs drop to the ground in autumn, and the eggs overwinter. The pale green larvae hatch in spring and crawl back up the plant to feed on its leaves. After the larvae molt and pupate in early summer, adult butterflies emerge during July and August to start the cycle over again. Each butterfly lives only a few weeks at most and by late August to mid September the colorful winged adults are gone for another year.

In 2011, thanks to the sharp eye of a Maine Butterfly Survey volunteer, a new population of Clayton's Copper was found in Woodland (Aroostook Co.), not far from an already documented occurrence in the same watershed. This was the first new record of the butterfly in ten years! Unfortunately, at the same time, we've been unable to confirm the species as still being present at another long-standing site since 2008.

MDIFW continues its partnership with the University of Maine to investigate key life history, habitat, and conservation questions about this rare butterfly. We now have estimates for population size, flight period, and cinquefoil patch size at each colony, as well as a better understanding of the conservation importance of each site. The University is also looking at the genetic relationship between the distinct population clusters of Clayton's Copper. This research will help shed light on if and how the butterflies move between sites and whether each subpopulation has the ability to persist over time. Another study is focused on identifying environmental characteristics of the wetlands



Figure 3. Distribution of Clayton's Copper in Maine.

where Clayton's Copper is found and on specific qualities of the host plant, which might explain why the butterfly occurs at some cinquefoil stands but not others.

Funding for this work comes from volunteer assistance, the federal State Wildlife Grants program, University of Maine, The Nature Conservancy, American Philosophical Society, and state revenues from the Maine Outdoor Heritage Fund, Loon Conservation Plate, and Chickadee Check-off funds.

--Beth Swartz

Rare Tiger Beetles

Tiger beetles are handsome, active insects that make their living running down smaller insect prey on the ground. These terrestrial beetles move so fast that they even sometimes outrun their eye-sight and have to pause to refocus – a behavior that aids in quick identification of adults in the field. Though many are dark colored and camouflage nicely with their preferred sandy or muddy habitat, some species can be quite striking in appearance with iridescent colors or intricate body patterns. Maine is home to 14 species of tiger beetles, three of which are considered State Special Concern due to their limited range and specialized habitat requirements. Tiger beetles have been considered good indicator species of biodiversity.

As a follow-up to Eco-regional surveys in the Central and Western Mountains, MDIFW conducted surveys for the Cobblestone Tiger Beetle in 2011. The Cobblestone Tiger Beetle was only recently discovered in Maine during surveys in 2009. This species with its distinctive markings and orange abdomen is considered globally imperiled (G2) and ranked critically endangered (by NatureServe) in New Hampshire, New Jersey, New York, Pennsylvania, and Vermont. In Canada, this beetle is known from only a few sites in New Brunswick where it is listed Endangered by the Committee on the Status of Endangered Wildlife in Canada. The newly discovered Maine population fills a critical distribution gap and offers additional hope for this species' recovery. As the name implies, the Cobblestone Tiger Beetle prefers cobble bars on vegetated islands in medium to large rivers. It appears these rivers need seasonal scouring of the cobble beaches but not prolonged flooding. Due to an apparently limited range (at present a 10 km stretch of a single river) and specialized habitat, the Cobblestone Tiger Beetle was recently listed as State Special Concern species and is a candidate for future State Endangered/Threatened status. Additional surveys during 2010 and 2011 were unsuccessful in finding other populations of the beetle.

MDIFW also surveyed coastal salt-marsh areas for another state Special Concern species, the Salt Marsh Tiger Beetle. This species appears to be declining in the Northeast: 'Possibly Extirpated' in New Hampshire; 'Critically Imperiled' in Rhode Island, Connecticut, and Delaware; and 'Vulnerable' in New York. Salt Marsh Tiger Beetle habitat is limited in Maine and threatened by tidal erosion, rising sea levels (per climate change models), human development, and coastal oil spills. The species status remains precarious in Maine, as the 10 known sites represent most if not all the available habitat for this specialized salt-marsh dweller.

Funding for this work comes from the federal State Wildlife Grants program, and state revenues from the Outdoor Heritage Fund, Loon Conservation Plate, and Chickadee Check-off funds.

--Jonathan Mays

Roaring Brook Mayfly

While many of Maine's mayfly species are widely distributed and relatively common, one holds the distinction of being among the rarest in the world. Unofficially dubbed the "Roaring Brook Mayfly", *Epeorus frisoni* was for many years known only from a single adult collected on Mt. Katahdin in 1939. This long history of a lone occurrence, despite extensive surveys of mayflies throughout Maine and North America, ultimately led to the species being listed as Endangered in Maine in 1997.



In 2003, MDIFW conducted the first surveys in over 60 years to specifically look for this rare insect. With special permission from Baxter State Park, we sampled mayfly larvae in three Katahdin streams in an attempt to reconfirm the species' presence and gather information that might help direct surveys elsewhere. As a result, we were able to verify that larvae found in two of the streams matched the specimen collected in 1939. Armed with basic information about the mayfly's life cycle and habitat preferences, we then began looking for the Roaring Brook Mayfly in similar habitats around the State.

Since then, MDIFW has surveyed approximately 160 streams and documented 12 more where the mayfly occurs, bringing the total number of sites currently known in Maine to 14. All of these sites are clustered in the mountains of central and

western Maine (Figure 4). 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, or even to Maine, it does appear to be New England's only endemic mayfly - restricted to cold, undisturbed, high-elevation streams of the northern Appalachian Mountain Range.

There's still much we don't know about the Roaring Brook Mayfly, but MDIFW has been able to use data collected during our surveys over the past several years to better inform conservation measures at sites where the mayfly is known or likely to occur. Even though high elevation stream habitats are typically isolated from most traditional land use impacts, potential conflicts with activities such as industrial windpower and resort development are increasingly being reviewed by MDIFW. To help ensure the State meets its obligation to protect this endangered species, the Department has developed recommendations for avoiding and minimizing negative effects of intensive development and commercial forestry activities in the mayfly's habitat. These include guidelines for placement and construction of stream crossings, and the maintenance of adequate forest canopy-cover and riparian buffers.

MDIFW will continue surveying for new occurrences of the Roaring Brook Mayfly and apply all that we learn to conserve this globally rare species as part of Maine's diverse and unique natural heritage.

Funding for this work comes from the federal State Wildlife Grants program, and state revenues from the Maine Outdoor Heritage Fund, Loon Conservation Plate, and Chickadee Check-off funds.

--Beth Swartz

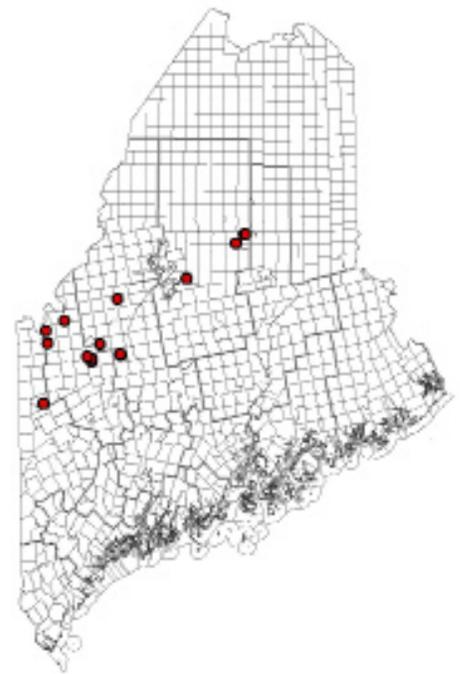


Figure 4. Distribution of Roaring Brook Mayfly in Maine.

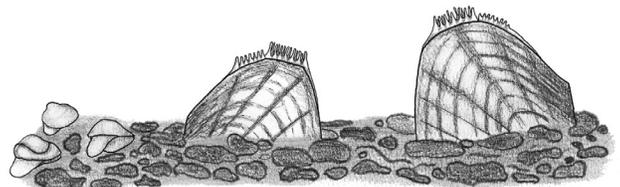
Freshwater Mussels

Freshwater mussels are relatively sedentary, bottom-dwelling invertebrates found in most of Maine's lakes, ponds, rivers, and streams. Often referred to as a "clam," the freshwater mussel's inconspicuous and seemingly drab lifestyle belies its importance. As filter-feeders, mussels provide a vital service to aquatic environments by filtering suspended particles such as algae, bacteria, and detritus from the water. The by-products are then returned to the ecosystem as essential nutrients for other organisms to use. Mussels are also a favorite menu item for a variety of wildlife such as muskrats, raccoons, otters, and some fish.

The life cycle of freshwater mussels might surprise you. Starting life in specialized brood chambers of the female's gills, they are released into the water column as tiny free-floating larvae called "glochidia", which are quite different in appearance from the adults. The glochidia have only a short period of time to encounter and attach to just the right fish species in order to successfully mature into the more familiar adult form. Some female mussels actually develop a "lure" that mimics a small minnow, crayfish, or aquatic insect in order to attract a potential host for her larvae. When a predatory fish takes the bait, it gets a mouth full of glochidia that then encyst in the fish's gills or fins. Doing no harm to the fish, the tiny mussels eventually drop off their mobile nurseries and burrow into the substrate. They often remain in the same spot for their entire lives – a period that can span 100 years or more for some species.

Because they constantly filter large volumes of water, reside in the benthic substrate, can't leave their surroundings, and live a long time, freshwater mussels are sensitive to contaminants and changes in their environment. Consequently, they are one of our most valuable indicators of water quality and aquatic ecosystem health. They are also one of the most imperiled groups of animals in the country. Of the nearly 300 species of freshwater mussels found in the United States, more than a third have already vanished or are in danger of extinction, and over 75% are listed as Endangered, Threatened, or Special Concern by various states. These dramatic declines have been caused largely by the degradation and loss of mussel habitat from pollution, dams, and the channelization and sedimentation of once clean, free-flowing rivers and streams. In some parts of the country, the accidental introduction of a prolific foreign competitor, the zebra mussel, is also jeopardizing many populations.

Maine's freshwater mussel fauna has fared relatively better than that of many states. We haven't lost any species, our freshwater habitats are reasonably clean, and the zebra mussel has not yet found its way into our waterways. However, we are not immune



to the problems of habitat loss and degradation that have eliminated populations and extirpated species in other parts of the country. Of our 10 native species, three (Yellow Lampmussel, Tidewater Mucket, Brook Floater) are currently listed as Threatened under the Maine Endangered Species Act and one (Creeper) is considered of Special Concern (Table 14). Fortunately, compared to most states within the range of these species, Maine hosts some of the best remaining populations and may be a last stronghold for these rare mussels.

During the past year, MDIFW has continued to work closely with the Penobscot River Restoration Trust, which will be removing two hydropower dams to allow fish passage on a 5½ mile stretch of the Penobscot where all four listed mussel species occur. Together we have developed, and are now implementing, a recovery and relocation plan that will minimize mortality to rare mussels when acres of river bottom are permanently dewatered. The plan also includes a two-year post-monitoring study to document the mussels' survival and how they respond to the change in their environment from an impounded to free-flowing system. While habitat should improve for Brook Floaters and Creepers, the outcome for Yellow Lampmussels and Tidewater Muckets is less certain. With proposals to remove hydropower impoundments increasing in Maine, the Penobscot River Restoration Project is an important opportunity to learn more about how dam removal and river restoration affects the status and long-term conservation of these rare mussels.

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

Table 14. Freshwater Mussels of Maine.

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).

Funding for this work comes from volunteer assistance, the federal State Wildlife Grants program, and state revenues from the Loon Conservation Plate and Chickadee Check-off funds.

--Beth Swartz

Special Habitats for Reptiles, Amphibians, and Invertebrates

Pitch Pine Woodlands and Barrens

Pitch Pine woodlands and barrens are lightly forested upland areas with dry, acidic, often sandy soils. Pitch pine, red pine, scrub oak, blueberry, huckleberry, and/or bluestem grasses are commonly among the sparse vegetation of this unique natural community. It's estimated that over half of the state's original pine barren acreage has been lost to residential development, agriculture, and gravel mining. Many dry woodlands and barrens also require periodic fire to prevent succession to a more common, closed-canopy white pine/oak system; fire is a natural disturbance that is now short-circuited by habitat fragmentation and fire suppression.

Once viewed as unproductive "wastelands", Maine's few remaining pine woodlands and barrens are now recognized as areas of exceptional wildlife value, providing habitat for a variety of highly specialized plants and animals. Several rare and endangered species persist in the State's remaining intact barren communities, mainly in the towns of Kennebunk, Wells, Waterboro, Shapleigh, Hollis, and Fryeburg. These unique habitats are especially rich in rare butterflies and moths (Order Lepidoptera), hosting species that feed on the specialized barrens vegetation, such as Edwards' Hairstreak (Endangered), Sleepy Duskywing (Threatened), Cobweb Skipper (Special Concern), and Barrens Buck Moth (Special Concern). Other rare species associated with Maine's barrens include Black Racers (Endangered), Grasshopper Sparrows (Endangered), Upland Sandpipers (Threatened), Short-eared Owls (Threatened), and Northern Blazing Star (a Threatened plant). To learn more about this and other rare natural communities in Maine go to: <http://www.maine.gov/doc/nrimc/mnap/features/community.htm>.

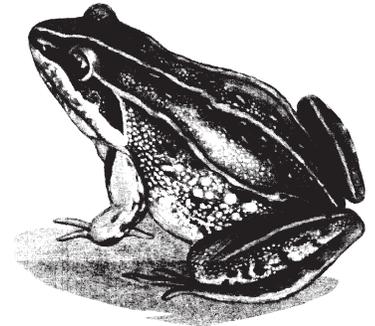
Funding for barrens research and management comes from The Nature Conservancy, the federal State Wildlife Grants program, the Loon Conservation Plate, and Chickadee Check-off funds.

--Phillip deMaynadier

Vernal Pools

Vernal pools are small, forested wetlands that frequently fill with water from early spring snowmelt and rains and then dry partly or completely by mid to late summer. Many of Maine's amphibians use vernal pools as breeding or foraging habitat. Some, like Spotted Salamanders, Blue-spotted Salamanders, and Wood Frogs, breed more successfully in these fishless habitats than in any other wetland type. Additionally, vernal pools provide habitat for a variety of small mammals, wading birds, waterfowl, aquatic invertebrates, and several state-listed animal species including Blanding's Turtles (Endangered), Spotted Turtles (Threatened), Wood Turtles (Special Concern), Ribbon Snakes (Special Concern), and Ringed Boghaunter dragonflies (Threatened).

We still have more to learn about why some vernal pools receive greater wildlife use than others. To this end, grants from the Maine Outdoor Heritage Fund and the U.S. Environmental Protection Agency helped support a University of Maine study by Dr. Robert Baldwin and Dr. Aram Calhoun to research the wildlife use and characteristics of vernal pools in York County. Rob and Aram's results suggest that Wood Frogs and other pool-breeding amphibians range widely in the forested landscape following breeding and that surrounding upland forests and swamps provide important habitat outside of the brief pool-breeding season. Rob also developed a landscape model that highlights the vulnerability of vernal pools in southern Maine to habitat loss and fragmentation from insufficient conservation lands and wetland regulations.



MDIFW continues to cooperate with the Department's of Environmental Protection and Conservation, Municipalities, the University of Maine, and other partners to identify potential strategies for protecting the unique values provided by smaller wetlands that "fall through the cracks" of current wetland regulations. Workshops on vernal pools are held throughout the state for landowners, land trusts, and land managers, and several new publications designed to offer voluntary techniques for protecting vernal pools and their wildlife are now 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 to the public 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*). Together, these publications provide recommendations designed to help maintain functioning vernal pool landscapes throughout Maine. All of the guides can be obtained by contacting Becca Wilson at Maine Audubon Society (207-781-6180 ext. 222; bwilson@maineaudubon.org).



Finally, the Departments of Inland Fisheries and Wildlife and Environmental Protection developed a definition of Significant Vernal Pools, a relatively new Significant Wildlife Habitat under the state's Natural Resource Protection Act, approved by the 120th 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. Recognizing a subset of the State's vernal pools as Significant will help biologists provide guidance on development activities within a critical upland life zone surrounding one of the state's highest value wildlife habitats.

Funding for MDIFW's efforts at research and protection of vernal pools comes from U.S. Environmental Protection Agency, the federal State Wildlife Grants program, the Loon Conservation Plate, the Chickadee Check-off, and the Maine Outdoor Heritage Fund.

--Phillip deMaynadier

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Give a gift to
wildlife this year -
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A detailed black and white illustration of a chickadee perched on a branch, facing left.

A Large-scale Assessment of Wild Brook Trout (*Salvelinus fontinalis*) Populations and Habitat in Maine

Forestry and agriculture, as well as residential development, have had detrimental effects on Maine's wild brook trout (*Salvelinus fontinalis*) populations. The Eastern Brook Trout Joint Venture: Fish Habitat Partnership (EBTJV) conducted a status assessment of wild brook trout in their native range and identified Maine as possessing the majority of healthy wild brook trout populations remaining in the United States, where range-wide, 17.4% of the existing strong and intact populations occur (Hudy et al. 2005). However, it also determined that Maine had the least amount of current assessment information available on its brook trout resources, especially with regard to stream populations. Hence, quantitative status assessment for roughly 2/3 of the state could not be completed at that time.

Maine's wild brook trout populations are concentrated in the interior highlands of the state, much of which is located in privately owned commercial forestlands. Maine's forests have a long history of land-use changes associated with commercial wood harvest including extensive channel modifications to facilitate log driving through streams and rivers. Although log driving was ended statewide over thirty years ago, many aquatic habitats within forested lands retain chronic degraded conditions and channel instabilities. Recent assessment of western Maine streams lying within forested lands indicated that a large proportion of the habitats surveyed are degraded, as indicated by a loss of pools, increased width-to-depth ratios, loss of sinuosity, excessive sediment transport, and bank instability (Bonney 2009). Much of this degradation probably dates from log driving. However, log drives have not been conducted on these waters for nearly a half century, and it seems likely that forest cutting is contributing to continued stream instability, despite restrictions of timber harvest within riparian areas.

Maine's coastal plain maintains fewer brook trout populations than the interior highlands, but the coast does maintain many wild, and possibly undocumented, populations of anadromous brook trout. Habitat in the southern part of the state and along the coastal plain tends to be more heavily developed, has suffered more habitat degradation, and has more introduced fish species that compete with brook trout for available habitat. Habitat loss and degradation in southern and central Maine is mainly attributed to urbanization and agricultural land uses and is a growing concern for brook trout conservation.

The EBTJV believes that efforts to improve the status of brook trout should begin by protecting "the best of the best" habitat that supports existing healthy, stable populations. The next step is to improve and reconnect adjacent habitats that have a high likelihood of supporting stable populations. This approach also applies to the restoration of impacted or unstable brook trout populations. Restoration should focus on habitat supporting populations that are doing relatively well then be extended to adjacent habitats (EBTJV 2008). This logic requires robust knowledge of existing resources and habitat conditions as well as a strong framework for prioritizing projects for greater efficiency of restoration and conservation efforts. Our objectives are to: 1) conduct significant survey and assessment efforts in Maine's streams that represent a diversity of habitat types, condition, and fish communities; and, 2) to develop a series of tools for assisting resource managers and landowners in developing restoration priorities and strategies for habitat rehabilitation and brook trout conservation.

The Maine Department of Inland Fisheries & Wildlife (IFW) surveyed 2,955 stream sites in 519 level-6 HUC (Hydrologic Unit Code) subwatersheds during 2007–2011 summer field seasons (Figure 5). Potential survey sites were selected according to probability of access in remote areas and were spatially distributed within subwatersheds to have at least two sites representative of the mainstem with the remaining sites representative of tributaries and headwaters. Up to 6 dedicated stream survey teams per year were distributed statewide to conduct IFW standard protocols for single-pass backpack electrofishing surveys, stream fish habitat condition surveys, and rapid geomorphic surveys at all accessible sites. All fish were accurately identified to species and counted. Brook trout were weighed and measured and scale- and fin-clip samples were collected for age analysis and tissue archives. Wild brook trout were found inhabiting 62% of all sites surveyed (1,821/2,955). Due to the limitations of

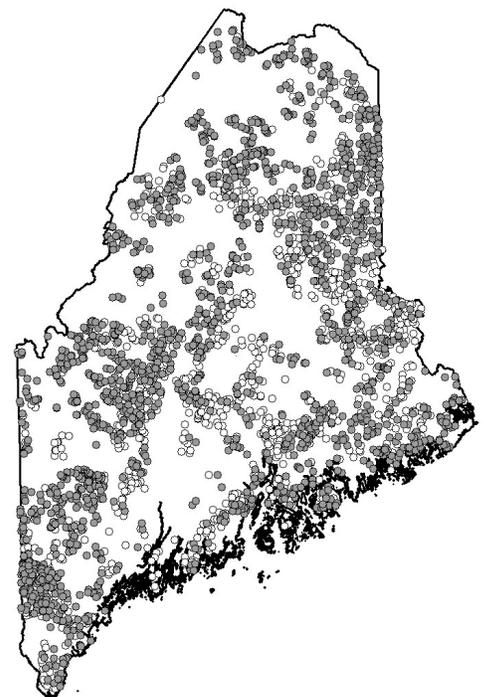


Figure 5. Locations of 2,955 stream sites surveyed in Maine, 2007-2011. Gray circles note locations where wild brook trout were found.

backpack electrofishing efficiency, surveyed streams typically were small, wadeable and had an average width of 4.8 m (15 ft, 9 in). On average, surveyed sites were primarily composed of riffle (51.2%), run (28.3%), pool (7.4%) and deadwater areas (5.6%) with minor amounts of cascade (1.9%) and rapid areas (0.3%) also encountered on occasion. Overall water quality was characterized as good with average conditions being 16.4°C, 8.4 ppm DO, water conductivity of 55.6 µS, alkalinity of 30.8 ppm CaCo₃, and pH of 6.4.

Identifying Brook Trout Habitat

One of the primary aims of the statewide stream survey was the identification of streams that harbor, or are likely to harbor, significant populations of wild brook trout and to develop a statewide dataset of brook trout habitat for conservation and management actions. While it is not possible to survey every single mile of the streams and rivers of Maine, by combining survey results with some simple decision-making rules it may be possible to identify streams that have a high probability of maintaining wild brook trout populations.

We used digital 1:24,000 hydrologic stream network shapefiles (National Hydrologic Dataset [NHD]: Maine Flowlines and Maine Catchments) and overlaid stream survey site locations from IFW efforts from 1990–2011 using ArcGIS v10.0 (ESRI 2010) for all spatial analyses. The NHD layers form a traceable network with associated small scale drainage units for all mapped streams of Maine. Catchments are relatively small drainage units on the landscape and often represent an individual stream reach or a relatively small stream network. Because brook trout are a highly mobile species and require access to a diversity of habitat types depending on time of year or point in their life cycle, we assume that trout found at a localized survey site actually use a much larger habitat area on an annual basis. Hence, all stream segments within a catchment where wild brook trout were found on survey are coded as 'likely brook trout habitat' (Figure 6). Areas that were surveyed and trout were not found are considered 'inconclusive' until additional survey effort determines if an area is used intermittently or trout have truly been locally extirpated.

While there is no 100% certain way to predict where brook trout will occur in a stream system, we feel that the use of a consistent, relatively simple framework will provide a sufficient predictive capability for initial habitat protection planning. In cases where a higher degree of certainty is required, filling in any knowledge gaps with further standard fishery surveys is required.

Ranking Subwatersheds for Habitat Protection and Restoration

The EBTJV promotes a tiered approach toward brook trout conservation and restoration at the subwatershed scale. Where quality habitat exists, partners should focus on habitat protection strategies to maintain and strengthen existing populations. Habitat protection can encompass a variety of methods depending on the conditions and opportunities within a particular subwatershed. Hence, identifying subwatersheds with existing healthy brook trout populations, as well as subwatersheds that hold promise for strengthening resources that are already compromised, is paramount for attaining the goals of the EBTJV.

The EBTJV defines 'healthy' subwatersheds as those where greater than 50% of available habitat is occupied by self-sustaining brook trout populations. In 2005, the EBTJV classified ~21.9 % of Maine's subwatershed area as 'healthy' brook trout habitat. However, ~68.8% of the state's subwatershed area was not classified due to data inadequacy at the time (Hudy at al. 2005). Most of the recent stream survey effort associated with this project was directed toward subwatersheds that previously lacked brook trout status information, so these data can be used to classify additional subwatersheds to help guide protection and restoration activities by the EBTJV.

Stream survey fish species status information collected by IFW efforts from 2007–2011 was combined with comparable data for the same timeframe from USFWS Maine Fishery Office and the Maine Department of Marine Resources' Bureau of Sea-Run Fisheries and Habitat. 3,533 sites that were surveyed for complete fish species composition and relative abundance by standard stream-electrofishing techniques were used to classify 412 subwatersheds in Maine.

Although survey information from at least seven individual sites within a subwatershed is preferred for classification purposes, a minimum number of four survey sites is required. Brook trout status is classified as 'healthy' when 50% or greater of surveyed area is inhabited by self-sustaining populations of brook trout and is considered 'reduced' where less

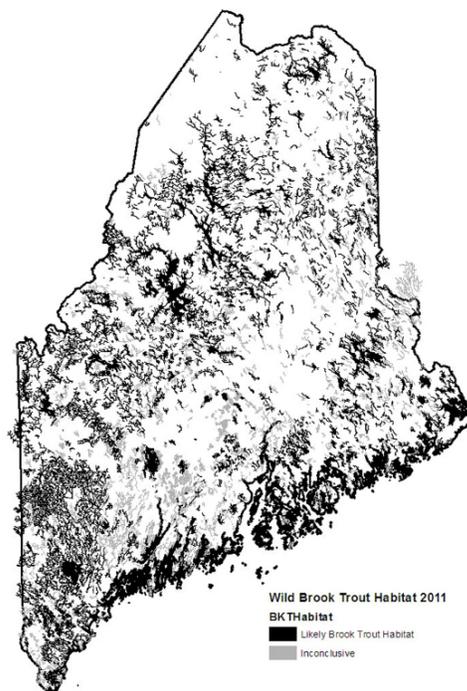


Figure 6. Areas occupied and managed for wild brook trout (black lines). Areas that require more survey effort to determine wild brook trout status are gray.

than 50% of surveyed habitat is occupied. In our most recent analysis, 95 additional subwatersheds met the criteria of 'healthy' brook trout status, and 70 were considered reduced-status subwatersheds (Figure 7). Subwatersheds with healthy brook trout populations are candidates for both habitat protection and restoration strategies. Examples include long term land protection, improved best management practices for managed lands, addressing stream connectivity constraints, and site-specific habitat rehabilitation projects. Subwatersheds with reduced status trout populations are candidates for habitat restoration strategies but may not necessarily be priorities for long-term land protection.

A Preliminary Model for Prioritizing Sites for Habitat Restoration or Management Actions

Because Maine's brook trout habitat concerns are broad, encompass most of the state, and remedies often require partner collaboration to satisfy costs, developing a framework for ranking specific problems or sites is necessary. Bonney (2006) identified water quality, instream habitat type, and competing fish species effects as significant factors affecting brook trout habitats. Hence, we developed a preliminary ranking for habitat quality, called the Maine Stream Index (MSI), for sites surveyed in 2007 (N = 846) following:

$$\text{MSI} = [\text{BKT Habitat}] + [\text{WaterQuality}] + [\text{FishCommunity}]$$

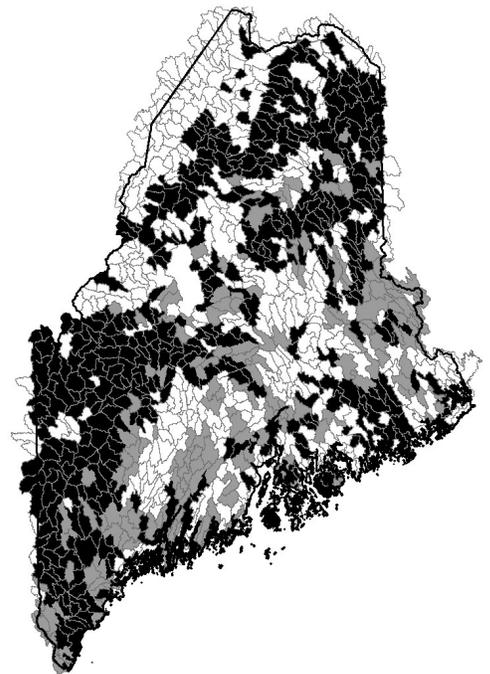


Figure 7. Subwatershed classification for EBTJV conservation strategies. Black areas denote subwatersheds with 'healthy' brook trout populations, and gray areas denote 'reduced' status subwatersheds. White areas are currently unclassified.

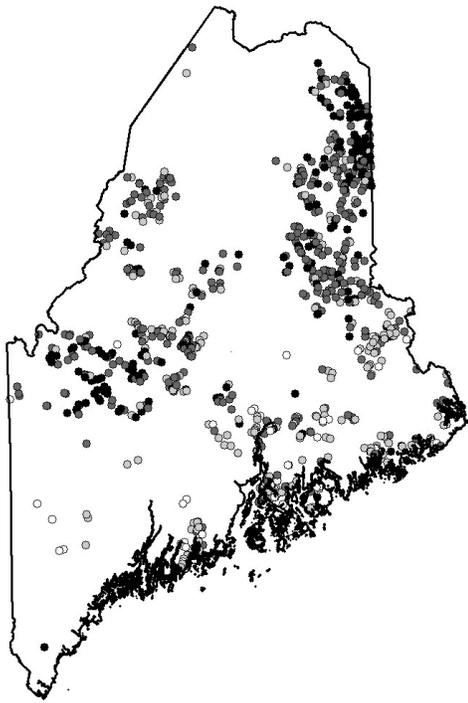


Figure 8. Maine Stream Index ranks for 846 stream survey sites in Maine. Sites are ranked by overall value of brook trout habitat quality, water quality and degree of intact fish communities. Site rankings vary from high value (black) to low (white).

Variables showing significant effects on brook trout populations or habitat from previous research were used to estimate model parameters. Variable classes were identified by previous modeling efforts (Olivero and Anderson 2008) or derived from IFW survey data by a natural-breaks method of determining classes using ArcGIS v9.32 (Table 15). Final MSI values are ranked from poor to high for determining overall site condition and identifying candidates for remediation (Figure 8).

Sites with poor, or low, rankings for habitat criteria, but high rankings for water quality and fish community structure may be good candidates for habitat rehabilitation or improved best management practices (BMP) on neighboring lands. The low habitat rating for these sites tends to be driven by a lack of pool area within the site. Seventy-nine percent (668/846) of ranked sites had 10% or less of available pool habitat. Habitat rehabilitation strategies that contribute to pool



Figure 9. A degraded brook trout stream showing the shallow, overwidened channel effects associated with past log driving activities. Although the riparian area has recovered, the stream lacks in-stream cover and pool habitats necessary for wild brook trout. Photo credit M. Gallagher.

formation may be warranted in these cases. Bonney (2006) noted that a lack of adequate pool habitat as a primary factor contributing to degraded brook trout streams and this condition is ubiquitous in streams with a history of past log driving activities (Figure 9). Although log drives no longer occur, it is conceivable



Figure 10. Rock weir with embedded root was constructed in 2007 showing scoured pool. Sandy River, Maine. Photo credit F. Bonney.

that pool losses may continue as a result of subwatershed activities that contribute to increased stream sedimentation or changes in overall hydrography. Many habitat rehabilitation projects in western Maine directed toward remediating a variety of habitat degradations, like lacking pool area, are showing promising results from in-stream treatments such as rock weirs channeling flow for enhanced pool scouring (Figure 10; Bonney 2008).

Because of the results of this project, IFW is currently partnering with the Maine Forest Service and others to review existing activities within riparian forestlands. This effort seeks to revise current BMPs as needed, investigate the utility of selective log placement in conjunction with harvest activities in headwater streams ('Chop and Drop'), and expand a temporary skidder bridge program to reduce the overall number of new road/stream crossings in timber harvest areas.

Table 15. Variables and classes used to estimate MSI model parameters.

Parameter	Justification	Source	Classes
[BKT Habitat]			
Slope	Goldstein et al 2002; Deschenes and Rodriguez 2007	NAHCS*	6 = very low gradient: <0.02% 5 = low gradient: >=0.02<0.01% 4 = low-moderate gradient: >=0.1<0.5% 3 = moderate-high gradient: >=0.5<2% 2 = high gradient: >=2<5% 1 = very high gradient: >5%
Stream Size Class	Smith and Kraft 2005	NAHCS	1 = Headwater: 0<3.861 sq. mi. 2 = Creek: >=3.861<38.61 sq. mi. 3 = Small river: >=38.61<200 sq. mi. 4 = Medium tributary river: >=200<1000 sq. mi.
% BKT habitat (riffle, run, pool area)	Bonney 2006	IFW	1 = Low: <= 25% riffle, run, pool 2 = Medium: 26 – 75% riffle, run, pool 3 = High: >75% riffle, run, pool
% Pool	Bonney 2006	IFW	1 = Low: <= 15% pool area 2 = Medium: 15 – 50% pool area 3 = High: >50% pool area
[WaterQuality]			
Geologic buffering capacity	Warren et al. 2008	NAHCS	1 = Low buffered, acidic 2 = Moderately buffered, neutral 3 = Highly buffered, calcareous
Temperature regime	Bonney 2006	NAHCS	1 = Transitional Cool 2 = Cold
Alkalinity	Theiling 2006 Warren et al. 2008	IFW	0 = missing 1 = Low: <= 10 ppm Calcium carbonate 2 = Moderate: >10 <= 140 ppm Calcium carbonate 3 = High: > 140 ppm Calcium carbonate
[FishCommunity]			
#BKT	Bonney 2001	IFW	0 = None 1 = Low: 1 – 23 2 = Moderate: 24 – 122 3 = High: > 122
#NativeSpp	Bonney 2006 MDIFW 2005	IFW	1 = Low: 0 – 29 2 = Moderate: 30 – 83 3 = High: > 83
#RareSpp	MDIFW 2005	IFW	1 = Low: 0 – 9 2 = Moderate: 10 – 40 3 = High: > 40
#NonNativeSpp	Bonney 2006	IFW	-1 = Low: 0 – 13 -2 = Moderate: 14 – 50 -3 = High: > 50

*NAHCS is the Northeast Aquatic Habitat Classification System (additional information and data: <http://rcngrants.org/content/northeastern-aquatic-habitat-classification-project>)

It is important to note that additional factors are known to affect brook trout habitat or potential outcomes of habitat restoration efforts. We'll continue to develop and refine models as additional information becomes available, such as indicators of stream connectivity within stream networks and measures of stream geomorphic stability. We intend to include metrics for stream connectivity as an additional parameter to the MSI in the near future. IFW also is continuing further analysis of additional variables collected during stream surveys. Efforts are underway to expand parameter estimation for brook trout habitat by including factors for instream cover, amount of woody material, riparian structure, and channel shading. Estimates of stream channel stability and geomorphic condition are also being investigated as model parameters to rank sites for probability of successful restoration potential.

Summary

Initial products of IFW's stream survey efforts of 2007–2011 are already shaping conservation action in Maine. The Maine Stream Index is currently being used to identify additional wood addition projects to be implemented by the Maine Forest Service and other partners. These projects will be used as reference sites for on-going efforts toward cooperative riparian management in commercial forestlands.

Efforts are underway toward integrating this project with Maine's Beginning with Habitat (BWH) program. Beginning with Habitat provides 1:24,000 scale comprehensive plant and animal resource maps to towns along with digital data. Towns can draft ordinance language for the conservation of fish and wildlife habitats ranging from road design standards that include fish and aquatic organism passage standards, to enhanced wetland and waterway buffering standards, and conservation subdivision design ideas. Natural resource information is regularly delivered through local technical assistance programs for planning boards, conservation commissions, and landowners. Data products from the trout-related efforts described above will greatly enhance the aquatic resource components, which have been lacking, in BWH maps and technical assistance to municipalities and landowners.

Our intent has always been to provide conservation partners, landowners, and policy makers with robust tools for making informed decisions regarding stream habitats and wild brook trout resources. By providing a series of robust datasets to assist with prioritizing areas, streams, and sites for continued conservation and protection of wild brook trout, cooperative conservation between public and private interests can flourish. Recent stream restoration projects in western Maine are already showing successful cooperative efforts toward rehabilitation at the subwatershed scale. Now, with comparable information for much larger areas of the state, we are poised to greatly expand and grow cooperative efforts across a diversity of areas and land uses to conserve a valuable Maine resource, our wild brook trout.

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