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Maine's Endangered and Threatened Wildlife

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Maine
Department
of Inland
Fisheries &
Wildlife

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

Preamble to the Maine Endangered Species Act (1975)



Mark McCollough

POSTER KEY

Maine Endangered Species:

1. Golden Eagle
2. Peregrine Falcon
3. Piping Plover
4. Roseate Tern
5. Least Tern
6. Black Tern
7. Sedge Wren
8. American Pipit
9. Grasshopper Sparrow
10. Blanding's Turtle
11. Box Turtle
12. Black Racer
13. Roaring Brook Mayfly
14. Ringed Boghaunter
15. Clayton's Copper
16. Edwards' Hairstreak
17. Hessel's Hairstreak
18. Katahdin Arctic

Maine Threatened Species:

19. Bald Eagle
20. Razorbill
21. Atlantic Puffin
22. Harlequin Duck
23. Arctic Tern
24. Upland Sandpiper
25. Northern Bog Lemming
26. Spotted Turtle
27. Loggerhead
28. Swamp Darter
29. Tidewater Mucket
30. Yellow Lampmussel
31. Tomah Mayfly
32. Pygmy Snaketail
33. Twilight Moth
34. Pine Barrens Zanclognatha

Federally Listed Endangered or Threatened Species, currently or historically occurring in Maine but not listed under Maine's Endangered Species Act:

35. Eskimo Curlew
36. Canada Lynx
37. Gray Wolf
38. Eastern Cougar
39. Northern Right Whale
40. Humpback Whale
41. Finback Whale
42. Sperm Whale
43. Sei Whale
44. Leatherback
45. Atlantic Ridley
46. Atlantic Salmon
47. Shortnose Sturgeon
48. American Burying Beetle
49. Karner Blue

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Wildlife

Augusta, Maine

2003



Credits



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This book is dedicated to Alan Hutchinson, who served as Maine Department of Inland Fisheries and Wildlife's nongame and endangered species program leader from 1985-1997.

Additional copies of this publication are available from
www.mefishwildlife.com, or:

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Thoreau climbed Mt. Katahdin in 1846. Today, the view remains remarkably similar to that observed by Thoreau 170 years ago.

... between the mountains are many ample rich and pregnant valleys as ever eye beheld, beset on each side with variety of goodly Trees, the grass man-high unmowed, uneaten and uselessly withering; within these valleys are spacious lakes or ponds well stored with Fish and Beavers ...

John Josselyn, 1674, *An Account of Two Voyages to New England*

Introduction

Immeasurable forest for the sun to shine on, that eastern stuff we hear of in Massachusetts. No clearing, no house. It did not look as if a solitary traveler had cut so much as a walking stick there. Countless lakes, Moosehead in the southwest, forty miles long by ten wide, like a gleaming silver platter at the end of the table.

But Maine, perhaps, will soon be where Massachusetts is. A good part of her territory is already bare and commonplace as much of our neighborhood ...

Henry David Thoreau, 1864, *The Maine Woods*

MAINE must have been like Eden at the time of European contact. A vast sea of towering pines and spruce carpeted the state, rivers ran free and clear, and an emerald sea crashed along a rock-bound coast strewn with forested islands. Wildlife prospered in every corner, from caribou herds in the north to puffins and great auks along the coast. Early settlers boasted of lobster so plentiful that they could be hand-gathered by the bushel, shorebirds so thick they could be killed by the dozen with a single shot, and salmon so abundant they could be netted by the boatful. Even in Thoreau's day, 200 years after first European contact, wildlife still abounded in the North Maine woods.

Those heady days did not last long, as a hungry population soon exploited the resources and tamed the land. By the late 1800s, the caribou were gone, seabirds had nearly vanished from the coast, and the last howl of the wolf was heard over what was once wilderness.

No one knows exactly how many species were lost from the state in the last 350 years. The larger and better known – woodland caribou, wolf, eastern cougar, Atlantic gray whale, timber rattlesnake, passenger pigeon, Labrador duck, great auk, and giant sea mink – were among the best documented. But scientists know that for every vertebrate lost, so too must have vanished a myriad of invertebrates, plants, fungi, and lichens. Indeed, the Karner blue

butterfly and American burying beetle, two of Maine's most striking invertebrates of the past, are now gone from the state. Twenty-six plants also are known to be extirpated from Maine. How many species of fungi, lichens, and invertebrates disappeared with the old growth forests or fire-maintained barrens? In some instances, the loss of a single species can trigger a cascade of subsequent extinctions. A current theory is that the vast populations of passenger pigeons provided a dependable source of small-sized carrion for the American burying beetle. When the passenger pigeon disappeared, so too did the burying beetle. What species disappeared with the extirpation of the burying beetle? We'll never know ...

We are only beginning to understand the great variety of species and patterns of biodiversity in Maine. Our state is a land rich in contrasts between the boreal and temperate, freshwater and saltwater, upland and wetland, and alpine and lowlands. This mosaic of natural communities, topography, and climate supports a wide diversity of wildlife that can be equaled in few other states. The species most familiar to us – breeding birds (226 species), mammals (60 species), reptiles (17 species), amphibians (18 species), and fish (69 species) – actually comprise less than 2 percent of the known wildlife species in the state. Over 15,000 species of invertebrates, 2,100 species of plants, and 3,500 species of


fungi have been documented, but experts believe many times these numbers actually exist. New species to science, like the broad-tailed shadowdragon dragonfly discovered in Maine and New Brunswick in the late 1990s, are still being documented. Maine has an impressive array of flora and fauna, when one considers that only a handful of species were present just 15,000 years ago when a mile-high sheet of ice covered the state. Today, vertebrate biodiversity is richest along the coast, grading to fewer species inland. The highest vertebrate and plant diversity is found in York and Cumberland Counties, an area of the state undergoing tremendous development pressure and loss of open space.

Public concern for the conservation of all of Maine's plants and wildlife has grown in the past two decades. Maine was among the first states to adopt a law to prevent further loss of wildlife species at risk. In 1975, the Legislature passed the Maine Endangered Species Act. In doing so, state policy was established "to conserve by according such protection as is necessary to maintain and enhance their numbers, all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend" (12 MRSA §7751). The Maine Endangered Species Act, more than any other piece of environmental legislation, launched the state on a determined effort to stem the tide of extinctions and preserve intact populations of fish and wildlife for generations to come. In the mid-1980s, the Maine Department of Inland Fisheries and Wildlife initiated nongame and endangered wildlife programs. Complementary programs to conserve rare plants and natural communities were also established and are now part of the Maine Natural Areas Program in the Department of Conservation. Maine is also part of the Natural Heritage Program (NatureServe), a national initiative to track and assess biodiversity.

In the 1990s, biodiversity issues became of great public and scientific interest. The Maine Forest Biodiversity Project and Maine Natural Areas Program completed the first assessment of status and trends of statewide biodiversity. The Maine Cooperative Fish and Wildlife Unit's GAP project documented patterns of vertebrate richness. Janet McMahon completed a thesis at the University of Maine on patterns of plant species richness. These projects completed an initial assessment of biodiversity in Maine.

Is there an extinction crisis in Maine? Probably not, but neither do the data suggest we be complacent. Actions initiated today to forestall further

extinctions could prevent a future crisis from occurring.

Paddling a canoe on a remote lake in northern Maine today, one can easily imagine having stepped back in time – the lakeshores seem pristine, loons yodel from a distance, moose forage at the lake's edge, an eagle soars overhead, and mink frogs chorus from a nearby marsh. We are fortunate to live in a state that still has the potential to conserve most of its native flora and fauna. Have we learned from our past, and are we willing to make difficult choices to preserve what is precious for the future? 

Mark McCollough, Leader
Endangered Species Group
May 2002

We must protect the forests for our children, grandchildren and children yet to be born. We must protect the forests for those who can't speak for themselves such as the birds, animals, fish and trees.

Qwatsinas, Nuxalk Nation

Bald eagles (right) have made a remarkable recovery. Nearly 300 pairs of these threatened birds nested in Maine in 2002.

History and Funding of Endangered Species Management in Maine

A Growing Foundation

Most of Maine's earliest efforts to conserve wildlife were focused on hunted species, although in the late 1800s legislation was passed to protect some songbirds and curtail market hunting of birds for food and feathers for the millinery trade. Early federal legislation was also important for non-hunted species. The Migratory Bird Treaty Act of 1918 protected songbirds, waterfowl, shorebirds, and wading birds. The Bald Eagle Protection Act of 1940 protected bald eagles and was amended in 1963 to protect golden eagles. Rachel Carson, who had a home in Maine, wrote *Silent Spring* in 1962 and drew public attention to the widespread use of chemicals in our environment and the decline of many wildlife species. In 1966, Congress passed the

Endangered Species Preservation Act. This was amended to the Endangered Species Conservation Act of 1969, and finally evolved into the Endangered Species Act (ESA) in 1973.

In developing and passing the ESA, Congress found that *“various species of fish, wildlife and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation; other species of wildlife have been so depleted in numbers that they are in danger of or threatened with extinction,”* and that these species are of *“esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people.”* Congress also declared that the purpose



of the ESA was to “provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved,” and “to provide a program for the conservation of such endangered species and threatened species.” The ESA was significant legislation and provided for establishing a list of endangered and threatened species; protecting these species against take, harm, and harassment; potentially protecting their habitats; requiring review of federal projects; and establishing a means for financial cooperation between the federal government and state agencies to protect species.

Until the 1970s, most state wildlife agencies focused management on game species because the agencies had been, and continue to be, funded largely by hunting and fishing license revenues and federal excise taxes on hunting and fishing equipment through the Federal Aid in Wildlife Restoration Act of 1937 (“Pittman-Robertson Act”) and the Federal Aid in Sport Fish Restoration Act of 1950 (“Dingell-Johnson Act”). Under this system of self-imposed taxation, anglers and hunters pay for most state wildlife and fisheries management programs. Section 6 of the ESA provided a new means by which the federal government could establish programs to share the cost of managing endangered species with states, thus expanding support for wildlife programs to a wider public. This new influx of federal funding was used to fund eagle management and recovery at the University of Maine in the late 1970s and was the impetus for establishing a nongame program in Maine in the early 1980s.

Maine’s First Law and List

In response to growing public concerns about species declines and the availability of new federal endangered species funding, many states passed endangered species acts and initiated nongame and endangered wildlife programs in the 1970s. The Legislature passed the Maine Endangered Species Act (MESA) in 1975. The wording of this landmark state legislation borrowed heavily from the federal

ESA and thus established parallel policies to protect endangered species.

Maine’s first endangered species list contained only those federally-listed species that occurred in the state, but the MESA gave the Commissioner of Inland Fisheries and Wildlife the authority to list other species and provided a way for the public to petition for the listing of new species. In 1981, Maine Audubon Society successfully petitioned to have the first new species, the least tern, added to the state list. In 1982, Peter Cross, a MDIFW biologist, prepared the first assessment of the status of nongame and rare wildlife management for the Commissioner. In 1983, Maine Department of Inland Fisheries and *Game* changed its name to Inland Fisheries and *Wildlife*. The Legislature took notice of these changes and in 1985 the Joint Standing Committee on Fish and Wildlife wrote a report entitled the *Nongame Fish and Wildlife Activities in MDIFW*, preparing the way for discussions of a new nongame and endangered wildlife program.

Fledgling Program

In the late 1970s and early 1980s, few funds, other than federal Section 6 endangered species allocations to states, were available for nongame and endangered wildlife management. Many states, including Maine, began to explore new ways of generating revenue. In 1984, the Legislature created the Nongame and Endangered Wildlife Fund. Primary revenues to the fund came from a voluntary tax checkoff (“Chickadee Checkoff”) on the state income tax form. Public contributions of \$115,000 during the first year enabled two biologists to be hired, and Alan Hutchinson was chosen as leader of the nongame and endangered wildlife program.

One of the first tasks for nongame biologists was to coordinate a review of the status of all vertebrate species. Wildlife Division staff held a public workshop, reviewed the status of birds, mammals, reptiles, and amphibians, and recommended additions to the Maine Endangered Species List. As a result,

One can find some irony in the fact that we are spending enormous amounts of money to discover evidence of life in outer space while at the same time some of us are content to watch countless numbers of species, about which we know nothing, disappear from the face of the earth.

Michael Bean

in 1986 six endangered and four threatened vertebrates were added to the list, bringing the number listed to 18 endangered and 4 threatened species.

Other programs were initiated in state government to address the conservation needs of plants and natural communities. The Maine Natural Heritage Program was established in 1985 with the help and encouragement of The Nature Conservancy. The Natural Heritage Program combined with the Critical Areas Program to form the Maine Natural Areas Program (MNAP), which is now part of the Department of Conservation. MNAP coordinates the state's rare plant program, and maintains a list of rare plants and natural communities. While listed plants were not legally protected under the MESA, MNAP works closely with private landowners on voluntary conservation measures. MDIFW and MNAP share responsibility for maintaining the comprehensive state database containing all information about the state's rare and endangered species.

Expansion and Reorganization

Programs for nongame and endangered wildlife continued to rapidly expand in scope and complexity through the late 1980s and 1990s. In 1988, the MESA was amended to enable the designation of Essential Habitat for state-listed species, thereby allowing protection not only of species, but also the habitats on which they depend. For several years, the state General Fund supported an endangered species biologist position to implement this program. In 1989, the Legislature clarified that MDIFW had responsibility for the conservation of invertebrates. In the same year, sweeping changes were made to bring most state environmental legislation under the umbrella of the Natural Resource Protection Act (NRPA). NRPA established a new means of protecting Significant Wildlife Habitat, including that of endangered and threatened species.

In the early 1990s, MDIFW discontinued its unique, separate nongame wildlife program and integrated nongame bird and mammal management throughout its research and regional staff of biologists. A core group of biologists was retained to address issues affecting endangered species, amphibians, reptiles, and invertebrates. This resulted in expanded programs for many nongame species. Many more biologists worked on nongame species for the first time, and substantial federal Pittman-Robertson funding was devoted to these species.

In 1994, MDIFW began a second species listing initiative and conducted a comprehensive review of



Mark McCollough

The common loon became a symbol of Maine's nongame program and was chosen to be depicted on the Conservation License Plate.

the status of all Maine species, including groups of invertebrates (butterflies, moths, dragonflies, damselflies, mayflies, and freshwater mussels) for which there was adequate information. MDIFW proposed that 20 new species, including, for the first time, 12 species of invertebrates, be added to the state list. In 1997, the Legislature approved all 20 species, increasing the state list to what it is today – 18 endangered and 16 threatened species.

Several significant changes were made to the Maine Endangered Species Act in the 1990s. In 1995, in response to the spotted owl controversy in the West and growing concern about federal endangered species listing, the Legislature transferred to itself the authority to list endangered and threatened species. It also eliminated a provision that automatically included federally listed species on the state list. To provide more flexibility in implementing MESA, amendments were added in 1999 to allow the limited taking of state endangered and threatened species with an approved Incidental Take Plan. This established state policies that parallel those established in the federal ESA.

Funding sources for nongame and endangered wildlife programs have grown, but income has not been consistent. A second major source of state funding, the Conservation License Plate or “Loon Plate,” was established in 1994 to provide funding for the Nongame and Endangered Wildlife Fund and for state parks. Its sales peaked in 1998 when over 15 percent of vehicles in the state were registered with this special plate, one of the highest participation rates in the country. It raised over \$600,000 annually for nongame programs, but sales dropped by 25 percent after the recent introduction of Maine's free, general issue chickadee plate.

Funding from the Chickadee Checkoff has also declined. In its early years, the Checkoff generated close to \$100,000 annually, but decreased by over half when it was moved to a supplemental tax form in 1998. Proceeds from the sale of a conservation lottery ticket were used to establish a third source of state funding for conservation programs. In 1996, the Maine Outdoor Heritage Fund was established. Fifteen percent of this fund is allocated to endangered species. From 1996 to 2000, 31 nongame and endangered species projects were funded, bringing over \$875,000 to MDIFW for species conservation. The unstable nature of state funding sources has forced biologists to rely increasingly on outside grants, including the Outdoor Heritage Fund, to support their work.

Recent Progress and Future Outlook

To meet the needs of species increasingly under pressure, nongame and endangered wildlife programs have continued to grow. Many programs have been successful. For example, during the 1990s Maine's bald eagle population grew to over 200 pairs; piping plovers increased to nearly 60 pairs; roseate terns returned to near-historic levels; and seabird populations increased. New biologists were hired to address songbird and wading bird conservation, develop statewide strategies for protecting wildlife habitat, gather biological data on Canada lynx, and complete surveys for rare and endangered species. Graduate students have assisted by conducting research projects on rare and endangered dragonflies, mussels, black terns, salt marsh sparrows, New England cottontails, and Blanding's turtles. Land protection has accelerated to include the purchase of many coastal areas, islands, eagle nesting areas, lakeshores, and endangered species habitat. Biologists address nongame wildlife planning on state-owned lands, and ecological reserves have been established on some state lands. Management plans with recovery objectives were developed for many rare species. Cooperation grew between MDIFW and its many conservation partners.

Nongame and endangered wildlife programs will continue to grow, especially if new sources of funding become available. For many years, conservationists have proposed that a federal funding program, similar to Pittman-Robertson and Dingell-Johnson, be established for nongame species conservation. U.S. Senator George Mitchell of Maine was instrumental in passing the Fish and Wildlife Conservation Act of 1980, which provided the legislative framework for such a program, but it was never fully funded. In the late 1990s, a national effort was

renewed to provide reliable federal funding for nongame wildlife. Congress has been debating the merits of such a program for many years. If funded, nongame and endangered wildlife programs in Maine and across the nation would expand to include the needs of many plant and wildlife species, protect habitats, and provide for the needs of nonconsumptive wildlife users.

Unfortunately, Maine's three sources of state nongame wildlife funding – the Chickadee Checkoff, Loon Plate, and Outdoor Heritage Fund – have been inconsistent or have declined, prompting many to wonder whether it is prudent to fund wildlife conservation in this way. Legislative committees have reviewed MDIFW's funding many times and have consistently recommended additional resources beyond hunting and fishing license revenue and federal aid. Other sources of state funding, including General Funds, need to be invested in Maine's fish and wildlife resources. These natural resources belong to all of the people of the state, and their conservation is our collective responsibility. 🟡

Make endangered species a vivid presence in the lives of people. Make it clear that every endangered species has a name, has a million-year history, has a place in the world. Bring us face-to-face with each of those species. Make us know that they are our companions in the biosphere. They are not just something out there you look at once in a while, but they're part of our existence ... they are part of us.

Edward O. Wilson

The threatened spotted turtle (right) with its polka-dotted shell is one of Maine's most colorful reptiles.

Maine's Endangered Species Act

THE Maine Endangered Species Act establishes a clear state policy to conserve all species of fish and wildlife in Maine and the ecosystems they need to survive. MDIFW's mandate, therefore, is to protect *all* the state's wildlife – charismatic and unpopular, predators and pollinators, invertebrates and vertebrates, species at the edge of their range, or species naturally dispersing into the state. All have inherent ecological and evolutionary value. Each species has its own unique genetic legacy. Each species functions as a cog in the wheel of working ecosystems. Wildlife also has cultural and esthetic value and has an important role in our state's history and economy. Simply put, wildlife is essential to the quality of life we enjoy in the Pine Tree State. Each

time we lose a species, we are a poorer society, and the integrity of our ecological systems is diminished.

Why List Species?

Listing is the first important step in recovering endangered species. During the listing process, biologists and policy makers have sometimes asked, "Why do we need an endangered species list? Can't we just develop and implement conservation programs for the rarest species and avoid listing?"

Endangered species lists are instrumental to implementing public policy and provide benefits to both the species and the people of Maine. First, a list establishes a clear public policy for prioritizing which species merit the substantial protection



afforded by endangered species legislation. Once listed, species are guaranteed certain protections. Species are protected from take (killing) and harassment. Individuals may not possess endangered and threatened species or parts thereof (feathers, eggs, specimens) without proper permits. Finally, listed species cannot be collected, sold, imported, or exported. With an established list there is no confusion among businesses, landowners, government agencies, and the public about which species merit this unique protection and which do not.

Second, an established list provides educational benefits. Maintaining a list of endangered species brings to the attention of the public these species, their life histories, and threats to their survival. This, in turn, can pay dividends in terms of nonregulatory, cooperative management agreements and planning. Educational materials such as posters, fact sheets, and this book provide a means to raise awareness about these species. It is inspiring to see inconspicuous species like the pine barrens zanclognatha, pygmy snaketail, and Clayton's copper butterfly become familiar to naturalists, regulators, and landowners around the state, simply by virtue of listing.

Third, a list provides a basis for reasoned planning and decisions regarding conservation priorities and allocations of scarce management resources. Species on the state list are determined by a rigorous biological evaluation to be in greatest danger of extirpation in the state. To ensure an objective, biological basis for listing, regulations were adopted in 1994 that specify six biological measures to be used in evaluating a species' risk of extinction: population viability, size, trend, distribution, fragmentation, and endemism (species that occur only in Maine). Listing proposals are peer reviewed by species experts from inside and outside of the state. After biologists have made their evaluations and recommendations, a proposed list of species is taken through the public rule-making process, public hearings, a hearing before the Fish and Wildlife Legislative Committee, a vote by the Legislature, and final approval by the Governor. This lengthy process provides ample opportunity for public involvement in the listing process.

A final reason for maintaining a listing process

that includes public input is that it protects the state from unexpected and unwarranted petitions to list species. Although the MESA provides for a public petitioning process, this has occurred only once (for the least tern in 1981). Petitions can be costly and require significant staff time. MDIFW attempts to update its state list about every five years. By establishing listing criteria in rule making, MDIFW has made clear the requirements for endangered or threatened status.

Biologists are frequently asked why species should be listed if they occur at the edge of their range here. The Maine Endangered Species Act recognizes the importance of preserving *all* species that naturally occur in Maine. Even individuals at the edge of their range contribute to functioning ecosystems. It is important to preserve populations of species throughout their natural range. As species disappear, ecosystems become less stable. Populations at the edge of their range may have unique genetic attributes or adaptations. These characteristics may become important in the species' evolution. It is also appropriate to preserve species for their aesthetic and economic values, even though they are more abundant elsewhere in the world. Some of Maine's most spectacular wildlife, such as puffins, arctic terns, and Canada lynx, are at the edge of their range, but have considerable value to the state. In addition, conservation programs developed for rare species in Maine may be applied to preserve species elsewhere in their range. National Audubon's puffin and seabird restoration programs, pioneered on the Maine coast, are used as a model for seabird restoration efforts worldwide. Conservation programs for endangered or threatened species also help conserve other species and habitats. For example, preserving the Kennebunk plains in southern Maine for rare plants, black racers, and grasshopper sparrows conserves a grassland ecosystem that supports hundreds of other species.

The listing process is a biological evaluation. MDIFW has been careful to keep discussions during the listing process focused on the biological reasons for listing a species. The political, social, and economic implications of listing a species should not influence the listing process. Given staff and fund-

The Endangered Species Act ... recognizes values, be they ethical or aesthetic, that transcend the purely practical and admit to an awe in the face of the diversity of creation.

James L. Buckley, 1979, *Washington Post*

ing restrictions, not all species will receive intensive management attention after listing. Priorities for which species will receive focused recovery programs are developed based on risk of extinction, population size, life history, genetic or taxonomic uniqueness, endemism, and cost and effectiveness of management programs to recover the species.

Essential and Significant Habitat

The habitat of all state-listed species is eligible for protection if designated as Essential Habitat. However, designation is not automatic, and must be first justified in a MDIFW recovery plan and go through a public rule making process. To date, Essential Habitat has been designated for only four species: the bald eagle, piping plover, least tern, and roseate tern. MDIFW is attempting to develop recovery plans for all state-listed species. After species' needs are documented, public working groups help MDIFW develop goals and objectives for the species' recovery. These may, or may not, include the need for regulated habitat protection. At present, recovery actions for all listed species are not possible because of insufficient staff and funding.

All projects funded, carried, permitted, and licensed by state agencies and municipalities within a mapped Essential Habitat receive MDIFW review. Essential Habitat designation does not prohibit landowners from activities near listed species! In fact, over 99 percent of requests have been approved, often with minor modifications in the timing or location of the proposed activity. Essential Habitat has proven to provide a standard and equitable means to protect endangered and threatened species habitat. There are no costs or additional permits required of the applicant. Landowners, towns, and state agencies are informed of mapped Essential Habitats and are encouraged to consult with MDIFW biologists early in project development. These early discussions enable biologists and applicants to discuss the needs of the listed species, develop equitable solutions, and avoid last minute delays and conflicts. Essential Habitat designation is removed when a species is delisted.

Habitats of endangered and threatened wildlife are also eligible for protection as Significant Wildlife Habitat (SWH) under the Natural Resource Protection Act (NRPA). MDIFW must define and map SWHs and the Department of Environmental Protection must adopt them via rule making before SWHs are protected, unless the SWH occurs within another protected natural resource identified under NRPA.

Currently, seabird nesting islands have been

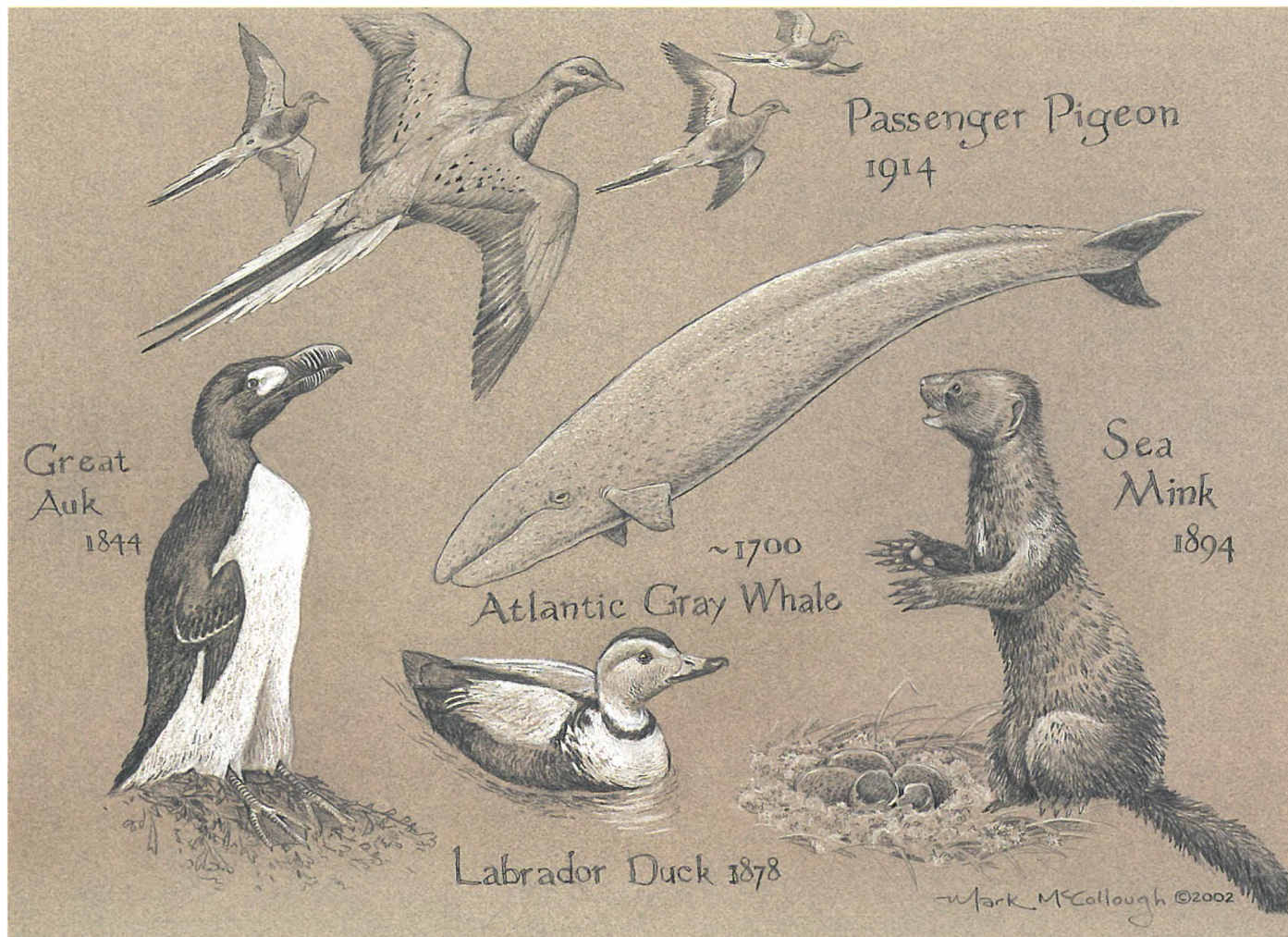


Mark McCollough

Nest trees are essential habitat for the bald eagle's continued survival. A climber prepares to lower eaglets to the ground for contaminants research and banding.

designated as SWH. MDIFW has developed criteria to identify, map, and rate high and moderate deer wintering areas and high and moderate value waterfowl and wading bird habitats. At this time, MDIFW has not designated SWH for endangered wildlife.

MDIFW views SWH as one of several means to achieve the conservation of wildlife habitats. MDIFW will attempt to conserve important wildlife habitats without resorting to land use zoning via a landscape strategy based on cooperative land use agreements with landowners and other non-regulatory options. This approach will likely be more effective than regulation and avoids political and social issues associated with zoning. MDIFW intends to employ zoning only when the cooperative approach does not conserve sufficient habitat to support species population goals.



*“And then there were none ...”
The passenger pigeon, great auk, Labrador duck, Atlantic gray whale, and sea mink are extinct and will never be seen in Maine again.*

Delisting Process

It is the ultimate goal of MDIFW to secure populations of all species so they can be removed from the state endangered species list. However, the Maine Endangered Species Act provides no specific protocol for removing a species from the list. So how are species delisted?

Sometime after listing, MDIFW develops an assessment (recovery plan) for each listed species. As part of this process, recovery criteria are identified for downlisting (moving a species from endangered to threatened status) or delisting (removing a species from threatened status off the list). A public

working group will also establish goals and objectives toward reaching the ultimate goal of delisting the species. Once these criteria are met, a delisting rule proposal is developed, public hearings are held, recommendations are made to the Legislative Fish and Wildlife Committee, the delisting proposal is voted on in the Legislature, the bill is signed by the Governor, and the species is removed from the list.

At present, no species have been removed from the Maine endangered and threatened species list. However, the bald eagle, whose numbers have climbed steadily, is close to meeting state delisting criteria. 🐦

In the end, our society will be defined not only by what we create but by what we refuse to destroy.

John Sawhill, The Nature Conservancy

Listing Categories

Maine statute recognizes two categories of listed species:

ENDANGERED: any species of fish or wildlife that has been determined by the commissioner to be in danger of extinction throughout all or a significant portion of its range. An endangered species is in immediate danger of extirpation from the state because of critically low or rapidly declining numbers. Habitat loss or degradation, overexploitation, pollution, disease, and competition with other species are all possible causes for decline. The continued existence of these species in the state is unlikely without implementing special measures to protect these species or their habitats.

THREATENED: any species of fish or wildlife that has been determined by the commissioner as likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. A threatened species is not in as critical jeopardy of extirpation as an endangered species, but will probably become endangered if populations experience further decline. Threatened species include indigenous wildlife that are rare and declining within the state, and that are likely to become endangered in the foreseeable future. There are no differences in terms of regulatory policy between endangered and threatened listing categories.

MDIFW keeps a third, unofficial list of **Special Concern** species. These are not protected by endangered species statutes and have no special legislative protection. However, they are believed to be vulnerable and could easily become threatened or endangered because of restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors. They include species suspected of being threatened or endangered or likely to become so, but for which insufficient data are available. Currently, there are just over 100 species on the state's Special Concern list.

Other terms frequently used in endangered species listing include extinct, extirpated, and endemic:

Extinct: An animal that has died out or is no longer in existence anywhere on Earth. Extinct species that once occurred in Maine include the passenger pigeon, Atlantic gray whale, sea mink, great auk, and Labrador duck.

Extirpated: An animal that has been eliminated from Maine, but still occurs elsewhere. Species extirpated from Maine, but that still exist elsewhere, include the gray wolf, woodland caribou, Karner blue butterfly, timber rattlesnake, eastern cougar, American burying beetle, persius duskywing (butterfly), frosted elfin (butterfly), regal fritillary (butterfly), tawny crescent (butterfly), chestnut clearwing (moth), wolverine, Eskimo curlew, and common murre.

Endemic: An animal that is restricted to, or present in, a small region and found nowhere else in the world. Species and subspecies endemic (or near endemic) to Maine include the Katahdin arctic butterfly, Clayton's copper butterfly, Tomah mayfly, and Roaring Brook mayfly.

Maine's Endangered and Threatened Species Lists

Maine has two endangered wildlife lists – one state and one federal. At one time, the Maine Legislature automatically placed federally listed species on the state list, but no longer. As a result, some species are state-listed only, others federal-listed only, and some are found on both lists. When species are federally listed, the listing justification is printed in the Federal Register. This justification includes the species' historic range, which may include Maine.

In 1997, MDIFW did not nominate some federally listed species that occur in Maine for consideration for state listing. Either insufficient data were available to make a listing determination (e.g., gray wolf and eastern cougar) or the species was believed extirpated from the state (e.g., Eskimo curlew, Karner blue, and American burying beetle). Some species (e.g., Atlantic salmon and Canada lynx) were federally listed after 1997. In the future, some federally listed species should be considered for state listing as new data are obtained.

Federally listed sea turtles and whales were dropped from the state list in 1997. After the 1997 state listing process was completed, MDIFW entered into an agreement with the Maine Department of Marine Resources (DMR) to give DMR primary responsibility for managing and listing marine turtles and mammals. DMR may propose that any of these species be placed on the state list using the same state listing process outlined earlier.

Maine Endangered and Threatened Fish and Wildlife Species List

MAINE ENDANGERED SPECIES

Birds

Golden Eagle – *Aquila chrysaetos*
 Peregrine Falcon – *Falco peregrinus* (breeding population only)
 Piping Plover – *Charadrius melodus***
 Roseate Tern – *Sterna dougallii**
 Least Tern – *Sterna antillarum*
 Black Tern – *Chlidonias niger*
 Sedge Wren – *Cistothorus platensis*
 American Pipit – *Anthus rubescens* (breeding population only)
 Grasshopper Sparrow – *Ammodramus savannarum*

Reptiles

Blanding's Turtle – *Emydoidea blandingii*
 Box Turtle – *Terrapene carolina*
 Black Racer – *Coluber constrictor*

Mayflies

Roaring Brook Mayfly – *Epeorus frisoni*

Damselflies and Dragonflies

Ringed Boghaunter – *Williamsonia lintneri*

Butterflies and Moths

Clayton's Copper – *Lycaena dorcas claytoni*
 Edwards' Hairstreak – *Satyrium edwardsii*
 Hessel's Hairstreak – *Callophrys hesseli*
 Katahdin Arctic – *Oeneis polixenes katahdin*

MAINE THREATENED SPECIES

Birds

Bald Eagle – *Haliaeetus leucocephalus***
 Razorbill – *Alca torda*
 Atlantic Puffin – *Fratercula arctica*
 Harlequin Duck – *Histrionicus histrionicus*
 Arctic Tern – *Sterna paradisaea*
 Upland Sandpiper – *Bartramia longicauda*

Mammals

Northern Bog Lemming – *Synaptomys borealis*

Reptiles

Spotted Turtle – *Clemmys guttata*
 Loggerhead – *Caretta caretta***

Fish

Swamp Darter – *Etheostoma fusiforme*

Mollusks

Tidewater Mucket – *Leptodea ochracea*
 Yellow Lampmussel – *Lampsilis cariosa*

Mayflies

Tomah Mayfly – *Siphonisca aerodromia*

Damselflies and Dragonflies

Pygmy Snaketail – *Ophiogomphus howei*

Butterflies and Moths

Twilight Moth – *Lycia rachelae*
 Pine Barrens Zanclognatha – *Zanclognatha martha*

FEDERALLY LISTED ENDANGERED OR THREATENED SPECIES,

currently or historically occurring in Maine but not listed under Maine's Endangered Species Act

Birds

Eskimo Curlew – *Numenius borealis** /?

Mammals

Gray Wolf – *Canis lupus*** /?
 Eastern Cougar – *Felis concolor cougar** /?
 Canada Lynx – *Lynx canadensis***
 Northern Right Whale – *Eubalaena glacialis**
 Humpback Whale – *Megaptera novaeangliae**
 Finback Whale – *Balaenoptera physalus**
 Sperm Whale – *Physeter macrocephalus**
 Sei Whale – *Balaenoptera borealis**

Amphibians and Reptiles

Leatherback – *Dermochelys coriacea**
 Atlantic Ridley – *Lepidochelys kempii***

Fish

Atlantic Salmon – *Salmo salar**
 Shortnose Sturgeon – *Acipenser brevirostrum**

Beetles

American Burying Beetle – *Nicrophorus americanus** /?

Butterflies and Moths

Karner Blue – *Lycacides melissa samuelis** /?

Note: * = Federally listed endangered species
 ** = Federally listed threatened species
 ? = Current presence uncertain in Maine

(For the companion list of endangered and threatened plants in Maine, contact the Maine Natural Areas Program, Department of Conservation, 93 State House Station, Augusta, ME 04333. Phone: 207-287-8046)

Management

of Maine's Endangered Wildlife

CAN MDIFW attain the broad goal of protecting all species of fish and wildlife as mandated in the Maine Endangered Species Act? Given current funding constraints, we do not yet have recovery programs for all state-listed species. However, MDIFW is working diligently with conservation partners to restore populations of as many endangered and threatened species as possible. Developing a recovery program for an endangered or threatened species requires careful thought and planning. Recovery plans are being developed for all state-listed species. Each plan identifies threats, enumerates strategies for restoring species and habitats, and establishes criteria for when a species can be removed from the list.

Before recovery actions can begin, biologists must determine what factors are limiting a species. **Limiting factors** can include loss of habitat, disease, competition or predation from other species, environmental contaminants or pollution, competition with invasive species, overexploitation, or other natural or human-caused factors. These factors must be alleviated if species' populations are to recover and grow.

Historically, excessive **exploitation** led to the extinction of some of Maine's species. In the absence of fish and wildlife laws in the late 1800s, Maine lost species like the sea mink, wolf, cougar, and caribou. Other species used for food, feathers, and other commercial purposes were nearly



MDIFW biologists Mark McCollough and Andy Weik band a bald eagle chick.

extirpated. Today, wildlife populations are more carefully monitored, and fish and wildlife laws prevent the excessive harvest of hunted and fished species. Nevertheless, some species, especially those with small populations, low reproductive rates, low natural survival, or long age to maturity, are more sensitive to harvest. In recent times, species like the harlequin duck may have been overexploited. Population declines for other migratory species may also be caused by excessive harvest in Central and South America where fish and wildlife laws may be nonexistent or not well enforced.

Today, **habitat loss** and degradation threatens more endangered and threatened species in Maine than any other factor. Many of the state's endangered species occur in southern Maine where development pressures are most intense. Habitat protection is one of MDIFW's highest priorities. There are many initiatives to protect some of the most critical habitats for endangered species. For example, over 50 bald eagle nest sites were acquired by MDIFW and conservation partners like The Nature Conservancy, U.S. Fish and Wildlife Service, and Maine Coast Heritage Trust. Over 7,000 acres of land were purchased by conservation partners like The Nature Conservancy and local land trusts in the Mount Agamenticus region to protect Blanding's and spotted turtles, rare plant communities, the ringed boghaunter dragonfly, and an outstanding complex of vernal pool habitats. MDIFW and the U.S. Fish and Wildlife Service preserved many seabird nesting islands, especially those hosting endangered species. Large sums of federal funding were secured to acquire fee title and conservation easements along Down East rivers for the Atlantic salmon. Funds from the Outdoor Heritage Fund and Land for Maine's Future were especially instrumental in protecting endangered species habitat. MDIFW, MNAP, and Maine Audubon also work with land trusts and municipalities through the "Beginning With Habitat" initiative to encourage local efforts

to protect critical habitat for endangered species. Essential Habitat regulations were employed to protect over 400 eagle nests, 20 roseate tern nesting islands, and 20 beaches for piping plovers and least terns. Future habitat protection efforts will likely employ new tools like landowner incentives, tax abatement, and cooperative agreements with landowners.

Competition and **predation** sometimes threaten species. Often, imbalances between wildlife populations are caused by human-induced changes in our environment. For instance, great black-backed and herring gull populations have increased because of greater food availability from open dumps and fish waste. These large predators eat the eggs and chicks of rare seabirds like puffins, roseate terns, and arctic terns and compete with them for nest space on islands. State, federal, and private conservation groups have reduced gull populations on selected islands to prevent the extirpation of the smaller seabirds. Fox, raccoon, skunk, gull, and crow predation inhibits the recovery of piping plovers and least terns on many beaches. Often, mammal and bird predators are attracted by garbage left on beaches by human visitors. To protect the rare plovers and terns, Maine Audubon places fence enclosures around nests to prevent predators from taking eggs. Ultimately, long-term solutions require that factors leading to artificially high predator populations must be addressed. In some instances, conflicts even arise between endangered species! Peregrine falcons from Mount Desert Island prey on arctic and roseate terns from nearby islands that are being managed for endangered seabirds. Fortunately, these incidents are infrequent, and management intervention has not been necessary.

Environmental **contaminants** and **pollution** have had a devastating effect on some Maine wildlife. Bald eagles, golden eagles, and peregrine falcons all declined because of the widespread use of

Man is incapable of making permanent changes in the cosmos. Except one. In only one way can man truly make his mark upon time and life and evolution: by exterminating any species of plant or animal. If he does that, if he eradicates or allows to fail any line of evolution through time, he will have permanently altered the life potential of the cosmos for as long as matter and energy are in balance.

Roger Caras, 1978, Yale

DDT in Maine after World War II to control forest insect pests. DDE, a persistent by-product of DDT that is magnified in the food chain, caused eggshell thinning and embryo mortality. Fortunately, DDT was banned in the U.S. in 1978, and bald eagle populations slowly recovered. Peregrines were extirpated from the state by the early 1960s, and golden eagles discontinued nesting in Maine in the late 1990s. PCBs, mercury, and dioxin contamination are still a problem for these species. These chemicals persist for decades in Maine's cool environment. Some species' recovery strategies will not be effective until chemical contaminants are at lower levels. Ridding the environment of toxic contaminants is a long, complex, and expensive endeavor. However, it must be accomplished to ensure a healthy environment for humans and wildlife.

Invasive species endanger many species globally. Fortunately, Maine has not yet experienced invasive plants or wildlife that severely disrupt ecosystems or alter habitats. Some species, like the zebra mussel, Eurasian milfoil, and purple loosestrife, are threatening wildlife elsewhere in New England. MDIFW participates with other state agencies in the Maine Invasive Species Task Force. This task force is developing a state plan to identify existing and potential invasive species, address current problems, and develop programs to prevent the introduction of invasive species.

Human disturbance is also a major factor limiting some species. For example, seabirds, eagles, piping plovers, and least terns are particularly sensitive to human disturbance during the incubation and brood-rearing period. Seabird nesting islands are posted to keep visitors off islands during this critical period. MDIFW works with landowners to help prevent disturbance of nesting eagles. Maine Audubon places signs and fences near piping plover and least tern nesting areas to keep beach users a respectable distance from nesting birds. In most instances, people and endangered species can coexist with careful planning and education!

A few state-listed species are **naturally rare** in the state. For example, black racers and Blanding's, spotted, and box turtles are at the northern limit of their range in Maine and are likely restricted by the rigors of a cool climate and lack of suitable habitat. Their populations at the edge of their range may be more sensitive to habitat loss and fragmentation. To help these species, MDIFW and conservation partners are working with municipalities in southern Maine to preserve large, forested tracts as open space. Other species, including the Canada lynx and northern bog lemming, are at the southern edge of



Parker Schuerman

An endangered black racer in the capable hands of MDIFW biologist Phillip deMaynadier.

their range in Maine. Conservationists are working with large forest landowners in northern Maine to develop forest management strategies that will maintain adequate habitat for these species. Finally, some species are extremely habitat-limited and were isolated in small habitat patches as the glaciers retreated from the landscape. The American pipit, Roaring Brook mayfly, and Katahdin arctic butterfly are found at only a single location in Maine. Fortunately, their unique habitat is well protected in Baxter State Park.

Some species are limited because their habitat was enhanced by humans and is now diminishing. Upland sandpipers, grasshopper sparrows, and black racers all likely flourished at the height of agricultural land use in New England in the mid-1800s. Now they are declining as grasslands revert to forestland or are developed for homes and businesses. Known habitats, like the Kennebunk Plains, are being managed as grasslands by using controlled burning and mowing. MDIFW encourages owners of blueberry lands in eastern Maine, airports, and



Phillip deMaynadier

Only seven pitch pine-scrub oak forest ecosystems remain in southern Maine and provide habitat for many rare invertebrates and plants, including the threatened pine barrens zancloagnatha and twilight moth.

large hayfields in Aroostook County to implement best management practices to enhance the nesting success of grassland birds.

Although limiting factors are known or suspected for many of Maine's listed species, we still lack good information on the life history, distribution, movements, habitat use, or population size and trends of many endangered or threatened species. MDIFW works closely with the University of Maine and other regional institutions to promote research studies of state listed species. For example, graduate students are investigating the fish hosts of the yellow lampmussel and tidewater mucket, identifying the factors limiting black tern populations, assessing harlequin duck survival rates and migration routes, addressing the effects of predation and tides on least terns, and radio-tagging Blanding's and spotted turtles to learn more about their movements and habitat use. Every year brings a new variety of research topics, as species' needs are identified and

priorities are set.

Populations of some listed species (e.g., roseate, least, and black terns; puffins; piping plovers; bald and golden eagles; grasshopper sparrows; and peregrines) are monitored annually to assess population trends. Monitoring techniques have yet to be developed to assess species such as mayflies, butterflies, moths, and mussels. Surveys are also important to determine where endangered and threatened species are located. MDIFW is currently conducting a systematic, seven-year, statewide survey for rare and endangered species in each of the state's 17 ecoregions. Data from these comprehensive surveys are providing better information on the distribution and relative abundance of listed species and an improved assessment of the status of many Special Concern species, including those that may merit listing in the future. Atlasing initiatives focused on freshwater mussels, dragonflies, damselflies, and butterflies are also underway. 🐸

Wild beasts and birds are by right not the property merely of the people who are alive today, but the property of unknown generations, whose belongings we have no right to squander.

Theodore Roosevelt

Habitats at Risk

Wildlife (and people!) requires food, water, and shelter to survive. If any of these habitat components are missing or altered significantly, animals become stressed and exposed to disease or predation, and may die. Because some habitats are rare (like certain peatlands, sand beaches, pitch pine barrens, and nesting islands), many of the animals that are specialized to live there are also rare. When these habitats disappear, the species that inhabit them do too. Other habitats were once relatively common (like brushy fields, grasslands, farms, and orchards), but as they are developed or revert back to forestland, the species that depend on these habitats may become rare or endangered. In developed landscapes in central and southern Maine, habitat fragmentation is endangering wildlife. Roads, housing developments, utility right-of-ways, and other habitat alterations separate patches of once contiguous habitat. Wildlife is killed crossing roads or simply can no longer access all the components of habitat that they need to survive.

Some of Maine's most endangered and vulnerable wildlife habitats include:

Vernal pools and other wetlands – Vernal pools are small wetlands that fill with water in the spring and often dry by late summer. These small wetlands in central and southern Maine are home to Blanding's and spotted turtles, ringed boghaunter dragonflies, and many other rare species. Forested uplands adjacent to vernal pools are being lost to housing developments, and the wetlands themselves are being filled. Turtles, salamanders, and dragonflies are losing their homes and can no longer move safely between wetlands. One third of Maine's state-listed species is associated with freshwater environments.

Rivers and streams – Maine has an outstanding freshwater resource with nearly 6,000 lakes and ponds and 32,000 miles of streams and rivers. Pollution has endangered species like the tidewater mucket, yellow lampmussel, pygmy snaketail, and bald eagle. It is important that Maine communities fully implement Shoreland Zoning standards to maintain water quality and riparian habitat.

Special forests – *Atlantic white cedar and pitch pine-scrub oak barrens* – These special forest types are found only at a few locations in southern Maine, but they host many rare plants and wildlife. MDIFW and The Nature Conservancy have purchased some of these forests to be managed for rare species like the black racer, twilight moth, and Hessel's hairstreak butterfly.

Coastal islands – Maine has over 3,000

islands, but fewer than 30 provide suitable habitat for endangered seabirds like the roseate and arctic tern, razorbill, and Atlantic puffin. Many islands are now in conservation ownership, but an overabundant gull population has been forcing many of the smaller, rarer birds away from their preferred nesting areas.

Grasslands – Many of Maine's grasslands are reverting to forest or being developed. As a result, many grassland birds are declining, and some are now endangered (grasshopper sparrow) or threatened (upland sandpiper). The regal fritillary, a grassland butterfly, is now extirpated in Maine.

Cliffs and alpine mountaintops – Cliffs and high altitude areas are unique to the mountainous regions of the state and support some of our rarest species like the golden eagle, peregrine falcon, American pipit, and Katahdin arctic. Fortunately, many of these habitats are already conserved and not in direct threat of being developed. However, global warming and acid precipitation may pose a threat to alpine ecosystems. Recreational uses can be a management concern.

Sand beaches and salt marshes – Over two-thirds of Maine's beaches have been lost to development, and adjacent salt marshes have been ditched, drained, and developed. This is the primary cause of endangerment for the piping plover and least tern. Some beaches are in conservation ownership, but at other sites conservation partners must work hard to ensure that large numbers of summer visitors share the beach with endangered species.

Actions to Help Maine's Endangered Wildlife

ALTHOUGH it may be difficult for everyone to participate directly in saving endangered species, individuals and groups can help on many levels, from becoming aware of species in trouble to volunteering time and money towards recovery efforts. For example, students at Nokomis High School in Newport studied black terns for over 10 years and successfully convinced the Legislature to list this species as endangered. Here are some other suggestions:

✓ **Learn** about, support, and become involved with MDIFW and USFWS wildlife conservation programs.

- ✓ **Ask questions.** Which species in your town are rare or endangered? Why? What is harming their habitats? Become informed and inform others.
- ✓ **Follow conservation guidelines** included under individual species in this book, and encourage neighbors and town planners to do so.
- ✓ **Become involved** in the process your community uses to evaluate development proposals, and ensure that habitat is being maintained for wildlife.
- ✓ **Buy** a conservation license plate, Outdoor Heritage Fund lottery ticket, or contribute to the Chickadee Checkoff.



The Maine Damselfly and Dragonfly Survey is one of several MDIFW "citizen scientist" programs where volunteers can assist with important natural history surveys.

Mark McCollough



- ✓ **Join** organizations like the Natural Resources Council of Maine, Maine Audubon Society, or Maine Chapter of The Nature Conservancy, who work toward endangered species conservation.
- ✓ **When voting**, consider the implications of your choices for wildlife and the environment. Contact your elected representatives to support wildlife conservation and habitat protection programs.
- ✓ **Volunteer** to become a “citizen scientist” and help MDIFW or Maine Audubon survey frogs, owls, songbirds, or dragonflies. 🐸



Individually, each of us can do only a little. Together, we can save the world.

Denis Hayes

For More Information

Additional information on Maine’s endangered species can be obtained at:

Maine Department of Inland Fisheries and Wildlife: www.mefishwildlife.com

U.S. Fish and Wildlife Service: www.endangered.fws.gov

Maine Natural Areas Program: www.state.me.us/doc/nrimc/mnap/home.htm

NatureServe: www.natureserve.org

For endangered wildlife, contact:

Endangered Species Group
Maine Department of Inland Fisheries and
Wildlife
650 State Street
Bangor, ME 04401
Phone: 207-941-4466

U.S. Fish and Wildlife Service
Maine Field Office
1168 Main Street
Old Town, ME 04468
Phone: 207-827-5938

**FEDERALLY
THREATENED**

Gray Wolf

(*Canis lupus lycaon*)



USFWS

Description

Few species have raised as much intense controversy and interest over the ages as the wolf. The gray wolf is the largest wild member of the dog family. Adults weigh 46-175 pounds depending on sex and subspecies. The subspecies, *C.l. lycaon*, found in the Great Lakes region, eastern Canada, and formerly the Northeast, is smaller than subspecies found in the West and northern Canada. The average weight of male wolves in Wisconsin is 77 pounds (range 57-102 pounds), and females average 62 pounds (range 46-75 pounds). Gray wolves superficially resemble coyotes or large domestic dogs, such as German Shepherds or huskies, but can be distinguished by their longer legs, larger feet, wider heads and snouts, and narrower chests. Coyotes (*Canis latrans*) are smaller (30-60 pounds), and have narrow, pointed noses and shorter legs. The wolf's coat color is variable, grading from pure white to pure black, but the most common color is rusty brown with long black guard hairs on the back and sides. The tail is

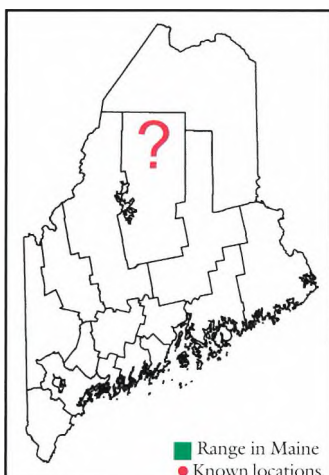
usually held straight, in line with the body. The front foot has five toes, and the hindfoot four. Track length (tip of toe to heel) is generally greater than 4½ inches.

Canids (members of the dog family) can interbreed. The gray wolf has specialized as a moose and caribou predator, and is now found in boreal areas of North America. The

red wolf (*Canis rufus*) is smaller (40-80 pounds), feeds primarily on deer, and was found predominantly in the Southeast. Gray and red wolves interbreed where their populations overlap. Maine probably had a mixture of gray wolves in the north where moose and caribou were the predominant prey and red wolves in the south and along the coast where deer were the predominant prey. These two species may have hybridized in central portions of the state. To add further confusion, some eastern coyotes in Maine have wolf genes acquired during their past range expansion to the East.

Range and Habitat

The gray wolf historically occurred across most of Europe, Asia, and North America, except for parts of California and the Atlantic coastal plain south of Virginia. In the lower 48 states, the gray wolf was extirpated from 95 percent of its historic range. Wolves were extirpated from Maine by the 1890s. Small populations persisted in northeastern Minnesota and northern Michigan. Since the 1980s, populations have greatly expanded in the Great Lakes region and northern Rockies, and gray wolves have been reintroduced into the Yellowstone region, Idaho, Arizona, and New Mexico. Gray wolves persist across Canada, and in eastern Canada are found as far south as the north shore of the St. Lawrence River in Quebec. Although often thought of as a "wilderness" species, the gray wolf occupies many habitats, and in many areas demonstrates tolerance to human activities. In the Northeast, large, relatively unfragmented blocks of forested habitats that support adequate deer and moose populations are considered best suited for wolves.



Life History and Ecology

Gray wolves are social animals and live in family groups or packs of 2-8 individuals, though some packs contain 20 or more members. Packs usually consist of parents (a single alpha pair), their offspring, and other non-breeding adults. Wolves begin to breed when they are 2-3 years old, sometimes establishing lifelong mates. Depending on latitude, females breed between January and April. The estrous period lasts 5-7 days, and gestation is 63 days. Litters average 6 pups, but may range between 1 and 11. The alpha female remains with the pups while the lead male and other members of the pack hunt and feed them. When the pups are 8-10 weeks old, they are moved from the den to a “rendezvous site,” where they remain while pack members hunt. A succession of rendezvous sites are used until the fall, when the pups are almost full grown and begin to accompany adults on hunts.

From late April to late fall, the wolf pack restricts its wanderings to small areas centered on the den and pups. After the pups abandon their rendezvous sites, the pack wanders widely. Summer home ranges in forested areas may be 3-10 square miles, while winter ranges are much larger. Often, after 1-2 years of age, a young wolf may disperse from the pack and travel up to 500 miles in search of a new home.

Wolves can live to be 16 years old in the wild. They are carnivores and prey on large animals such as white-tailed deer, caribou, moose, and beaver. Pack members communicate by howling, especially during winter breeding and pup rearing.

Threats

Wolves were extirpated from much of their historic range by hunting, trapping, and poisoning. Many wolf eradication programs were government sponsored. Bounties were enacted in Scarborough in 1730. The state enacted wolf bounties from 1832-1903. Early settlers also depleted populations of deer, caribou, and moose and competed with wolves for food. Today, human activity and disturbance are sometimes detrimental, particularly near denning areas. Hunting and trapping are used to manage wolf populations in Alaska and Canada where wolves are still numerous. Hybridization of gray wolves and coyotes could alter the genetic integrity of wolf populations, especially if wolf numbers are low or habitat changes favor coyote populations. Woods roads do not seem to present a barrier to movement, but they increase human access and associated disturbances. High-speed, interstate

highways can be a more significant source of mortality and can act as a barrier to dispersal.

Conservation and Management

In 1969, the U.S. Fish and Wildlife Service listed the gray wolf as endangered (threatened in Minnesota). In 2003, they were downlisted to threatened throughout most of their range, including Maine. Federal recovery plans include restoring populations in the Great Lakes states and possibly the Northeast. Endangered Species Act protection allowed the Great Lakes population to grow to about 2,200 animals, and populations have expanded in Minnesota, Michigan, and Wisconsin. Delisting is being considered. There has been considerable public discussion about reintroducing wolves to the Northeast. Recent reintroductions in the West have been successful, and some biologists believe wolves could be successfully restored to Maine or the Adirondack region in New York. Decisions to restore this predator of deer and moose would require consideration of many biological, public, and political issues. Two wolves were killed in Maine in 1993 and 1996, but their origin was unknown. Tracks and other evidence suggest there may be additional wolf-like canids in the state, but there is no conclusive evidence of reproduction or establishment of packs. Given the physical barrier to dispersal from Quebec posed by the St. Lawrence River, unsuitable agricultural habitat in southern Quebec, and liberal wolf trapping regulations in Quebec, it is highly unlikely that wolves can naturally recolonize Maine. Experience from recovering populations in the Great Lakes and the West demonstrates that dispersing wolves must be protected to establish populations. Uncertainty about which subspecies of wolf occurred in Maine in the past, and whether wolf genes occur in Maine’s coyote population, are questions that must be considered before developing plans for wolf recovery.

Recommendations:

- ✓ Report all wolf sightings to MDIFW as soon as possible. Sightings can be verified from good photographs, tracks, scat, or hair samples.
- ✓ Conserve large blocks of unfragmented forestland to maintain the long-term integrity of habitat for potential recovery. Avoid the construction of new high-volume/high-speed highways in currently undeveloped areas of northern, western, and eastern Maine.
- ✓ If wolves are documented, avoid disturbing denning areas or rendezvous sites. 🐾

**FEDERALLY
THREATENED**

Canada Lynx

(Lynx canadensis)



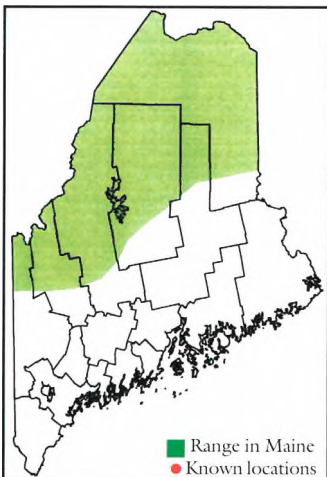
USFWS

Description

The loup cervier, lucivee, and Indian devil are all names used by old-time Maine woodsmen for the elusive Canada lynx. This is a secretive, forest-dwelling cat of northern latitudes and high mountains. It is medium-sized, similar in size to the bobcat, but appears larger because of its long legs. It has unique, long (over one inch), black tufts of fur on the ears and a short, black-tipped tail. (Bobcats have small tufts on the ears, and 3-4 black bars on the tail. The tip of the tail is black on top and white underneath.) The winter coat is light gray and faintly spotted, and the summer coat is much shorter and has a reddish-brown cast. Lynx have unusually large, densely haired feet to help travel over snow. Adult males average about 33½ inches long and weigh 26 pounds. Females are about 32 inches long and average 19 pounds.

Range and Habitat

Lynx are common throughout the boreal forest of Alaska and Canada. The southern portion of their range once extended into the U.S. in the Rocky Mountains, Great Lakes states, and the Northeast. Today, they are known to exist in the lower 48 states only in Montana, Washington, Maine, and possibly Minnesota. Confirmed tracks and sightings in Maine in the last 15



years have been concentrated in northern Aroostook, Piscataquis, Somerset, and Franklin Counties. Historic data suggest they also occasionally occur in eastern Maine. A recent habitat assessment completed by the University of Maine documented the likelihood of suitable lynx habitat in several areas in northern Maine. Good habitat consists of large areas of young, dense stands of balsam fir and northern hardwoods approximately 10-20 years after a major forest disturbance (cutting, fire, etc.). These stands provide the highest densities of snowshoe hares, the primary food for lynx, and suitable areas for denning.

Life History and Ecology

Mating occurs during March, and 1-7 young are born 60-65 days later in May. Maine litters produce 1-4 kittens. Lynx dens in Maine consist of a bed under thick regenerating fir or elevated downed logs. The female raises the kittens. Young leave the den area in late June or early July and stay with the female for a full year before leaving their mother in late winter.

Lynx are highly specialized to hunt snowshoe hare, which comprise over 75 percent of their diet. When hares are abundant, lynx may consume one or two a day. In the summer, the diet is more varied and may include grouse, small mammals, and squirrels. In winter, carrion (dead animals) may supplement the diet.

Lynx are primarily nocturnal, but Maine lynx have been very active during the day. Family groups (mother and kittens) hunt together to increase efficiency. Males are solitary for most of the year except the breeding season. Size of the home range varies with snowshoe hare density, habitat, and

season. In Maine, home ranges are about 18 square miles, or the equivalent of half a township. Home ranges overlap, especially where neighboring lynx are of different ages and sexes.

In northern Canada and Alaska, snowshoe hare populations undergo a 10-year cycle. Lynx numbers vary with the snowshoe hare populations. Snowshoe hare fluctuations in Maine are poorly understood, and may be more influenced by habitat availability and forest practices than by a multi-year cycle. During periods of low prey availability, lynx will travel hundreds of miles. Forty percent of the lynx population can starve and litter size declines following a crash in snowshoe hare populations.

Threats

Lynx are rare at the southern edge of their range as in Maine. Populations likely fluctuate with populations of snowshoe hares and are affected by lynx populations in neighboring Canada. Decreased snowfall in recent decades gives a competitive advantage to bobcats, whose range periodically expands northward. Bobcats are more aggressive and displace lynx from their home ranges. In recent years, a few lynx have been incidentally trapped or snared. Fishers killed several radio-collared lynx in Maine. Clearcutting is beneficial to lynx by providing large patches of young forest stands preferred by snowshoe hare. Recent trends in forest practices from large clearcuts to selective cutting may limit future lynx habitat. Woods roads are not a barrier to movement, but do increase human access and associated disturbances and introduce a small chance of road mortality. High-speed, interstate highways may be a more significant source of mortality and barrier to movements.

Conservation and Management

Lynx have always been present in Maine, but populations fluctuated. Several hundred animals may occupy the state during periods of high snowshoe hare populations and optimal habitat conditions. Trapping and hunting seasons for lynx have been closed in Maine since 1967. In 1997, the lynx was considered for state listing, but there was insufficient information to assess its status. Its current status is a Species of Special Concern. In response to petitions, the U.S. Fish and Wildlife Service named the lynx as threatened in 2000. A recovery plan has yet to be developed.

Habitat conditions were close to ideal in Maine in the late 1990s as the widespread clearcuts of the 1980s attained prime conditions for snowshoe hares. As stands mature and snowshoe hare numbers

decline, lynx populations will likely decline. Lynx habitat used today will not be prime habitat 10 or 15 years later. Careful planning may be needed to ensure that sufficient young stands are always present on the landscape to preserve populations of lynx and snowshoe hares.

The role of lynx immigration from neighboring populations in New Brunswick and Quebec in supporting Maine's lynx population is unknown. Biologists have yet to determine whether a self-sustaining population of lynx can be supported in Maine through periods of low snowshoe hare density.

Much of our knowledge of lynx in Maine came from a study conducted near Clayton Lake from 1999-2003. Thirty-two lynx were radio-tagged, and 17 dens and 37 kittens were discovered. This study documented movements, sources of mortality, and home ranges, and assessed survey techniques. In 2002, a 3-year winter snow track survey was initiated to assess the relative abundance and distribution of lynx throughout their range in Maine.

Recommendations:

- ✓ Report all lynx sightings to MDIFW as soon as possible. Sightings can be verified from good photographs, tracks, scat, or hair samples.
- ✓ Manage northern forests in landscapes (at the township level) with areas having a high proportion of regenerating balsam fir/northern hardwood stands (less than 30 years old) that support high densities of snowshoe hares.
- ✓ Ensure that large blocks of suitable regenerating habitat are distributed widely over the landscape of northern and western Maine.
- ✓ Avoid incidental take of lynx from trapping and snaring.
- ✓ Conserve large blocks of unfragmented forestland. Avoid the construction of new high-volume/high-speed highways in currently undeveloped areas of northern and western Maine. 🐾

**FEDERALLY
ENDANGERED**

Eastern Cougar

(*Felis concolor couguar*)



Description

The status of this elusive cat is a mystery in the Northeast. Although many have claimed to catch a glimpse of a “catamount” or “panther,” hard evidence of its existence is virtually nonexistent.

The cougar is a large cat. Adult males weigh 175-200 pounds and average 8 feet in length. Adult females weigh 75-175 pounds and average slightly less than 6½ feet in length. The cougar has a long, slender body; small, broad, rounded head; and short, rounded ears that lack elongated terminal tufts. It has a long (26- to 32-inch), thick tail, which is lacking in the bobcat and Canada lynx. Cougars are uniformly tawny; the chance of a cougar being black is extremely low in North America. The underside of the body is whitish, overlaid with buff and dusky spots, especially along the flanks and inner sides of the limbs. The feet are dark brown.

The upper lip is whitish, and the back of the ears and tip of the tail are blackish brown. The forepaw has five toes, the hindpaw four. Each digit has a retractile claw. Track width is 3-4 inches and rarely shows the claws. Tail marks may be seen in deep snow. The cougar’s vocalizations are a purring sound and a high scream.

Cougars are known by many names, including puma, mountain lion, catamount, and panther. For decades, the eastern cougar was

believed to be a distinct subspecies and different from western cougars and the Florida panther (*Felis concolor coryi*). Recent genetic studies, however, suggest that all North American cougars are similar, and there may be no unique subspecies.

Range and Habitat

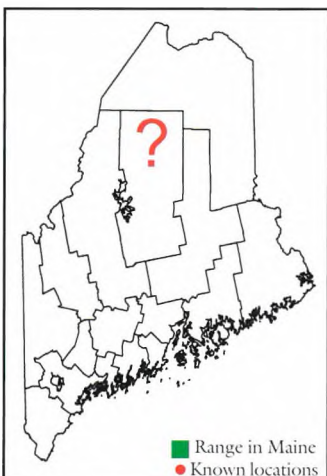
The cougar was once found throughout all of North and South America between southern Canada and Patagonia. The current range of the cougar is greatly reduced, and the species is primarily found in the western U.S. and Canada. However, frequent, unconfirmed sightings are reported throughout its former range in the East. A recent intensive five-year survey effort in the Southeast failed to produce reliable evidence of eastern cougars. The closest known breeding population to Maine is in north-western Ontario.

Cougars inhabit large, undeveloped tracts of habitat. They can live in forested, grassland, and alpine habitats. In general, they are shy, secretive animals, but in recent years they have been seen more frequently in suburban areas in the West where development has intruded into their habitat. Adequate prey, particularly white-tailed deer, is an essential habitat characteristic.

Life History and Ecology

Cougars reach sexual maturity when 2½ years old. Breeding may occur throughout the year, but peak litter production occurs in the summer months. Several males may be attracted to a mature female and may accompany her until she is receptive to mating. If the males meet, they may engage in aggressive behavior and fighting.

Gestation lasts approximately three months and



litters of 1-6 kittens are produced, with 2-3 kittens being common. Den sites are simple and include cavities in rock outcrops, dense thickets, or under logs in less mountainous terrain. Weaning occurs at 2-3 months of age, and the young remain with the mother until they are almost two years old. Late in their second winter, the young disperse to establish individual home ranges. Because of this prolonged period of parental care, female cougars usually breed only once every 2-3 years, although in some populations, litters can be produced every year.

Cougars are primarily solitary, establishing individual home ranges of up to 25 square miles. In eastern North America, white-tailed deer are the primary prey, although smaller birds and mammals such as snowshoe hare and porcupines may be taken.

Threats

Cougars disappeared in Maine because of indiscriminate hunting and trapping of predators in the 1800s, habitat changes, and declining deer, moose, and caribou populations. The last breeding population of cougars in the East occurs in Florida. Since these cats require large acreages of undeveloped land, their numbers have been reduced by the presence of highways, development, and human activity.


Conservation and Management

Accounts of cougars are common in historic literature from Maine. However, the last documented eastern cougar was killed in 1938 in northern Maine. Numerous sightings have been reported in Maine and New Brunswick in recent years. However, many of these are likely domestic cats, dogs, bobcats, lynx, and fishers that were mistaken for cougars. Tracks, scat, and hair samples, believed to have come from cougars, recently have been observed or collected in Maine and New Brunswick. Some MDIFW biologists and wardens also believe they have seen cougars. If cougars exist in the wild, it is possible that these animals are escaped pets, particularly in urban or coastal areas where suitable habitat is not available. Cougar tracks have not been encountered in state and federal winter track surveys in northern Maine for wolves and lynx. There is no evidence at this time that a breeding population exists in the state.

In 1969, the eastern cougar was placed on the federal Endangered Species List. This subspecies is also listed as Endangered by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). There is no open hunting

or trapping season on cougars in Maine. Perhaps cougars will disperse across Canada and recolonize their former range in the state. Large tracts of forestland in the northern, western, and eastern portions of Maine could support these animals.

Recommendations:

- ✓ Report all cougar sightings to MDIFW as soon as possible. Sightings can be verified from good photographs, tracks, scat, or hair samples.
- ✓ Conserve large blocks of unfragmented forestland to maintain the long-term integrity of habitat for potential recovery. Avoid the construction of new high-volume/high-speed highways in currently undeveloped areas of northern, western, and eastern Maine. 

STATE
THREATENED

Northern Bog Lemming

(*Synaptomys borealis*)



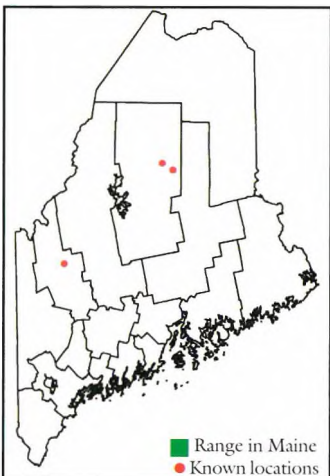
Mark McCollough

Description

The northern bog lemming is among Maine's rarest and most elusive mammals. Like the Canada lynx, it is more numerous in the North and reaches the southern edge of its range here. Unlike the lynx, it has not received federal listing attention, associated research, and surveys, and its status remains a mystery.

The northern bog lemming is a small mammal about the size of a vole (about one ounce). The bog lemming has a blunt nose, short tail, and somewhat grayer coat than the common red-backed vole (*Clethrionomys gapperi*). The upper parts are dull brown, and are slightly brighter on the rump. Toward the head the fur has a grizzled appearance. The underside is grayish. The tail is brown above and paler below, and the feet are dark grayish. Bog lemmings have a groove along the outer edge of each incisor, which similar-looking species of voles do not have.

Two species of bog lemmings, the northern and southern (*S. cooperi*), live in Maine. They are very similar in appearance and are difficult to distinguish. Unlike the southern bog lemming, the northern species has rusty-tipped fur at the base of the ears. Also, female northern bog lemmings have eight mammae, while southern bog lemmings only have six. Tooth structures



must be examined under magnification to confirm identification of the two species. The northern bog lemming does not have closed triangles on the outer surface of its molars, and it has a sharp projection pointing back from the roof of the mouth.

Range and Habitat

The northern bog lemming is widely distributed across northern North America, ranging from Alaska to Labrador and south to Washington and Maine. This species has not been found in great numbers anywhere, with the exception of moderate-sized populations in Alaska and around the Hudson Bay. It is less common at the southern extent of its range, which includes Maine and adjacent New Hampshire.

In Maine, the northern bog lemming has been found at five locations, including two sites in Baxter State Park. The species has also been captured in three locations in New Hampshire: along the Wild River not far from the Maine/New Hampshire border, near the base of Mt. Washington, and on Mt. Mooselauke. Most occurrences are at elevations of 2000 feet or greater. In other parts of the species' range, it occurs at much lower elevations, where its habitat needs are provided by a northern tundra-like habitat, rather than an alpine environment.

The northern bog lemming usually occurs in moist, wet meadows or boggy areas, often in conjunction with arctic or alpine tundra and spruce-fir forests. Frequently it occurs near a spring or other source of water or near lush, mossy logs and rocks. Specimens found in Maine are associated with deep, moist sphagnum, both in low- and high-elevation settings.

Life History and Ecology

Limited information is available on the ecology of this species. The northern bog lemming constructs runways above ground or below the leaf litter. The nest is located either above ground concealed in vegetation, or several inches below ground. It is lined with dried leaves and grasses, and occasionally fur. Northern bog lemmings are social animals that live in colonies. Foods include sedges, grasses, raspberry seeds, and the fungus *Endogone*. Predators may include mammals, hawks, owls, and snakes. Little is known about the species' reproductive behavior, although it may be similar to that of the southern bog lemming, which breeds throughout the year and may produce several litters. The gestation period lasts 21-23 days, and a litter may contain 1-8 young. When born, the young are blind, naked, and helpless, and weigh about a tenth of an ounce.

Threats


Because the northern bog lemming is found in so few sites and in such low numbers in Maine, it is vulnerable to extirpation. Suitable habitat is not abundant in Maine. Mountain elevations above 2,700 feet are subject to special regulations in Maine, but development of ski areas or wind power could be harmful. Wind power development has been proposed for one known site in western Maine. The discovery of northern bog lemmings at low-altitude spruce-fir forests in Baxter State Park may indicate broader habitat use. Sensitive microhabitats (especially wet, sphagnum ground cover) within forests could be altered by logging equipment on non-frozen ground. Additional research is needed to better understand the full range of habitats used. Competition with other small mammals may also limit the species' distribution.

Conservation and Management

The northern bog lemming was listed as threatened in Maine in 1986, because of its apparently low numbers and limited distribution. As yet, no specific conservation plans have been implemented for this species. Further information on habitats used by the species in Maine is needed to develop appropriate conservation measures. Moist, high-elevation mossy areas seem to be optimal habitat. The northern bog lemming shares these habitats with other rare small mammals, including the yellow-nosed vole and rock shrew (both Species of Special Concern). Once the lemming's habitat needs are better understood, land use should be carefully planned to protect the lemming and other rare species. System-

atic small mammal surveys are needed. A recent small mammal inventory in northwestern Maine yielded two new records of northern bog lemmings.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW to assist with planning.
- ✓ Deliver any bog lemming specimens to MDIFW to confirm identification. Note the site location as accurately as possible so MDIFW can locate and protect associated northern bog lemming populations.
- ✓ Minimize impacts to high elevation habitats that may potentially harbor northern bog lemmings and associated species (cool, moist, mossy areas of a boreal or alpine character). Survey these areas for the species' presence.
- ✓ To preserve the vegetation and physical structure required by the northern bog lemming, do not stray off marked trails, especially in fragile alpine areas on Mt. Katahdin, Bigelow Mountain, and high elevation areas on the Appalachian Trail. 

**FEDERALLY
ENDANGERED**

Northern Right Whale

(Eubalaena glacialis)



Mark McCollough

Description

The northern right whale is the world's rarest cetacean. It is a large, rotund, slow-swimming whale that inhabits shallow coastal waters. Because of its slow speed, large size, high blubber volume (causing it to float when dead), and propensity to inhabit shallow, coastal habitats, it was the "right" whale for 19th century whalers to hunt, thence its name. Right whales are distinguished by the absence of a dorsal fin; large head (about 1/4 of total body length); curved mouth; throat grooves; paired nostril openings; and callosities (wartlike structures) around the eyes, blowhole, lower jaw, and on top of the snout. The body is 44-55 feet long, smooth, black to light gray, and appears mottled, with white underparts. The flippers are long (up to five feet) and broad, and are located below the level of the eyes. The tail flukes are broad (up to 18 feet wide). Baleen plates up to seven feet long are rooted in the gums of the upper jaw. Females are larger than males, and adults weigh 45-55 tons. They have a distinctive V-shaped spout or blow.

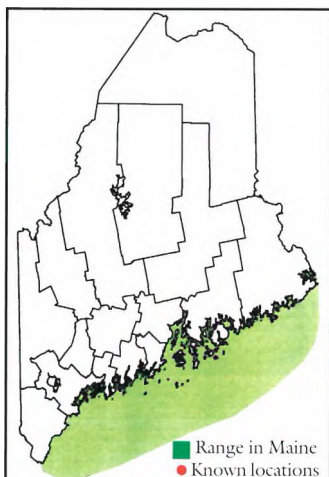
Range and Habitat

Right whales occur in the North Atlantic and North Pacific in extremely low numbers. In the Atlantic they have been observed from Iceland to Florida; however, they concentrate along the East coast from the

Bay of Fundy to Georgia and Florida. They prefer shallow inshore areas and are rarely observed far from the coast.

Life History and Ecology

Right whales occur singly, in pairs, or in small groups of 3-8 at feeding areas. Occasionally groups of up to 30 individuals are seen. New England waters represent a major feeding and nursery area. In March and April right whales congregate in the plankton-rich waters off Cape Cod Bay and Georges Bank in the Gulf of Maine and spend the summer in the Bay of Fundy and off the southeastern coast of Nova Scotia. Courtship occurs in August and September. During the winter months, a portion of the population, consisting of females and young calves, migrates to calving grounds in the shallow waters between Savannah, Georgia and Cape Canaveral, Florida. Calving peaks between December and March after an unknown gestation period. Calves average 15 feet long at birth and will nurse for at least nine months. Females give birth to one calf every 3-5 years. Lifespan is unknown. Males and females may reach sexual maturity at a body length of about 45 feet, which corresponds to about 7-10 years of age. Although they produce extensive and complex sounds underwater, they do not produce "songs" or use these sounds in echolocation as other whales do. Right whales filter-feed both at the surface and underwater. They swim with their mouths open and use their baleen plates to filter copepods (small crustaceans about the size of a grain of rice) and euphausiids (shrimp-like animals) from the water column.



Threats

Populations were nearly extirpated by commercial whaling. Because they are slow-moving, spend considerable time on the surface, and inhabit inshore areas, right whales are especially at risk of entanglement in fishing gear and collisions with ships. Marine ecosystem changes induced by global warming and pollution may affect food availability. Recreational whale-watching may occasionally cause disturbance, but this is believed to be insignificant. Because of the extremely small population size, any mortalities are significant and limit population recovery. Collisions with vessels have killed at least 13 right whales since 1976. There were 16 recorded encounters between right whales and fishing gear from 1975-1989, and 57 percent of photographed whales have scars and injuries from rope and net cuts. Right whales are likely affected by genetic problems associated with critically small populations.

Conservation and Management

Europeans began whaling along the East Coast as early as the 16th century. By the end of the 17th century, right whale populations had declined significantly from overhunting, but sporadic whaling continued into the 20th century. Right whales were hunted primarily for their oil and baleen. Whale oil, extracted from the blubber, was used primarily as an illuminant, and to a lesser extent for the tanning of leather and manufacture of candles, soap, and lard substitutes. Baleen was used in fashionable women's clothes, whips, and canes.


The North Atlantic population is now estimated to be 300-350 animals. The species has had almost complete protection since 1937, but populations have not increased. The right whale is protected from take and harassment by the federal Endangered Species Act and Marine Mammal Protection Act and was federally listed as endangered in 1970. Right whale populations are carefully monitored annually and a photo catalog has been established to identify and track individuals.

The right whale was the subject of intense public debate in the late 1990s when the National Marine Fisheries Service (NMFS) was sued to designate Critical Habitat and institute protection measures that could potentially close some inshore fisheries. In response, NMFS designated three seasonal feeding and calving areas as Critical Habitat. In 2000, the Atlantic Large Whale Take Reduction Team developed a Take Reduction Plan to implement specific gear modifications to reduce the risk of entanglements that lead to serious injury or

mortality to large whales on the Atlantic coast. Implementation policy is still changing. The Maine Department of Marine Resources has lead management authority for marine mammals, including the northern right whale.

Recommendations:

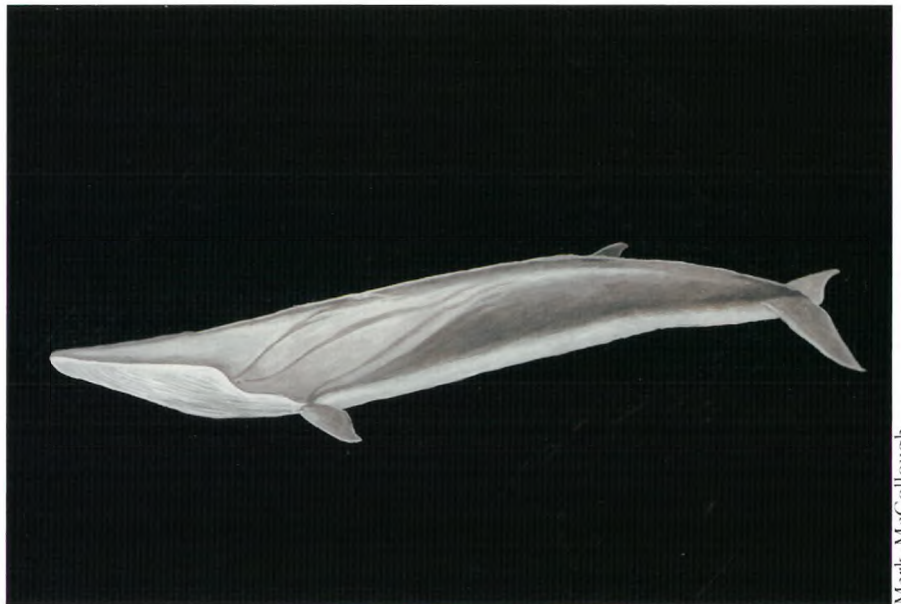
The Maine Department of Marine Resources recommends that National Marine Fisheries Service Guidelines for whale protection be employed. Regulations can be found at www.nero.nmfs.gov/whaletrp/. Current (2002) guidelines include the following:

- ✓ Dedicate state education and outreach efforts to fishermen.
- ✓ Close critical whale habitats to some types of fishing gear during times when whales are likely to be present.
- ✓ Prohibit some fishing practices (e.g., leaving inactive gear for more than 30 days) that increase risk of entanglement.
- ✓ Require some gear modifications in federal waters (e.g., knotless weak links in buoy lines for lobster traps and gillnets, no floating line at the surface) to reduce risk of entanglement.
- ✓ Utilize state and federal contacts for Whale Disentanglement Networks to locate entangled whales and remove gear. If you see an entangled whale, call the Northeast Disentanglement Network at 1-800-900-3622, the Coast Guard Station nearest you on 16 VHF Radio, the Maine Whale Take Reduction Coordinator, or the Maine Marine Patrol.
- ✓ Investigate and implement measures to reduce ship strikes of whales, including: 1) routing ships around observed whales, 2) restricting speed of vessels operating in whale habitats, 3) requiring mandatory shipping lanes when transiting through critical habitat areas, and 4) providing ship captains operating in critical habitats with the latest whale sighting data.
- ✓ Whale watchers must employ the following guidelines: 1) No vessel should approach closer than 300 yards. When whales are nearby, move at a constant, slow, "no wake" speed. 2) Do not engage props while whales are within 100 yards and do not chase whales. 3) When watching whales, do not box them in or cut off their path to prevent them from leaving. 4) Do not attempt to approach mothers with young calves. 5) Do not operate aircraft within 300 yards of a whale.
- ✓ Plan for protection of critical whale habitats in state and federal oil spill contingency planning. 

**FEDERALLY
ENDANGERED**

Finback Whale

(Balaenoptera physalus)



Mark McCollough

Description

The massive finback whale (sometimes referred to as “fin” whale) is second in size only to the blue whale, making it the second largest animal on earth. It is long (up to 78 feet), sleek, and streamlined, and is the fastest great whale. A rorqual whale, it has 50-100 pleats and grooves extending from the chin to the navel that allow the throat area to expand when feeding. The finback’s most unusual characteristic is the asymmetrical coloring on the lower jaw, which is whitish on the right side and mottled black on the left. Otherwise, it is light gray to brownish-black on the back and sides. Two light-colored chevrons (stripes) originate behind the blowholes and slant aft toward the flukes (tail) to form a broad V across the back. The undersides of the body, flippers, and tail flukes are white. The finback whale has a prominent curved dorsal fin located far back on the top of its body. This whale produces a distinctive, robust spout, which rises to 20 feet. When starting a dive, it arches its back,

showing its dorsal fin, but rarely shows its flukes or breaches the surface. Females are slightly larger than males, and weight for both sexes is between 50-70 tons.

The finback is distinguished from the blue whale by its smaller size, unique coloration, longer, narrower head, and taller dorsal fin. The sei

whale is smaller and more slender, has a uniformly colored body, and has a relatively smaller dorsal fin.

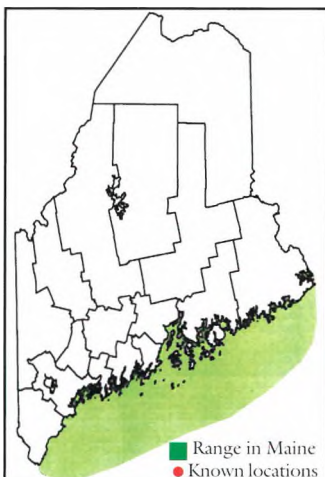
Range and Habitat

Finbacks live in all oceans of the world in coastal and offshore waters. They are found in largest numbers 25 miles or more from shore. They tend to be nomadic and migrate to subtropical waters for mating and calving during the winter and to high latitudes and cold currents for feeding in the summer. North Atlantic finbacks are most abundant between Long Island and Labrador. They are most typically observed in 300- to 600-foot water depths over the continental shelf. New England waters represent a major feeding area for North Atlantic populations. Some individuals overwinter near Cape Cod, but in the Gulf of Maine the period of peak abundance is April through October.

Life History and Ecology

Finback whales are the most common whales in the Gulf of Maine. They travel singly, or occasionally in groups of up to 100 on feeding grounds and during migration. In the Gulf of Maine, they feed on herring, capelin, squid, and krill. They have been observed circling schools of fish at high speed, rolling on their right sides, and engulfing the dense school of fish. They can dive as deep as 755 feet in search of food. Their asymmetric color patterns may aid in capture of food. They can consume up to two tons of food a day. During feeding, large volumes of water and food are engulfed and the plated grooves in the throat expand. The mouth is closed and water is expelled through 350 baleen plates, which trap the food near the tongue to be swallowed.

Finbacks probably start to mate at 5-10 years old



when they attain a length of 55-60 feet. Breeding may occur throughout the year, although the peak period occurs from November or December until March. The gestation period lasts about 12 months and the calf weighs about two tons at birth. The calf is weaned at about six months of age or when it reaches 35-40 feet in length. Females usually have one calf every third year. Potential longevity is unknown.

Threats

Populations were greatly reduced by commercial whaling. Like other large whales, finbacks are at risk of entanglement in fishing gear and collisions with ships. Marine ecosystem changes induced by global warming and pollution may affect food availability. Recreational whale watching may occasionally cause disturbance, but this is believed to be insignificant. Mortality rates from these causes are not limiting population recovery at this time.

Conservation and Management

Given their speed and preference for the open sea, finbacks were almost completely protected from early whalers. However, with the introduction of modern, fast boats and harpoon guns, finback whales became easy victims. With the depletion of blue whales, the whaling industry turned to the smaller, abundant finback whales as a replacement. As many as 30,000 were killed annually from 1935-1965. The International Whaling Commission (IWC) whaling quotas were lowered in the mid-1970s and reduced to zero in 1985. The North Atlantic population before hunting was 30,000-50,000. In 2000, the IWC estimated there were 2,200 finbacks between Virginia and the Gulf of St. Lawrence. Several thousand more likely exist off eastern Canada. Populations off eastern North America are believed to be increasing.

Finbacks were federally listed as endangered in 1970. Finbacks are protected from take and harassment by the federal Endangered Species and Marine Mammal Protection Acts. In 2000, the Atlantic Large Whale Take Reduction Team developed a Take Reduction Plan to implement specific area closures and gear restrictions and identification of Critical Habitat in Northeastern waters. Implementation policy is still changing. The Maine Department of Marine Resources has lead management authority for marine mammals, including the finback whale.

Recommendations:

The Maine Department of Marine Resources

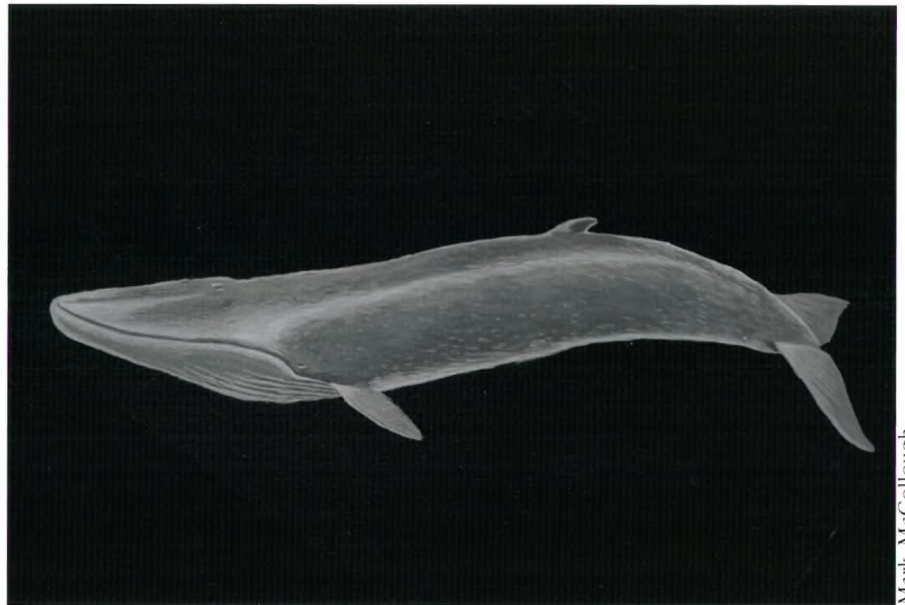
recommends that National Marine Fisheries Service Guidelines for whale protection be employed. Regulations can be found at www.nero.nmfs.gov/whaletrp/. Current (2002) guidelines include the following:

- ✓ Dedicate state education and outreach efforts to fishermen.
- ✓ Close critical whale habitats to some types of fishing gear during times when whales are likely to be present.
- ✓ Prohibit some fishing practices (e.g., leaving inactive gear for more than 30 days) that increase risk of entanglement.
- ✓ Require some gear modifications in federal waters (e.g., knotless weak links in buoy lines for lobster traps and gillnets, no floating line at the surface) to reduce risk of entanglement.
- ✓ Utilize state and federal contacts for Whale Disentanglement Networks to locate entangled whales and remove gear. If you see an entangled whale, call the Northeast Disentanglement Network at 1-800-900-3622, the Coast Guard Station nearest you on 16 VHF Radio, the Maine Whale Take Reduction Coordinator, or the Maine Marine Patrol.
- ✓ Investigate and implement measures to reduce ship strikes of whales, including: 1) routing ships around observed whales, 2) restricting speed of vessels operating in whale habitats, 3) requiring mandatory shipping lanes when transiting through critical habitat areas, and 4) providing ship captains operating in critical habitats with the latest whale sighting data.
- ✓ Whale watchers must employ the following guidelines: 1) No vessel should approach closer than 300 yards. When whales are nearby, move at a constant, slow, "no wake" speed. 2) Do not engage props while whales are within 100 yards and do not chase whales. 3) When watching whales, do not box them in or cut off their path to prevent them from leaving. 4) Do not attempt to approach mothers with young calves. 5) Do not operate aircraft within 300 yards of a whale.
- ✓ Plan for protection of critical whale habitats in state and federal oil spill contingency planning. 🐳

**FEDERALLY
ENDANGERED**

Sei Whale

(Balaenoptera borealis)



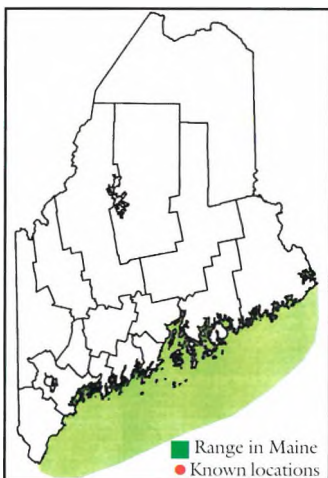
Mark McCollough

Description

The sei whale (pronounced “say”) is smaller than the finback whale and larger than the minke whale. Sei whales are 25-50 feet in length and weigh 40 tons. Females are slightly larger than males. Sei whales can be identified by an inverted V shaped spout, which extends 6-8 feet high. The sei whale resembles the finback, and can be very difficult for the amateur to distinguish. Sei whales have smaller, more erect dorsal fins, dark undersides of the flippers and tail flukes, and bluish-gray coloration with whitish spots. Sei whales lack the asymmetric lower lip coloration and dorsal chevrons (V-shaped stripes on the upper back) of the finback. The sei whale has 30-60 pleated grooves that extend from the chin along the belly. These pleats enable the throat to expand when feeding, to accommodate a large volume of water and food. Baleen plates are rooted in the gums of the upper jaw and number between 219 to 402 plates on each side of the jaw.

Range and Habitat

Sei whales are found throughout the world’s oceans. They occur in the North Atlantic from Iceland to the Venezuela coast. They are seen infrequently in U.S. waters and very rarely in the Gulf of Maine. These whales breed and feed in open oceans. They are more frequently



observed in temperate waters in the summer and subtropical waters during the winter. Two populations have been tentatively identified in the western North Atlantic. One population occurs in the Labrador Sea in June and migrates later in the summer northward along the coasts of Labrador, West Greenland, and possibly Iceland. The other population occurs off the continental slope of the United States during winter and migrates northward by mid to late June to Georges Bank, Northeast Channel, and Browns Bank. Periodic movements into the Gulf of Maine occur rarely, and may be followed by years or decades with no sightings.

Life History and Ecology

Sei whales are usually seen as singles or pairs, but sometimes thousands may gather if food is abundant. Like northern right whales, they are “skim-mers,” meaning they feed near the water surface using their baleen to filter small shrimp-like animals (copepods, euphausiids, amphipods) and schooling fishes from the water column. They are fast and swim at speeds of up to 35 miles per hour. Whalers identify sei whales by their swimming behavior, which includes erratic changes in direction. They are shallow divers and only remain submerged for 5-10 minutes.

Breeding occurs between November and March, with the peak in January. The gestation period lasts 10½ to 12 months. Calves are dependent on milk from the mother for about nine months and are weaned when they reach 24-27 feet in length. Both sexes become sexually mature at about 8-10 years of age, which corresponds to a length of about 36 feet for males and 40 feet for females. They do not reach full adult size until they are about 25 years old.

Breeding occurs at intervals of three years. They may live as long as 74 years.

Threats

Commercial whaling depleted populations in all oceans. Like other large whales, sei whales are at risk of collisions with ships. Marine ecosystem changes induced by global warming and pollution may affect food availability. Recreational whale watching may occasionally cause harassment, but this is believed to be insignificant. Mortality rates from these causes are not limiting population recovery at this time.

Conservation and Management


Hunting of sei whales began in the North Atlantic in the 1800s. A whaling station at Blandford, Nova Scotia killed hundreds of sei whales in the 1900s. In 1972, populations were estimated to be only 21 percent of original numbers. In the early 1980s, there were estimated to be as few as 2,200-2,300 individuals in U.S. Atlantic waters. Hunting is no longer a problem for sei whales as a result of protection received through the International Whaling Commission, Endangered Species Act, and Marine Mammal Protection Act. Cetacean experts believe sei whale populations to be increasing, but data are sparse. Given the species' pelagic (open-ocean) ecology, there have been no reported fishery-related mortality or injuries. The Maine Department of Marine Resources has lead management authority for marine mammals, including the sei whale.

Recommendations:

The Maine Department of Marine Resources recommends that National Marine Fisheries Service Guidelines for whale protection be employed. Regulations can be found at www.nero.nmfs.gov/whaletrp/. Current (2002) guidelines include the following:

- ✓ Dedicate state education and outreach efforts to fishermen.
- ✓ Close critical whale habitats to some types of fishing gear during times when whales are likely to be present.
- ✓ Prohibit some fishing practices (e.g., leaving inactive gear for more than 30 days) that increase risk of entanglement.
- ✓ Require some gear modifications in federal waters (e.g., knotless weak links in buoy lines for lobster traps and gillnets, no floating line at the surface) to reduce risk of entanglement.
- ✓ Utilize state and federal contacts for Whale

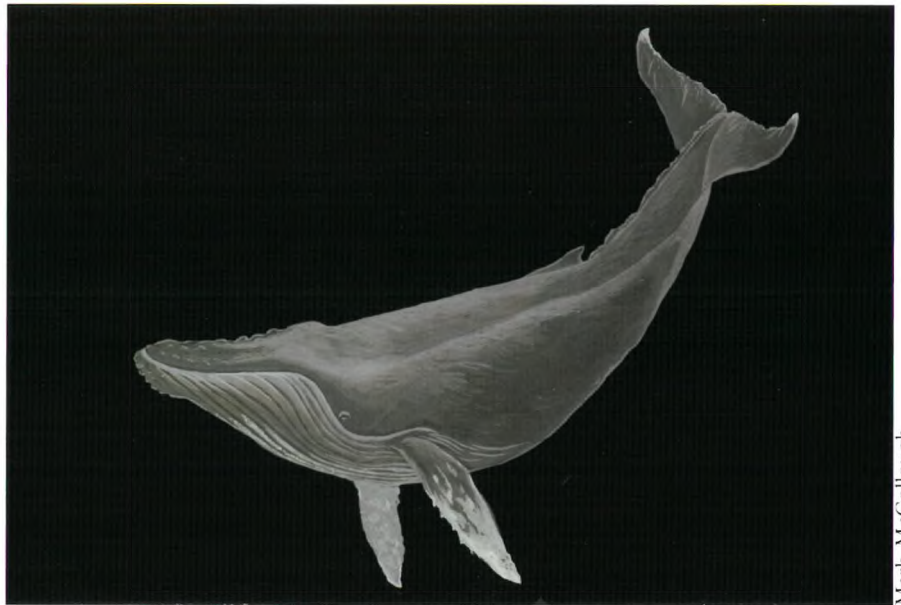
Disentanglement Networks to locate entangled whales and remove gear. If you see an entangled whale, call the Northeast Disentanglement Network at 1-800-900-3622, the Coast Guard Station nearest you on 16 VHF Radio, the Maine Whale Take Reduction Coordinator, or the Maine Marine Patrol.

- ✓ Investigate and implement measures to reduce ship strikes of whales, including: 1) routing ships around observed whales, 2) restricting speed of vessels operating in whale habitats, 3) requiring mandatory shipping lanes when transiting through critical habitat areas, and 4) providing ship captains operating in critical habitats with the latest whale sighting data.
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- ✓ Plan for protection of critical whale habitats in state and federal oil spill contingency planning. 

**FEDERALLY
ENDANGERED**

Humpback Whale

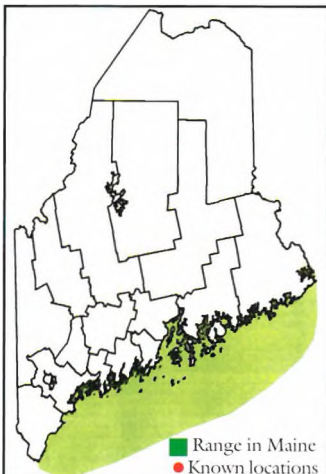
(Megaptera novaeangliae)



Description

Humpbacks are the best known whales, yet are seriously endangered. Their relatively slow swimming speed and acrobatics make them the favorite of New England whale watchers. Humpbacks are large, black whales that readily show their tail flukes when diving. They have wart-like bumps around their heads and in front of their twin blowholes. The spout is about 10 feet high and is more squat than that of the finback. The dorsal fin is located far back on the top of the body and is smaller than that of finback or sei whales. Baleen plates are rooted in the gums of the upper jaw and number between 270-400 on each side of the mouth. On the underside are 14-35 parallel grooves that extend from the throat to the navel or beyond. Barnacles are usually located on the chin, anterior portion of the grooves, back edges of the flippers, and flukes. Coloration is typically black above and white below. Humpbacks have long, narrow flippers ($\frac{1}{4}$ to $\frac{1}{3}$ of total body length) with knobs on the anterior margins. Flippers

are usually white above and below, but the upper surface may be spotted with black or all black. Tail flukes are all black with white spots along the trailing edges and undersides. Individual whales can be identified by the unique color patterns on their flukes. Females are larger than males and measure 45-50 feet, while males



measure 40-48 feet. Adults weigh 25-40 tons.

Range and Habitat

Humpbacks are found in all the world's oceans, but are uncommon in arctic regions. They migrate to feeding areas in northern latitudes in the summer and return to warmer tropical Caribbean waters to winter and breed. In the North Atlantic, there are populations in the Gulf of Maine, Nova Scotia, Newfoundland, Labrador, and Greenland. In these areas, humpbacks inhabit waters over the continental shelf. The humpback whale is relatively common in the Gulf of Maine and is observed frequently by whale watchers.

Life History and Ecology

On their northward migration, humpbacks pass through New England waters in April and May. Some animals remain in the Gulf of Maine for the summer, where they feed primarily on herring, sand lance, and other small fish. Other humpbacks continue northward, reach Labrador by July, and remain there until September. On their southward migration, they pass through New England waters from October through December.

Humpback whales are seen singly, in pairs, or in small groups of 12 or more. Just before a deep dive, they expose a greater portion of their backs, curve their bodies, and display their tail flukes perpendicular to the water surface. They are among the most acrobatic of whales and often are seen breaching (leaping out of the water), lobtailing (standing on their head and slapping their tail on the water), waving their flippers in the air, and splashing their flippers on the water. Vocalizations include loud whistles and wheezing sounds, which may be used

Breeding occurs at intervals of three years. They may live as long as 74 years.

Threats

Commercial whaling depleted populations in all oceans. Like other large whales, sei whales are at risk of collisions with ships. Marine ecosystem changes induced by global warming and pollution may affect food availability. Recreational whale watching may occasionally cause harassment, but this is believed to be insignificant. Mortality rates from these causes are not limiting population recovery at this time.

Conservation and Management

Hunting of sei whales began in the North Atlantic in the 1800s. A whaling station at Blandford, Nova Scotia killed hundreds of sei whales in the 1900s. In 1972, populations were estimated to be only 21 percent of original numbers. In the early 1980s, there were estimated to be as few as 2,200-2,300 individuals in U.S. Atlantic waters. Hunting is no longer a problem for sei whales as a result of protection received through the International Whaling Commission, Endangered Species Act, and Marine Mammal Protection Act. Cetacean experts believe sei whale populations to be increasing, but data are sparse. Given the species' pelagic (open-ocean) ecology, there have been no reported fishery-related mortality or injuries. The Maine Department of Marine Resources has lead management authority for marine mammals, including the sei whale.

Recommendations:

The Maine Department of Marine Resources recommends that National Marine Fisheries Service Guidelines for whale protection be employed.


Regulations can be found at www.nero.nmfs.gov/whaletrp/. Current (2002) guidelines include the following:

- ✓ Dedicate state education and outreach efforts to fishermen.
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Disentanglement Networks to locate entangled whales and remove gear. If you see an entangled whale, call the Northeast Disentanglement Network at 1-800-900-3622, the Coast Guard Station nearest you on 16 VHF Radio, the Maine Whale Take Reduction Coordinator, or the Maine Marine Patrol.

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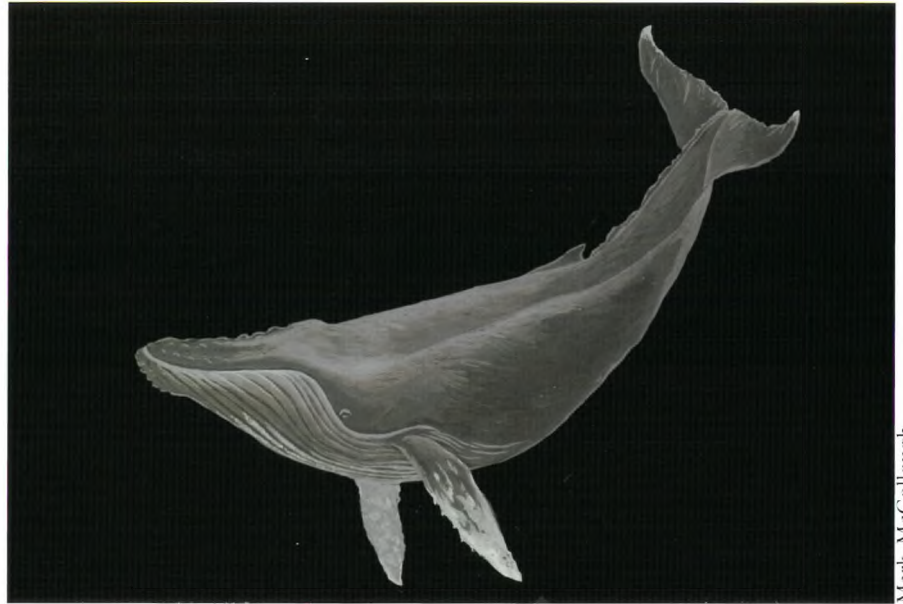
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✓ Plan for protection of critical whale habitats in state and federal oil spill contingency planning. 

**FEDERALLY
ENDANGERED**

Humpback Whale

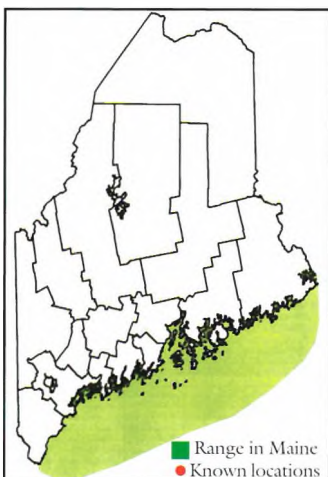
(Megaptera novaeangliae)



Description

Humpbacks are the best known whales, yet are seriously endangered. Their relatively slow swimming speed and acrobatics make them the favorite of New England whale watchers. Humpbacks are large, black whales that readily show their tail flukes when diving. They have wart-like bumps around their heads and in front of their twin blowholes. The spout is about 10 feet high and is more squat than that of the finback. The dorsal fin is located far back on the top of the body and is smaller than that of finback or sei whales. Baleen plates are rooted in the gums of the upper jaw and number between 270-400 on each side of the mouth. On the underside are 14-35 parallel grooves that extend from the throat to the navel or beyond. Barnacles are usually located on the chin, anterior portion of the grooves, back edges of the flippers, and flukes. Coloration is typically black above and white below. Humpbacks have long, narrow flippers ($\frac{1}{4}$ to $\frac{1}{3}$ of total body length) with knobs on the anterior margins. Flippers

are usually white above and below, but the upper surface may be spotted with black or all black. Tail flukes are all black with white spots along the trailing edges and undersides. Individual whales can be identified by the unique color patterns on their flukes. Females are larger than males and measure 45-50 feet, while males



measure 40-48 feet. Adults weigh 25-40 tons.

Range and Habitat

Humpbacks are found in all the world's oceans, but are uncommon in arctic regions. They migrate to feeding areas in northern latitudes in the summer and return to warmer tropical Caribbean waters to winter and breed. In the North Atlantic, there are populations in the Gulf of Maine, Nova Scotia, Newfoundland, Labrador, and Greenland. In these areas, humpbacks inhabit waters over the continental shelf. The humpback whale is relatively common in the Gulf of Maine and is observed frequently by whale watchers.

Life History and Ecology

On their northward migration, humpbacks pass through New England waters in April and May. Some animals remain in the Gulf of Maine for the summer, where they feed primarily on herring, sand lance, and other small fish. Other humpbacks continue northward, reach Labrador by July, and remain there until September. On their southward migration, they pass through New England waters from October through December.

Humpback whales are seen singly, in pairs, or in small groups of 12 or more. Just before a deep dive, they expose a greater portion of their backs, curve their bodies, and display their tail flukes perpendicular to the water surface. They are among the most acrobatic of whales and often are seen breaching (leaping out of the water), lobtailing (standing on their head and slapping their tail on the water), waving their flippers in the air, and splashing their flippers on the water. Vocalizations include loud whistles and wheezing sounds, which may be used

for communication. During the breeding season, males may produce complex “songs.” Humpback whales swim along with their mouths open and use their baleen plates to filter small shrimplike crustaceans (krill), schooling fishes, and squid from the water column.

Humpbacks reach sexual maturity at about nine years, when males reach 33 feet long and females about 36 feet. Breeding may occur throughout the year. In the Atlantic, the shallow waters of the Caribbean Sea provide wintering and breeding areas. Calving occurs at two-year intervals, but some females have a calf every year. The gestation period lasts 11-12 months. The single calf is weaned at 5-6 months of age or when it reaches about 25 feet in length. Humpbacks may live to be about 50 years old.

Threats

Humpback whales were easy targets for whalers because they inhabit waters close to shore and are slow swimmers. Entrapment and entanglement in fishing gear occurs frequently in the Gulf of Maine, where 4-6 entanglements are documented annually. Studies show that 48-78 percent of animals in our region have scars from entanglement. Ship strikes, disturbance from underwater acoustics, commercial whale watching and research boats, and habitat degradation are additional threats. Commercial fishing may compete with whales for some species (herring), or remove predators like mackerel, which may result in increases in sand lance, a preferred food.


Conservation and Management

Humpbacks are among the most endangered of the large whales. Between 1905-1965, 28,000 humpbacks were killed. In the North Atlantic, they were protected from commercial hunting in 1955. Populations are now believed to be slowly increasing; however, only about 8,000 individuals remain in the western North Atlantic. It is believed humpbacks number 15,000-20,000 worldwide at present, or about 15-20 percent of the original population. Human-caused injuries and mortalities are believed to be frequent enough to be limiting the rate of recovery.

In 1965, humpback whales were protected worldwide by the International Whaling Commission, and they are now protected by the federal Endangered Species Act and Marine Mammal Protection Act. The Maine Department of Marine Resources has lead management authority for marine mammals, including the humpback whale.

Recommendations:

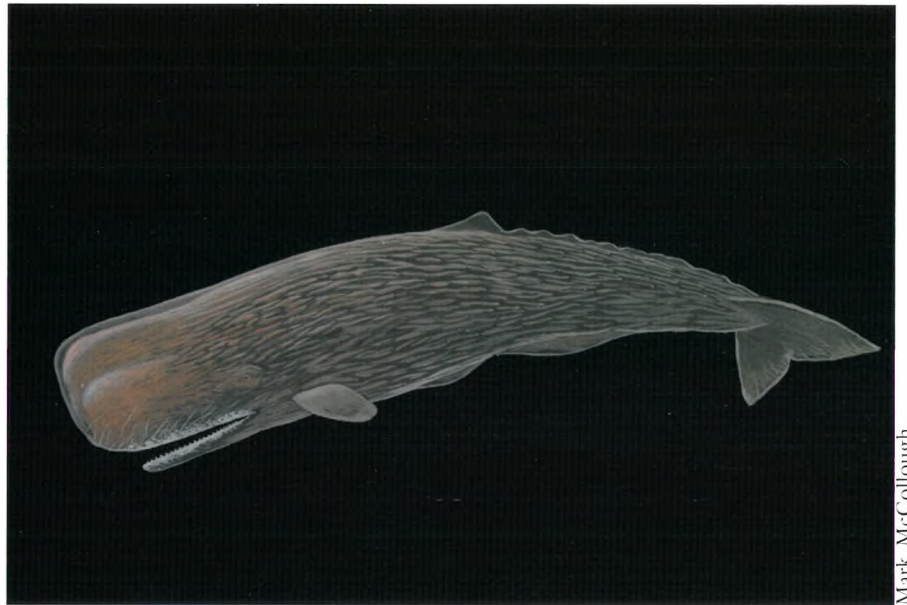
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- ✓ Plan for protection of critical whale habitats in state and federal oil spill contingency planning. 

**FEDERALLY
ENDANGERED**

Sperm Whale

(*Physeter macrocephalus*)



Mark McCollough

Description

The sperm whale was immortalized in Herman Melville's epic novel *Moby Dick*. This distinctive cetacean is the largest of the toothed whales. It is identified by its large, blunt, barrel-shaped head and narrow lower jaw containing 40-50 conical teeth. The teeth fit into sockets in the upper jaw. The head comprises about a third of total body length for adult males and a fourth for adult females. A single blowhole is located on the left front end of the head. The spout projects forward at an angle unlike that of any other whale. Eyes are located above and behind the edge of the mouth. There are several short grooves on the throat. The dorsal (upper) fin is thick and has a low profile, forming a compressed hump. Additional humps extend along the spine to the tail flukes. The large and triangular flukes are deeply notched. The small flippers are located a short distance behind and below the eyes.

Overall color is usually brown or slate-gray, with patches of white around the corners of the mouth and vent. The skin on the back appears wrinkled. The dorsal and ventral (lower) surfaces of both the flippers and flukes are the same slate gray or brown color as the rest of the body.

Adult males are typically larger than females and reach 49-59 feet in length and weigh up to 35-45

tons. Females grow to about 36 feet and a maximum weight of 13-14 tons.

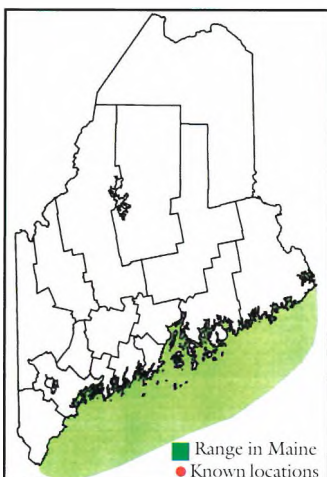
Range and Habitat

Sperm whales are found in all of the world's oceans, except in the arctic. In the North Atlantic, they are found from Nova Scotia to the Gulf of Mexico. They prefer deep waters and generally stay along the edge of the continental shelf in water 3,000 to 6,000 feet deep. They are rarely observed in the Gulf of Maine. Males travel either alone or in groups, and are found in higher latitudes during the summer than in winter. Only mature males are found at breeding areas near the Equator. Females, calves, and juveniles remain in the warmer tropical waters of the Atlantic year-round.

Life History and Ecology

Sperm whales feed primarily on squid (especially giant squid), although octopi, sharks, skates, and other fish are also taken. Their search for squid accounts for much of their biology, behavior, and annual and seasonal movements. Each day, adult males eat about 3.5 percent of their body weight in squid. Many animals have scars from encounters with giant squid. Sperm whales feed primarily in areas of upwelling where food is plentiful, such as along the edges of the continental shelf, and locate their prey by using sonar. They dive to depths of 3,000 feet and can remain underwater from 20 minutes to over an hour. Their heads contain a large reservoir (3-4 tons) of waxy liquid called spermaceti that may help regulate their buoyancy.

Sperm whales are social animals and may occur in groups of 1000 or more individuals. Males form



harems during the breeding season. Mating occurs in the Northern Hemisphere from January to July, and peaks from March through May. The gestation period is the longest of any whale and lasts 16-17 months. In the Atlantic, calving occurs from May to November near the Azores. The calf receives milk from its mother for about 12 months, and weaning occurs when the calf measures about 21 feet. Females do not become pregnant for at least nine months after weaning; thus calving rate is only about once every four years. Sperm whales may live to be 50 years of age.

Threats

For nearly two centuries, the sperm whale was the staple of the New England whaling industry. During this time over one million were killed, severely reducing populations. They were hunted for their spermaceti, ambergris (a waxy substance in their digestive tracts), and oil. Spermaceti was used to make lubricant for machinery, ointments, and smokeless candles. The highly valuable ambergris was used in perfume. Oil was once used as fuel for lamps, lubricant, and base for skin creams and cosmetics.

Sperm whales are rarely found inshore and thus are rarely entangled in fishing gear. However, in 1994, a sperm whale was successfully disentangled from a mesh gillnet in Birch Harbor, Maine. These whales may be threatened by ocean pollution and ingesting plastics.

Conservation and Management

Current estimates of the sperm whale population in the Atlantic are between 20,000-100,000 individuals; population trends are unknown. The sperm whale is protected by the federal Endangered Species Act and Marine Mammal Protection Act. The Maine Department of Marine Resources has lead management authority for marine mammals, including the sperm whale.

Recommendations:

The Maine Department of Marine Resources recommends that National Marine Fisheries Service Guidelines for whale protection be employed. Regulations can be found at www.nmfs.gov/whaletrp/. Current (2002) guidelines include the following:

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- ✓ Plan for protection of critical whale habitats in state and federal oil spill contingency planning. 🐳

**STATE
THREATENED**

Harlequin Duck

(Histrionicus histrionicus)



Mark McCollough

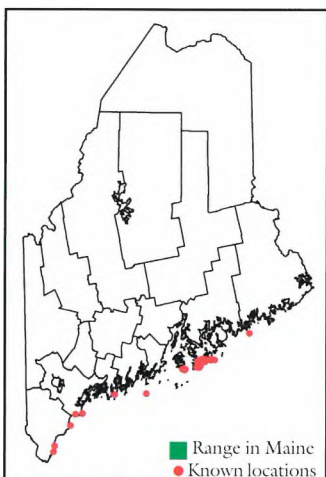
Description

The harlequin is a small diving sea duck and is among the most beautiful waterfowl of North America. As such, it is much sought after by bird watchers and naturalists. The striking blue, white, black, and chestnut plumage of the males gives the duck its name, in honor of the Italian clown. Adult males have slate-blue bodies, chestnut flanks, and white streaks and spots on the head, neck, and back. A white crescent between the eye and the bill extends alongside the black crown stripe. Adult and juvenile females are uniformly sooty-brown with three white dots on the head. Young males achieve their adult plumage after the molt during their second summer.

Range and Habitat

Harlequins are found in the northern hemisphere and winter on both the Atlantic and Pacific Oceans. The larger Pacific population (300,000 birds) breeds in Asia and western North America. Fewer than

15,000 harlequins are thought to exist in the Atlantic population, and they breed in eastern Canada, Greenland, and Iceland. Harlequins that winter along the coast of eastern North America, including Maine, seem to come primarily from a breeding population of about 1,800 individuals in southeastern Canada



(Quebec, Newfoundland, and Labrador). The closest nesting population occurs on the Gaspé Peninsula. The eastern Canadian population winters from Newfoundland south to Virginia, although the majority winter in the Gulf of Maine. About 1000 birds winter in Maine, primarily at a few traditional sites in outer Jericho and Penobscot Bays.

Eastern North American harlequins nest in the subarctic. They winter in small flocks on rough coastal waters and exposed rocky shores, especially on the outermost, remote islands in Maine.

Life History and Ecology

Beginning in late March, harlequin ducks leave their wintering grounds and migrate to eastern Canada where they breed and nest inland along turbulent mountain streams and rivers. After mating, the females lay 3-8 creamy to buff-colored eggs that are incubated for about 28 days. The nest is frequently on the ground in a rock crevice or dense cover, although nests in tree cavities have sometimes been observed. After breeding, the males depart for molting areas along the coast. Some wintering birds from Maine were documented molting in Greenland. Despite being separated for a period of time each summer, harlequins establish long-term pair bonds that are reformed each year on wintering areas. Fall migration begins in September, and birds arrive on wintering areas in October and November. They winter in the same locations each winter, and the same pairs can often be seen feeding and resting at the same ledge year after year. They forage by diving in the foaming surf along remote, exposed rocky shorelines where they glean amphipods (small shrimp-like animals), small snails, and other marine invertebrates from the seaweed and bottom. They

spend much of the short winter days feeding, but during warm fall and spring days they haul out on the rocks to rest and preen.

Threats


Compared to other waterfowl, harlequin ducks have an extremely low reproductive potential. They do not breed until they are three years old and have small clutch sizes. In some years, only half of the breeding-age females may breed, perhaps because of limited food resources or other disturbances in the breeding areas. As a result, the eastern North American population is particularly susceptible to sources of adult mortality. Harlequin populations declined from unrestricted subsistence hunting and liberal limits for sport hunting. Hunting was discontinued in eastern Canada and Maine in the early 1990s. A potential threat is oil spills. A catastrophic spill in outer Penobscot Bay in winter could affect most of the eastern North American population.

Conservation and Management

The harlequin was listed as endangered in eastern Canada in 1990, but was removed from the Canadian list in 2001. It was listed as threatened in Maine in 1997. It was a candidate for federal listing in the early 1990s, and in 1998 was petitioned for federal listing. The proposed listing was determined to be unwarranted because of lack of information about movements between the three Atlantic breeding populations.

Because of concern about its status and future, considerable effort has been directed at conserving harlequin ducks in Maine. A University of Maine graduate student completed landmark life history studies in the 1990s and continues to capture and mark birds to document movements, survival, and site fidelity. Considerable research continues in eastern Canada to better document nesting areas and breeding success. MDIFW and others have conducted numerous comprehensive surveys of wintering habitat by shore, boat, and aerial counts. Satellite telemetry and genetic studies are underway to determine the relationship between Canadian and Greenland nesting populations and the origin of birds wintering off the coast of Maine. Population augmentation techniques have not been developed. It is believed that the population will slowly increase on its own in response to protection from hunting and other sources of human-caused mortality. As a state-threatened species, the harlequin is strictly protected in Maine.

Recommendations:

- ✓ Avoid activities that routinely disrupt the feeding of harlequins on wintering areas (e.g., dragging for fish and shellfish, excessive disturbance by bird watchers and waterfowl hunters).
- ✓ Route oil-bearing ships away from known harlequin wintering areas and develop oil spill contingency plans for these habitats.
- ✓ Protect birds from poaching and other sources of human-caused mortality. 

**STATE
ENDANGERED**

**FEDERALLY
THREATENED**

Piping Plover

(Charadrius melodus)



MDFW

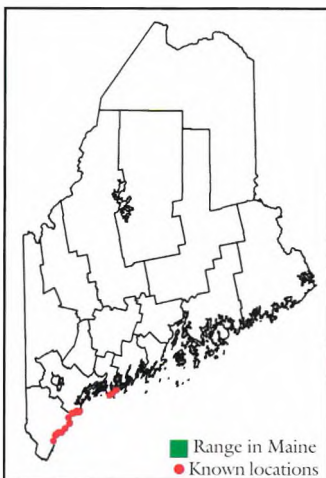
Description

The piping plover is a small, handsome shorebird (about seven inches long) found on sandy beaches and dunes in southern Maine. Its back is a uniform sandy brown color. The underside is white, and is interrupted by a single narrow black band around the neck. The bill is short and orange with a black tip. The legs are orange. The semipalmated plover, a common migrant on beaches in late summer, is similar in appearance, but has a darker brown head and back and a wide brown or black collar.

Summer visitors to southern Maine beaches have a good opportunity to see piping plovers. Signs, fenced sections of beach, and nest enclosures identify areas of the beach that are being managed for nesting piping plovers. By giving the birds space and following a few rules of beach etiquette, we can share the beach with this endangered species.

Range and Habitat

The piping plover breeds in three distinct populations in North America. About 1,400 pairs nest in alkali wetlands and along large rivers in the northern Great Plains of the U.S. and Canada. A tiny population of only about 20 pairs nests on beaches along Lakes Superior and Michigan. The Atlantic coast population of about 1,500 pairs nests on ocean



beaches from Newfoundland to South Carolina. Wintering areas include the southeast Atlantic coast from North Carolina to Florida and the Gulf Coast south to the Yucatan Peninsula.

Habitat for the piping plover includes beaches, mudflats, sandflats, tidal ponds, and salt marshes. On the Atlantic coast, nest sites include open sand, gravel, or shell-covered beaches above the high tide line. Sand spits, barrier islands, blowout areas in dunes, and dredge spoil are preferred nesting areas.

Life History and Ecology

After returning to breeding beaches in Maine in April, males establish and defend a territory by elaborate aerial displays. The breeding territory includes both feeding and nesting habitat. When the male has attracted a mate, one of several scrapes is selected as the nest site and is lined with pieces of shell and tiny pebbles. Over a period of six days the female lays a clutch of four eggs. Incubation begins after the laying of the last egg and lasts for about 28 days. Both sexes share with incubation and feeding young. If the first nest is destroyed, females may re-nest.

Within hours of hatching, the precocial chicks leave the nest but stay close to be brooded by the parents. Parents lead the chicks away from the nest scrape a day or two after hatching, but usually remain within the established territory. Chicks remain close to parents and alternate between feeding and being brooded. Adult females may desert broods within 5-10 days after hatching. Fledging occurs in 28-32 days.

After fledging, adults and young congregate on feeding areas prior to migration. Piping plovers feed primarily on marine worms and small crustaceans

found in the “splash zone,” although they also feed extensively in piles of wrack (seaweed) that accumulates at the high tide line. Intertidal flats and back dune ponds are also used for feeding. Plovers can live to be 14 years of age.

Threats

Habitat loss and degradation, human disturbance, and predation threaten the recovery of this species. Over two-thirds of Maine’s 30 miles of beaches have been lost as nesting habitat for piping plovers because of construction of jetties, seawalls, and high density housing. Maine’s beaches are used by tens of thousands of visitors annually during the plover nesting season. Beach users can crush nests and chicks and disturb feeding birds. Pets (dogs and cats) destroy nests and harass plovers. Vehicles required for beach maintenance activities, especially beach sweeping and garbage collection, can crush eggs and chicks and alter habitat. Beach sweeping and removal of the wrack line also eliminates valuable feeding habitat. Garbage left on beaches attracts predators, including foxes, skunks, raccoons, crows, and gulls, all of which readily prey on plover eggs and chicks. Beach restoration and “nourishment” activities can have a net benefit for plovers if done in the off-season, but also may attract birds to high human use areas. Without intensive management, the aforementioned threats would rapidly reduce Maine’s plover population to near-extinction.

Conservation and Management

Piping plover populations declined in the 1800s because of unlimited harvesting for subsistence and the millinery trade (ladies’ hat decorations). Numbers increased and peaked in the 1940s following the passage of the Migratory Bird Treaty Act. After WWII, many Maine beaches were rapidly developed for summer homes, and populations of plovers and other beach nesting birds plummeted. By 1981, only seven pairs could be found in the state.


Atlantic coast piping plovers are federally threatened, and they were listed as endangered in Maine in 1986. A state recovery plan was written for plovers in 1990. Piping plover nesting, feeding, and brood-rearing habitats were given legal protection by Essential Habitat designation in 1995. Essential Habitat designation requires that all projects funded, permitted, and carried out by municipalities and state agencies in mapped areas be reviewed by MDIFW.

Piping plover management begins in April when plover territories on beaches are fenced and signed.

These areas offer refuge from human disturbance for nesting birds and recently fledged chicks. Wire mesh enclosures are placed around nests as soon as they are found to prevent predation by birds and mammals. Biologists and wardens patrol nesting areas several times weekly to deter dogs, educate the public, and monitor nests and chicks. In some instances, programs to deter or remove nest predators have been initiated. Population and productivity data are collected each year to monitor population health and recovery status. Plovers share their beach environment with nesting least terns (endangered) and many other migratory shorebirds.

In some communities, municipalities help with monitoring and management activities. Intensive management has enhanced productivity and survival of young, and numbers have steadily increased to 55-60 pairs at about 20 sites in the late 1990s.

Recommendations:

- ✓ Avoid further residential development of beach and dune habitats. Review Essential Habitat maps and guidelines prior to development near plover and tern beaches and adjacent dunes, intertidal areas, and salt marshes. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service prior to any project that alters beaches or dunes.
- ✓ Municipalities should strive to maintain important beach and dune systems identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow the state and federal laws and regulations pertaining to sand dunes.
- ✓ To preserve water quality and wetland functions, maintain contiguous, forested riparian habitats at least 250 feet from salt marshes adjacent to plover and tern nesting areas. Follow Shoreland Zoning standards.
- ✓ Avoid major projects and activities on plover and tern beaches during the nesting season (April 1 to August 31).
- ✓ Do not approach plovers or terns or their nests. Respect fenced or posted areas to protect endangered species and other wildlife.
- ✓ Keep pets off the beach during the nesting season (April 1 to August 31).
- ✓ Remove trash from the beach. Carry in/carry out is the best trash collection policy.
- ✓ Avoid flying kites or placing beach volleyball areas within 150 yards of plover or tern nesting areas.
- ✓ Avoid fireworks within one mile of nesting areas.
- ✓ Avoid use of vehicles on the beach during the nesting season. If vehicles are used, employ a “spotter” to walk in front of the vehicle to search for eggs and chicks.
- ✓ When feasible, remove jetties and seawalls that adversely affect plover and tern habitat. 

**FEDERALLY
ENDANGERED**

Eskimo Curlew

(Numenius borealis)

Description

Everyone has heard of the passenger pigeon, but far less familiar is the Eskimo curlew that has shared a similar fate. The Eskimo curlew is one of North America's rarest birds and may be extinct. It is a large shorebird, approximately 11 inches long, with a thin, slightly decurved bill. It is predominantly brown above, fading to buff on the breast and abdomen. The chin and throat are not streaked, but the sides of the head and neck, chest and upper breast have narrow dark streaks that change to broad V- or Y-shaped markings on the flanks. The back and shoulders are almost black with buff-colored markings. The tail is grayish-brown with dark bars and a narrow buffy stripe at the tip. There are dark stripes on the head with an indistinct median crown stripe. The legs are bluish-gray.

The Eskimo curlew is easily confused with the closely related and more common whimbrel that is regularly observed in Maine in late summer. The Eskimo curlew is 25 percent shorter in body length and appears more brown than the whimbrel, which is more gray. In addition, the whimbrel has a distinct light median crown stripe, while the curlew's stripe is indistinct or even absent. The whimbrel has grayish wing linings, while the curlew's are cinnamon-colored. The whimbrel has barring on the underside of the primaries, but the curlew's primaries are clear underneath (although the underwing coverts are barred).

Range and Habitat

The Eskimo curlew is a species of the far north, breeding in northern Alaska and the Northwest Territories of Canada. It spends the winter many thousands of miles away in the extreme southern parts of South America. Its northward and southward migrations follow two different routes. In the spring, it migrates north along the western edge of South America, across Central America, and through the prairie states and provinces to its breeding grounds. This predominantly land-based migration takes the bird through important feeding areas in the Midwest. In the fall, the birds fly eastward across Canada to Labrador



Mark McCollough

and occasionally through the northeastern U.S., and then far out over the Atlantic Ocean on a non-stop flight to South America. In recent years, the range of this species has been questionable, because so few birds have been observed on breeding, wintering, or migratory staging areas.

The Eskimo curlew breeds on tundra in arctic and subarctic regions. Breeding grounds are treeless and contain dwarf shrubs, grasses, and sedges. Often, these areas support plants of the heath family, particularly crowberry (*Empetrum nigrum*), the berries of which are an important food source for curlews arriving in the spring. Wintering grounds in South America include large, open, treeless areas dominated by grasses and interspersed with wetlands. Northward migration in the spring takes the curlew through tallgrass and mixed grass prairies, which provide a variety of invertebrate foods. The curlews seem to have a preference for burned-over areas, rather than cultivated areas. During southward migration, they favor old fields, pastures, blueberry barrens, salt grass meadows, sand dunes, and intertidal flats.

Life History and Ecology

In the past, large northward-migrating flocks of Eskimo curlews arrived from March to mid-May on the grasslands of North America to feed on abundant insects. Curlews were commonly found in association with the American golden plover (*Pluvialis dominica*). Grasshopper

pers, particularly the Rocky Mountain grasshopper (*Melanoplus spretus*), which is now extinct, was a preferred food. Sometimes Eskimo curlews followed farmers plowing fields and ate the insect larvae and worms brought to the surface.

They arrive on arctic nesting grounds in May and remain until early August. Curlews eat berries from the previous growing season while on the breeding grounds, but also consume insects. Little is known about the nesting behavior of the Eskimo curlew. Because of the short arctic breeding season, curlews only produce one brood during mid to late June. Nests are a depression in the earth lined with decayed leaves. Usually four eggs are laid. It is unknown if both sexes or only the female incubate the eggs, but in related species, both parents incubate. Peak hatching occurs during the end of June through mid-July. After hatching, the young are cared for by both parents.

The adult birds leave the breeding grounds before the fledglings to begin the eastward and southward migration. These migrants historically reached the coast of Labrador in eastern Canada by mid-August where they fed on crowberries on the tundra until departing in late September. Fall migrants could be seen along the New England coast from late August to mid-October where they rested in large fields and consumed berries; they also ate insects, spiders, worms, fiddler crabs, and grass seeds.

Threats

In the 19th century, flocks of Eskimo curlew numbering in the thousands were seen along migration routes. Extensive agricultural development in the Great Plains eliminated most of the tallgrass and mixed-grass prairie that was essential to the northward migration of the Eskimo curlew. Fire repression hindered the regeneration of these prairie habitats. Without key habitats and food sources, Eskimo curlews could not maintain the energy reserves necessary for their long migrations and successful reproduction.

Hunting also contributed to the species' decline in the 1800s. In a manner similar to the hunting of passenger pigeons, commercial hunters shot curlews by the thousands during spring and fall migrations. When numbers of passenger pigeons became too low, hunting pressure on Eskimo curlews became even greater. New England colonists named them "dough birds" because of the great quantities of fat that they built up in their bodies prior to southerly migration.


Conservation and Management

By the early 1900s, the species was becoming rare, and only about 70 individuals have been observed in the last 50 years. No confirmed reports of Eskimo curlews have been made since the mid-1980s, despite concerted efforts to locate the birds on their breeding and wintering grounds. Several unconfirmed sightings of the Eskimo curlew have occurred during the last 20 years. Some of these birds were likely whimbrels. The most frequent sightings have been in Texas, and the most recent unconfirmed sighting occurred in 1996 in southwestern Manitoba.

It is unknown whether the Eskimo curlew still exists. It is possible that populations, when reduced below a certain level, were unable to recover. The breeding grounds of this bird have remained relatively unchanged and pristine. However, migratory staging areas have changed dramatically and no longer provide sufficient food and habitat. In addition, changes to habitats in South America, while not contributing directly to the decline of the species, will likely hinder any possible recovery to a viable population level.

To preserve any chance of preventing the species' extinction, conservation measures are being implemented jointly by the governments of the United States, Canada, and Argentina. Currently, there is no recovery plan for the Eskimo curlew. However, the bird is protected by legislation in Canada, Mexico, and the United States. In the U.S. the Eskimo curlew is protected by the federal Endangered Species Act and the Migratory Bird Treaty Act. Although its breeding habitat is secure, the grasslands on which the curlew depends during winter and migration have decreased in quantity and quality. Preserving and re-creating grasslands will be essential for any conservation efforts to succeed for this species. Specifically, the Eskimo curlew needs natural tallgrass and mixed-grass prairies, with a regime of controlled burning for their regeneration, rather than cultivated farmland. In addition, some researchers have proposed a captive breeding and release program, should any adult curlews be located. However, such a program has the inherent risk of removing the last remaining birds from the wild with the possibility that they will not survive in captivity.

Recommendations:

- ✓ Report any sightings of Eskimo curlews immediately to MDIFW and U.S. Fish and Wildlife Service biologists. 

**STATE
THREATENED**

Upland Sandpiper

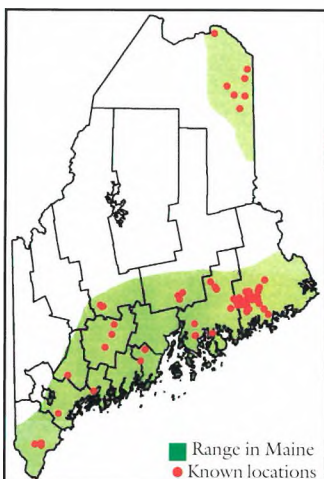
(*Bartramia longicauda*)

Description

Upland sandpipers (or “uppies” to birders) provide an added dimension to grasslands. Their musical call, stirring courtship flights, and habit of perching on fenceposts enliven the rural landscape. Upland sandpipers are among the rarest and most appealing of grassland birds in the Northeast. They are large shorebirds (12 inches high, 26-inch wingspan) identified by a small head, long neck, long tail, black rump, overall buffy plumage with intricate brown markings, and yellow legs. Feathers on the back are olive-buff and strongly barred dark brown with pale buff fringes. The dark streaking on the buff-colored breast contrasts with prominent dark chevrons along the white flanks. The wings are long and pointed. In flight, the undersides of the wings are white and strongly barred dark brown. The tops of the wings are blackish at the tip and brown next to the body. The upland sandpiper has a prominent dark eye and crown stripe. Its short bill is curved slightly downward. When alighting, the species momentarily holds its wings straight up. Its call is a liquid, mellow *ch-wut*, and in flight it whistles a strong *qui-di-di-du*.

Range and Habitat

The upland sandpiper breeds across North America from Alaska, the prairie Provinces, Midwestern states, and northern tier states to Maine. The highest nesting densities are in the northern prairie states and provinces. In Maine, upland sandpipers breed in large grasslands and barrens along the coast and eastern Aroostook County. Most of the state’s population nests in the Downeast



Andy Weik

blueberry barrens. Wintering areas are in South America, with the largest concentrations in Argentina.

Upland sandpipers require large fields (greater than 150 acres), with open shortgrass areas such as blueberry barrens, meadows, pastures, hayfields, fallow agricultural fields, and airports. They occasionally breed in bogs and open peatlands. They prefer a mix of short and tall (less than 24-inch) grass interspersed with patches of bare ground. Fence posts, if available, are used for singing perches. The birds avoid fields with uniform coverage of dense grass and legumes, or a thick layer of dead vegetation. They will use fields dominated by bunchgrasses or blueberry plants.

Life History and Ecology

Upland sandpipers first breed at one year of age. Adults arrive on breeding grounds in Maine from late April to early May. Males call while they circle high above their territories. Upland sandpipers are monogamous, and are thought to arrive on their breeding areas already paired. After elaborate courtship displays, they select a nest site. They nest in extensive, open tracts of short grassland cover types. They are loosely colonial, and several nesting territories are usually grouped in fields. While nest sites are defended, nearby loafing and feeding sites are shared communally. The nest is a shallow scrape in the ground lined with dry grass, with overhanging vegetation for concealment. A clutch of four eggs is incubated for 21-27

days. Within a day of hatching, chicks leave the nest. At least one parent guards the chicks until fledging occurs at 30-34 days of age. Feeding and brood-rearing occur in open, short, grassy cover types. Prey items are primarily insects and include grasshoppers, crickets, and other small invertebrates.

Threats

Upland sandpipers were more common in Maine in the 1800s when a higher percentage of the state was in farmland. Maine agricultural lands diminished from 33 percent of the landscape to 6 percent, as grasslands have reverted to forests or have been fragmented by residential and commercial development. As grasslands disappeared from the landscape in the 1890s, so did upland sandpipers. In the past 100 years, populations have probably stabilized or slightly increased. In the Northeast, hayfields were traditionally harvested in late summer and provided good habitat throughout the breeding season. Today most hayfields are mowed earlier and more frequently, or planted to crops. Pastures can be suitable habitat unless they are subject to heavy grazing. Extensive row crops or fields uniformly covered with mat-forming grasses are not suitable. Some agricultural pesticides negatively affect grassland birds or their insect food.

Conservation and Management


The upland sandpiper was listed as threatened in Maine in 1997 because of small populations, regional population declines, and diminishing habitat in the Northeast. It is also listed as a Migratory Bird Species of Management Concern in the Northeast by the U.S. Fish & Wildlife Service. Historically, upland sandpipers were common summer residents in Maine and were distributed among 13 counties. At the peak of agricultural development in the late 1800s, upland sandpipers were considered common.

After 1950, declining agriculture and increasing reforestation resulted in widespread loss of potential breeding habitat. Since 1989, upland sandpipers have been reported at 73 sites in 11 counties. Current breeding habitat is limited to the few remaining large grasslands and blueberry barrens in the state. Continued existence of this species depends on maintaining these habitats. Maine has the largest upland sandpiper population in the Northeast (currently about 150 pairs), and as such will play an important role in conservation of the species in the region. Additional research is needed to document the species' nesting ecology, populations, productivity, survival of chicks, and limiting factors. Habitat protection, enhancement, and management are key to the species' recovery. Nests, eggs, and fledglings of upland sandpipers are protected from take by the Maine Endangered Species Act.

The upland sandpiper shares its habitat with many other rare or declining species such as the grasshopper sparrow (endangered), short-eared owl, vesper sparrow, horned lark, killdeer, bobolink, meadowlark, northern harrier, and savannah sparrow. All these species rely on grasslands, and all are declining in the Northeast. Conservation of the upland sandpiper depends on maintaining the

remaining grassland areas of the state, particularly fields greater than 150 acres.

Recommendations:

- ✓ Prior to land development or managing grasslands and barrens, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain important grasslands and barrens identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Maintain known nesting areas in native grasses, little bluestem, or low-growing shrubs like lowbush blueberry and do not develop or convert them to other land uses.
- ✓ When managing grasslands, employ best management practices using guidelines in Massachusetts Audubon Society's *Conserving Grassland Birds* publications (www.massaudubon.org).
- ✓ Avoid mowing nesting areas between May 1 and August 5. If mowing is necessary prior to early August, mark nest sites or locations of young birds and leave patches of unmowed grass or low-growing shrubs. Raise the mowing bar to greater than six inches to prevent destruction of nests and young birds.
- ✓ Keep grazing animals off known nesting fields during the critical nesting period (May 1 to August 5).
- ✓ Maintain approximately 40 percent of the vegetation cover at a height of 8-12 inches, with minimal litter and grass cover. Maintain some patches of bare ground, scattered tall forbs (8-25 inches), and short shrubs for song perches.
- ✓ Manage multiple, contiguous fields to provide a mosaic of grassland types by mowing, burning, or late-season grazing. Mow every 2-5 years to inhibit establishment of shrubs and trees.
- ✓ Burn fields every 5-10 years after September 1 or before May 1. Do not burn more than 50 percent of a grassland within a year.
- ✓ Avoid or minimize herbicide and pesticide applications, or employ integrated pest management techniques.
- ✓ Limit commercial gravel and sand mining in grasslands and blueberry barrens. Restore old gravel pits and agricultural fields to grasslands and low shrubs. 

**STATE
THREATENED**

Arctic Tern

(Sterna paradisaea)



Stephen Kress

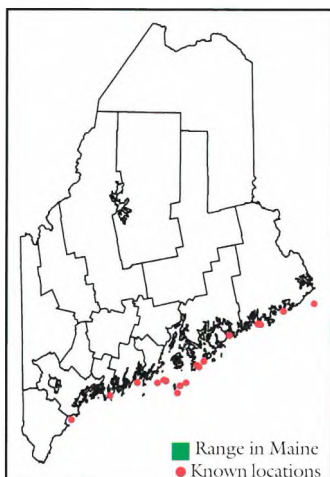
Description

The arctic tern is the champion “globe trotter,” annually migrating over 15-20,000 miles round-trip from its nesting areas in North America to wintering areas in the Antarctic. The arctic tern is a graceful, medium-sized seabird (length 15 inches, wingspan 31 inches) with long, pointed wings and a long, forked tail. In the breeding season it has a light gray body and belly and a white rump and tail. Its black cap and nape are separated from its gray throat by a white facial stripe. The arctic tern is distinguished from other tern species by its deep red beak. Common terns have red beaks tipped in black, and roseate terns generally have all-black or salmon-colored beaks.

Range and Habitat

Arctic terns have the longest annual bird migration known. After leaving North America, they fly across the North Atlantic, travel south along the coasts of Europe and Africa, and winter in the Antarctic – a distance of over 10,000 miles! Their return route may be along the coast of South America.

Maine’s arctic tern population is at the southern edge of the species’ range in eastern North America. Here the terns nest primarily on a few outer coastal islands, always in close association with other terns



and other seabirds. Nesting islands are usually treeless and covered by short herbaceous vegetation. Arctic terns prefer to nest on bare rocks and beaches, presumably because their short legs preclude movement through tall, dense vegetation. Of the 3,000 islands off the coast of Maine, at least 150 have been used by nesting terns in the last century. Arctic terns currently nest on only 10 islands in Maine.

Life History and Ecology

Arctic terns return to their breeding grounds when sexually mature at 3-5 years of age. However, some birds may breed as early as two years old. After they breed for the first time, they exhibit high fidelity to a nesting island, and often return to the same breeding colony yearly. They arrive at breeding islands in Maine in mid-May.

After elaborate courtship flights, ground displays, and ritual feeding, terns establish pair bonds and select a nest site. Two eggs are laid between May 20 and June 10 in a simple scrape that is often lined with pebbles, shells, or vegetation. The incubation period lasts 20-24 days, and both parents share responsibility for incubation. Chicks leave the nest within days, but continue to be fed and brooded by the parents. Fledging occurs in 21-28 days. Within 2-3 days after fledging, they begin to accompany parents on short flights to nearby feeding areas, and generally depart the colony within two weeks. Fall migration begins in mid to late August.

Arctic terns feed on small fish and crustaceans, which they capture by plunging into the water and catching with their bills. Primary foods eaten in Maine include white hake, Atlantic herring, and sand lance. The terns may forage up to 10 miles

away from their nesting island, in deep water, rocky shores, upwelling areas, and over schools of predatory fish. Some individuals specialize in taking shrimp and small amphipods (shrimp-like animals).

Terns can be long-lived. The longevity record for an arctic tern is 34 years!

Threats

The primary causes of declining tern numbers in the Gulf of Maine are gull predation, human disturbance, and food shortages. Gulls arrive on nesting islands earlier than terns, occupy the best nesting areas, and drive terns away. Gulls also eat tern eggs, chicks, and sometimes adults. Habitat on a few islands has been lost because of the construction of permanent or seasonal dwellings. Human disturbance on islands can cause nest and chick abandonment and increase gull predation. Terns feed on the immature forms of many commercially valuable fish. Fisherman may compete with terns for species like herring and hake. Nesting productivity is low in years of poor food availability or adverse weather conditions (rain, fog) that prevent terns from finding food. The recent collapse of some commercially valuable fish stocks may have adverse effects on tern populations.

Conservation and Management

Prior to passage of laws protecting migratory birds, arctic terns were harvested to supply feathers for the millinery trade (to make women's hats) and their eggs were collected for food. Passage of the Migratory Bird Treaty Act of 1918 provided protection for migratory birds, and by 1931 an estimated 8,000 pairs of arctic terns nested on the coast of Maine. However, since the 1940s, arctic tern numbers have declined because of predation and competition with gulls. Most of the population is now concentrated on a few islands managed by conservation groups. The arctic tern was listed as threatened in Maine in 1997 because of past declines and because the population is nesting on only a few islands.

Recovery of Maine's island nesting tern populations (arctic, common, and roseate) requires intensive management. Since the 1970s, terns have disappeared from most of their former nesting islands. Intensive management is occurring on 10 tern nesting islands. Management includes removal or control of competing gull populations, use of decoys and sound recordings to attract terns, and maintaining the presence of tern managers to protect the birds from human disturbance during the nesting season. Management has halted popula-

tion declines, and arctic tern numbers have stabilized at about 2,500 pairs. This is still far below historic levels. More than 90 percent of Maine's breeding population nests at only three sites – Machias Seal Island, Matinicus Rock, and Petit Manan Island. Because of food limitations and gull predation, arctic terns have not recolonized many of their former nesting areas. Arctic tern nesting islands are designated as Significant Wildlife Habitats under Maine's Natural Resource Protection Act or as Protection Fish and Wildlife areas under the Land Use Regulation Commission.

Recommendations:

- ✓ Protect seabird nesting islands and adjacent waters from further development, especially human dwellings, fishing piers, docks, and aquaculture facilities. Review Essential Habitat maps and guidelines prior to development near roseate tern islands. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service to assist with planning.
- ✓ Municipalities should strive to prevent development of seabird nesting islands and adjacent waters and identify these areas in comprehensive plans. Consider protecting a ¼ mile buffer around seabird nesting islands.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Stay off seabird nesting islands during the nesting season (April 1 to August 15). If visitation is approved (e.g., commercial tours to a seabird island), remain on designated paths and in blinds to minimize disturbance.
- ✓ Keep boat activity more than 660 feet from seabird nesting islands. If birds flush from the island, you're too close.
- ✓ Keep all pets off islands. Do not introduce mammalian predators.
- ✓ Locate aquaculture facilities farther than ¼ mile from seabird nesting islands.
- ✓ Avoid overfishing and polluting nursery areas for herring, hake, and other fish stocks important as food for seabirds.
- ✓ Do not use gill nets near seabird islands or known feeding areas.
- ✓ Do not dump oil, litter, or waste overboard. Even small amounts of oil can kill birds. Seabirds are often injured by eating plastic particles from trash that are mistaken for food.
- ✓ Avoid overboard discharge of fish waste or bait. Predatory gull populations have increased because of this readily available supply of food. 🐦

**FEDERALLY
ENDANGERED**

**STATE
ENDANGERED**

Roseate Tern

(Sterna dougallii)



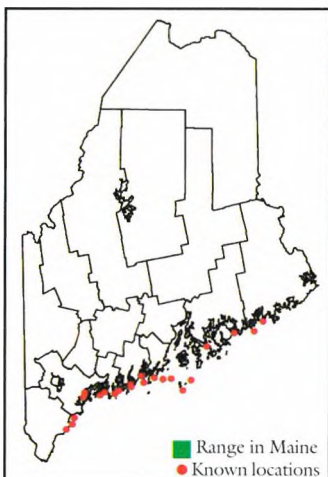
Stephan Repasky

Description

Roseate terns are graceful seabirds (length 15 inches, wingspan 31 inches) with pointed wings and long, forked tails. They are very similar in appearance to arctic and common terns. Roseates are distinguished by their voices, the lack of a black trailing edge on the underwings, and shorter wings. At the beginning of the breeding season their bills are entirely black, but a salmon-red color develops along the basal third as the season progresses. In the breeding season, they have white bellies that can be washed with a rosy tinge (hence their name); light gray bodies; and white rumps and tails. Like other terns, they have black caps and napes, and their legs and feet are bright reddish-orange.

Range and Habitat

Roseate terns nest in temperate and tropical marine habitats throughout the northern hemisphere. The North American subspecies breeds in two distinct groups: the Northeast population, which breeds from the Magdalen Islands of Quebec south to Long Island in New York, and a population in the Caribbean Sea. Both populations winter in South America from Colombia to Brazil. Roseate terns nest exclusively in marine environments on islands, barrier beaches, and salt marsh islands. Nesting islands are



close to good foraging areas. Of the 3,000 islands off the coast of Maine, at least 150 have been used by nesting terns in the last century. In recent years, only 4-6 islands have been used by roseate terns.

Life History and Ecology

First breeding is generally at 2-4 years old. After roseate terns breed for the first time, they are highly faithful to a nesting island, returning to the same breeding colony year after year. They arrive at breeding islands in Maine in mid-May. Roseates pair with a single mate, but may exchange mates from year to year. After a three-week period of courtship, 1-5 (average 2) eggs are laid in mid-May to mid-June. The nest is a simple scrape in dense vegetation or under rocks or driftwood. Both adults incubate eggs, and chicks hatch in about 23 days. The chicks stay close to the nest site and are fed by the parents for 22-30 days before they fledge.

Roseate terns feed on small fish, and sand lance predominates in the diet in the Northeast. In Maine, white hake, four bearded rockling, herring, and pollock are also taken. Roseates forage by plunging into the water and catching small fish with their bills. They favor fishing over shallow sand shoals and tide rips. During August and early September, large flocks of roseates can be observed at migratory staging areas (inlets, barrier beaches, and islands, usually adjacent to good food sources). The longevity record for a roseate tern is 25 years.

Threats

The primary factors affecting tern populations in Maine are gull predation, habitat loss, human disturbance, and food shortages. Herring and great black-backed gulls arrive on nesting islands earlier

than terns, occupy the best nesting areas, and drive terns away. Tern eggs, chicks, and even adults are taken by gulls. Laughing gulls, which nest in close association with terns, have increased rapidly on some islands, driving terns from prime nesting habitat and taking some eggs and chicks. Habitat on some islands has been lost because of the construction of permanent or seasonal dwellings. Human disturbance on islands can cause nest and chick abandonment and increase gull predation. Terns feed on the immature forms of many commercial fish like herring and hake. Commercial fisherman may compete with roseate terns for food. Nesting productivity is low in years of poor food availability or adverse weather conditions (rain, fog) that prevent terns from finding food.

Conservation and Management

By 1890, roseate terns in the Northeast were reduced to about 2,000 pairs because of overharvest for the millinery trade (decorating ladies' hats). Although most nesting islands were abandoned during this period, at least four sizable colonies survived. With the passage of migratory bird laws in the early 1900s, roseate numbers rebounded. The Northeast population peaked in the 1930s at about 8,500 pairs. Maine's population was never very large, reaching about 275 pairs in 1931. Since the 1940s, roseate numbers have declined throughout their range because of predation and competition by increasing gull populations. By 1977, only 2,300 pairs remained in the Northeast. This population was listed as endangered in 1987 by the federal government. Maine's population dwindled to 52 pairs in 1987, the year after it was listed as endangered by the state. The roseate tern is also listed as endangered in Canada.

Recovery of Maine's tern populations (arctic, common, and roseate) has required intensive management on a few nesting islands. Ten Maine nesting islands are currently managed for terns. On each of these islands, gulls are removed or controlled, decoys and sound recordings of colonies are used to attract nesting terns, and tern managers live on the islands during the nesting season to deter predators and control human disturbance. Roseate tern numbers have responded well to management, and about 289 pairs nested on four islands in the state in 2001. Most of Maine's breeding population nests at only two or three islands, and the birds have yet to recolonize many of their former nesting areas. Roseate tern nesting islands are designated as Essential Habitats under the Maine Endangered Species Act, Significant Wildlife Habitats under the

Maine Natural Resource Protection Act, or as Protection Fish and Wildlife areas under the Land Use Regulation Commission. Because of Essential Habitat designation, all projects or activities funded and carried out by municipalities and state agencies within ¼ mile of roseate tern nesting islands are reviewed by MDIFW.

Recommendations:

- ✓ Protect seabird nesting islands and adjacent waters from further development, especially human dwellings, fishing piers, docks, and aquaculture facilities. Review Essential Habitat maps and guidelines prior to development near roseate tern islands. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service to assist with planning.
- ✓ Municipalities should strive to prevent development of seabird nesting islands and adjacent waters and identify these areas in comprehensive plans. Consider protecting a ¼ mile buffer around seabird nesting islands.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Stay off seabird nesting islands during the nesting season (April 1 to August 15). If visitation is approved (e.g., commercial tours to a seabird island), remain on designated paths and in blinds to minimize disturbance.
- ✓ Keep boat activity more than 660 feet from seabird nesting islands. If birds flush from the island, you're too close.
- ✓ Keep all pets off islands. Do not introduce mammalian predators.
- ✓ Locate aquaculture facilities farther than ¼ mile from seabird nesting islands.
- ✓ Avoid overfishing and polluting nursery areas for herring, hake, and other fish stocks important as food for seabirds.
- ✓ Do not use gill nets near seabird islands or known feeding areas.
- ✓ Do not dump oil, litter, or waste overboard. Even small amounts of oil can kill birds. Seabirds are often injured by eating plastic particles from trash that are mistaken for food.
- ✓ Avoid overboard discharge of fish waste or bait. Predatory gull populations have increased because of this readily available supply of food. 🐦

**STATE
ENDANGERED**

Least Tern

(Sterna antillarum)



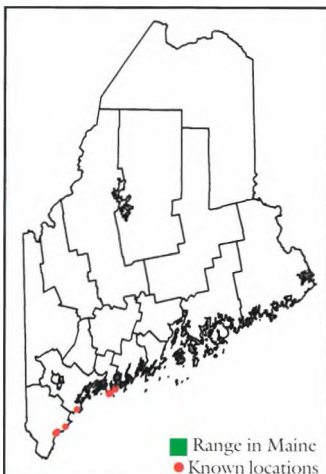
Maine Audubon Society

Description

Feisty and acrobatic, the least tern is the smallest of Maine's five species of nesting terns. It is about nine inches long and has a 20-inch wingspan. The least tern is white with pale gray feathers on the back and upper surfaces of the wings, except for a narrow black stripe along the leading edge of the upper wing feathers. Its cap is black with a small patch of white on the forehead. In summer, the adult has a yellow bill with a black tip, and yellow to orange feet and legs. The juvenile has a black bill and yellow legs, and the feathers on the back are darker than those of the adult, with a distinctly "scaled" appearance. The least tern's small size, white forehead, and yellow bill distinguish it from Maine's other resident terns.

Range and Habitat

Least terns breed in three North American populations: along the Atlantic coast from Maine to Texas, the Pacific Coast from California to Mexico, and the major rivers in the Mississippi watershed. The Atlantic Coast population is the largest at about 10,000 pairs. Least terns migrate to the eastern coast of Central and South America and northeast Brazil for the winter.



Least tern nesting habitat includes open sand, gravel, or shell-covered beaches above the high tide line. The birds are particularly attracted to the dynamic sand spits at the ends of beaches. They feed on small fish over shallow open water areas, stream and river outlets, tidal ponds, and salt marshes adjacent to nesting areas.

Life History and Ecology

Least terns arrive in New England between late April and early May. Most do not return from wintering areas to breed until they are 2-3 years old. Males establish and defend territories where they display to prospective mates, either to reestablish old pair bonds or to find a new mate. During courtship the male feeds fish to a female. Both sexes make scrapes in sandy areas with sparse vegetation above the high tide line, although the female selects the scrape that becomes the nest.

First clutches of two eggs are laid about 2-3 weeks after arrival on the breeding grounds. Incubation begins after laying the first egg and lasts 19-25 days. Both sexes incubate, brood, and feed chicks. Renesting occurs if the eggs or chicks are destroyed early in the breeding period. Both sexes defend their territory, eggs, and chicks. Birds from a colony often band together to drive away potential predators, including humans, by diving and defecating on intruders.

Chicks depart the nest shortly after hatching and may wander as far as 200 yards from the nest. Fledging occurs after 20 days. After the young have fledged, adults and young from several nests associate with each other for feeding, loafing, and roosting. Fledglings follow parents to feeding areas, where they are fed by parents and eventually begin to forage for themselves. Young birds disperse from colony sites about three weeks after fledging. Before migrating, adults with fledglings may remain for 6-8 weeks within the coastal breeding habitat. Adults and juveniles congregate at prime fishing areas beginning in late July and early August. They forage in bays, estuaries, rivers, creek mouths, and tidal marshes, usually within 1½ miles from colonies. They hover up to 30 feet above the water, then plunge into the water and grasp small marine fish with their beaks. The species of forage fish have not been documented in Maine.

Immatures remain on wintering areas for their first year. Wintering areas of the Atlantic coast populations are largely unknown, although some banded birds have been

resighted on the northern coast of South America. Least terns can live to 24 years of age.

Threats

Habitat loss and degradation, human disturbance, and predation threaten the recovery of this species. Natural phenomena (storm tide flooding, excessive rainfall) can also cause egg and chick loss. Over 2/3 of Maine's 30 miles of beaches have been lost as nesting habitat for least terns because of construction of jetties, seawalls, and high-density housing. Maine's beaches are used by tens of thousands of visitors annually during the least tern nesting season. Beach users can crush nests and chicks. Pets (dogs and cats) destroy nests and harass terns. Beach maintenance activities, especially vehicles associated with beach sweeping and garbage collection, can crush chicks and alter habitat. Garbage left on beaches attracts predators, including foxes, skunks, raccoons, crows, and gulls, all of which readily prey on tern eggs and chicks. Beach restoration and "nourishment" activities can have a net benefit for least terns if completed outside the nesting season, but also may attract birds to high human use areas. Without intensive management, the aforementioned threats would rapidly reduce Maine's least tern population to near-extinction.

Conservation and Management

There are no records of least terns nesting in Maine during early European settlement. They were likely present, but were quickly extirpated by subsistence hunting. The species was nearly extirpated from the entire East Coast during the 1870s by overharvest for the millinery trade (decorating ladies' hats). Least terns were first recorded nesting in Maine in 1961. Since that time, nesting colonies have been documented at 13 sites. Populations have been monitored since 1977, and the population has fluctuated between 39 (in 1982) and 125 pairs (in 1993).


Pacific and interior populations of least terns are federally endangered. Least terns are listed as a Species of Management Concern on the East Coast by the U.S. Fish & Wildlife Service. They were listed as Maine's first endangered species in 1982. A state recovery plan was written for least terns in Maine in 1993. Least tern nesting, feeding, and brood-rearing habitats were given legal protection in Maine by designating these areas as Essential Habitats in 1995. Least tern numbers have not increased substantially despite two decades of intensive management.

Least tern management begins in May when nesting areas on beaches are fenced and signed. These protected areas offer refuge from human disturbance for nesting terns and recently fledged chicks. Chronic predation and human disturbance are major factors limiting populations, and entire colonies can be lost in a single night from these causes. In many years, only a handful of young are fledged. Electric fencing and large wire mesh fences have been employed to deter predators, with mixed results. Predator control (especially removal of resident pairs of foxes) has not been effective because of social and political limitations that reduce the effectiveness of trappers. Nightly monitoring of colonies has recently proven to be successful in

detering predators. Biologists patrol nesting areas several times weekly to deter dogs, educate the public, and monitor nests and chicks. Population and productivity data are collected each year to monitor population health and recovery status.

Because of Essential Habitat designation, all projects or activities funded and carried out by municipalities and state agencies are reviewed by MDIFW. In some communities, municipalities help with monitoring and management activities. Least terns nest in the same beach environment as piping plovers (endangered) and many other migratory shorebirds.

Recommendations:

- ✓ Avoid further residential development of beach and dune habitats. Review Essential Habitat maps and guidelines prior to development near plover and tern beaches and adjacent dunes, intertidal areas, and salt marshes. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service prior to any project that alters beaches or dunes.
- ✓ Municipalities should strive to maintain important beach and dune systems identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow the state and federal laws and regulations pertaining to sand dunes.
- ✓ To preserve water quality and wetland functions, maintain contiguous, forested riparian habitats at least 250 feet from salt marshes adjacent to plover and tern nesting areas. Follow Shoreland Zoning standards.
- ✓ Avoid major projects and activities on plover and tern beaches during the nesting season (April 1 to August 31).
- ✓ Do not approach plovers or terns or their nests. Respect fenced or posted areas to protect endangered species and other wildlife.
- ✓ Keep pets off the beach during the nesting season (April 1 to August 31).
- ✓ Remove trash from the beach. Carry in/carry out is the best trash collection policy.
- ✓ Avoid flying kites or placing beach volleyball areas within 150 yards of plover or tern nesting areas.
- ✓ Avoid fireworks within one mile of nesting areas.
- ✓ Avoid use of vehicles on the beach during the nesting season. If vehicles are used, employ a "spotter" to walk in front of the vehicle to search for eggs and chicks.
- ✓ When feasible, remove jetties and seawalls that adversely affect plover and tern habitat. 

**STATE
ENDANGERED**

Black Tern

(Chlidonias niger)



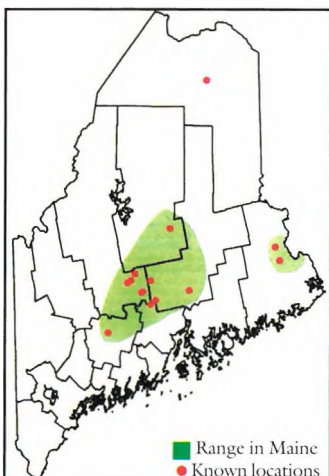
Mark McCollough

Description

Most people are familiar with seeing terns at the ocean, but black terns nest exclusively in freshwater marshes. The black tern is a small (length 9-10 inches), robin-sized tern with unmistakable black plumage. It has a black head and underbody with grayish-black wings and tail. The base of the underside of the tail is white and the underside and leading edge of the wings are whitish. The bill and eyes are black, and the legs are reddish. In late summer and fall, black terns begin to molt and may be mottled with white, especially on the head and neck. Juveniles are white with a dark crown patch and brownish underparts. Their flitting, darting flight is easily recognized.

Range and Habitat

The black tern nests sporadically throughout the northern U.S. and Canada. The largest populations are found in northern prairie regions. Smaller populations are scattered in the Northeast states and



Maritime provinces. In Maine, black terns nest in large (over 40 acres), shallow emergent marshes associated with lakes, impoundments, and slow-moving streams. About 11 nesting areas have been identified. Most occur in the Sebasticook River watershed, but small nesting colonies also occur at a few lakes in

eastern Maine and Portage Lake in Aroostook County. Nest locations are selected in still water in dense emergent vegetation surrounded by small patches of open water. Some colony sites are in bogs adjacent to lakes. Feeding habitat includes adjacent marshes, fields, and areas of open water. Black terns winter in marine and coastal areas of Central and South America.

Life History and Ecology

Black terns usually breed at two years of age. They arrive at breeding areas in Maine in mid to late May. Returning birds congregate at communal feeding and resting areas and soon begin courtship displays. These displays include “high flights” where small groups ascend several hundred yards and descend in a shallow glide to near the water’s surface. Males carry fish in their bills in a “fish flight” display to attract prospective mates. Ritualistic feeding occurs at potential nest sites.

Black terns nest semi-colonially, typically in clusters of 3-15 nests. The nests are small cuplike gatherings of sticks or reeds and are usually constructed on floating mats of dead vegetation or small mud flats. Both sexes participate in nest building, incubation, and feeding young. A three-egg clutch is laid over a 3-4 day period in early June. Incubation begins with the first egg laid, and eggs begin to hatch after 21 days. Hatching peaks in late June. Birds will re-nest if eggs are destroyed in early incubation. The young are brooded by both parents for the first 10 days. Chicks wander from the nest site within 3-5 days and fly at 20-24 days. Fledglings begin to forage for themselves, but the parents continue to feed the young for an additional two weeks. Adults and young feed on small fish and

insects.

After the young fledge, they remain at breeding areas for only a week or two before beginning migration. Fall migration begins in late July and most birds are gone from breeding areas by mid to late August. Fall migration patterns and routes are not well understood. Immature birds remain in marine areas until they are mature. They can live to eight years of age and likely older.

Threats

Until recently, little was known of factors limiting black tern populations in the Northeast. Research at the University of Maine suggests that fluctuating water levels and nest and chick predation limit population growth. Flooding may eliminate the nests of entire colonies, and in some years significantly reduce productivity. Tern eggs and chicks are killed by herons, bitterns, mink, raccoons, snapping turtles, and predatory fish. Food is adequate and Maine tern chicks grow at rates comparable to those in other areas. Habitat is not limiting as many wetlands are apparently suitable for nesting but unused. Pesticides reduce favored insect foods. Eutrophication (nutrient enrichment of waters) has caused black tern declines in Europe. Stocks of small pelagic fish on core wintering areas have declined and may have reduced overwinter survival.


Conservation and Management

Black terns slowly declined throughout much of their range, and populations are about a third of that measured in the 1960s. In the Northeast, black terns nest in Pennsylvania, New York, Vermont, and Maine, and they are endangered in all of these states. Nesting in Maine was first documented at Messalonskee Lake in 1946. Similar records from New Brunswick suggest that black terns expanded into the region in the 1940s and 1950s in response to the creation of many large marshes for waterfowl. Maine's population has been monitored annually since 1990 by students from Nokomis High School in Newport, and seems to have increased slightly to 80-90 pairs. In 1991, the black tern was listed as a candidate for the federal endangered species list and in 1997 was listed as endangered in Maine. Maintaining stable water levels in impoundments, using floating nest platforms, and employing measures to deter predators may be future recovery options.

Recommendations:

✓ Prior to land development or forest harvesting near black tern wetlands, consult with a biologist

from MDIFW to assist with planning.

- ✓ Municipalities should strive to maintain areas adjacent to black tern nesting sites in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting wetlands and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow Shoreland Zoning and LURC standards.
- ✓ To preserve water quality and wetland functions, maintain contiguous, forested riparian habitats at least 250 feet from wetland habitat for black terns.
- ✓ Avoid placing roads, pipelines, houses, yards, and other developments within 250 feet from black tern wetlands. Protect grasslands, lakes, and waterways adjacent to black tern wetlands as feeding areas.
- ✓ When projects are proposed within 250 feet of black tern wetlands, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ Direct motorboat traffic at least 300 feet away from nesting areas. Establish no-wake areas around vulnerable nesting areas. If the birds leave nests, begin to vocalize, and dive at boats, you are too close!
- ✓ Prevent the introduction of new fish predators (e.g., northern pike, muskellunge, large-mouthed bass) to watersheds supporting black terns. Predatory fish eat young terns and affect small fish populations used as food by terns.
- ✓ Manage impoundments for a stable water level, particularly during the incubation period from May 25-July 15.
- ✓ Support prevention and eradication of introduced aquatic plants like variable milfoil and purple loosestrife that may greatly degrade habitat for black terns.
- ✓ Place interpretive signs near boat launches to inform the public of nesting terns and their conservation needs. 

**STATE
THREATENED**

Razorbill

(*Alca torda*)

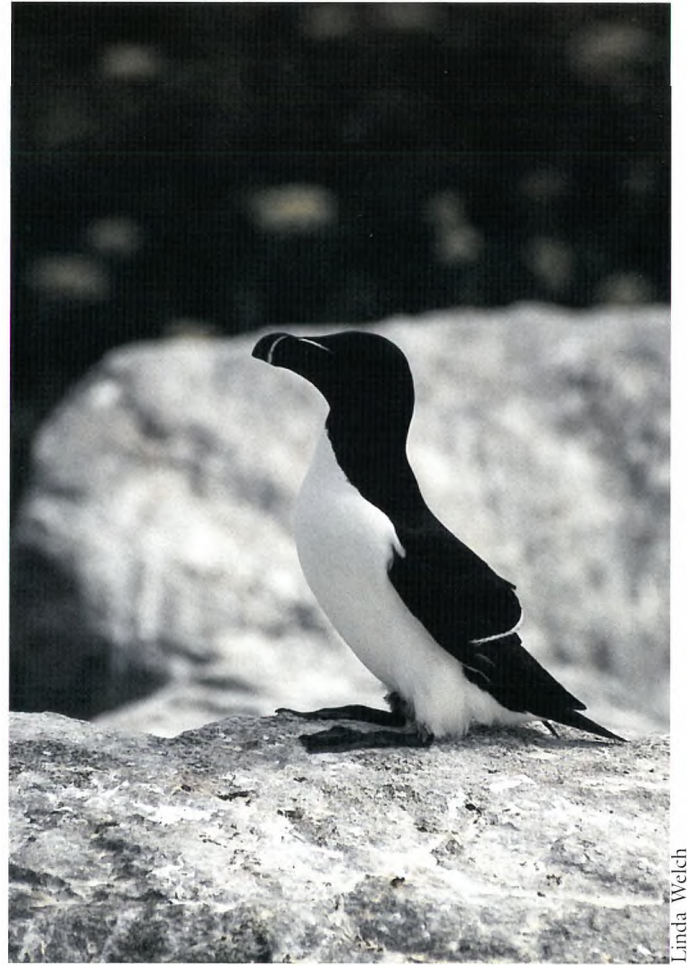
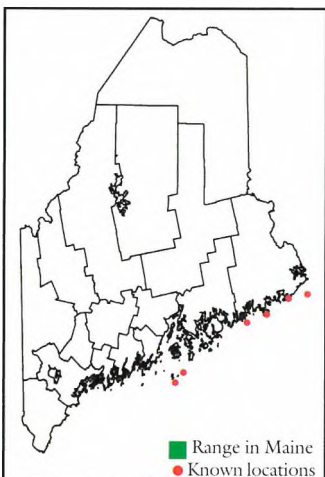
Description

In the northern hemisphere, Maine's puffins, guillemots, and razorbills are the ecological equivalent of penguins. Appropriately dressed in "formal attire," these tuxedoed birds fly underwater, capture fish, and live in large colonies. Another relative, the extinct great auk, used to winter off the coast of Maine.

Razorbills are short (17 inches long), chunky seabirds with short, stubby wings. They are members of the auk family and are closely related to puffins, guillemots, and murres. The breeding adult razorbill is distinguished by a black back and head, white belly, thick bill, and uptilted tail (when swimming). The black bill is flat with a vertical white mark midway along its length. A white line extends from the eye to the bill. Winter plumage is similar; the bill covering is shed, and the throat, cheeks, and ear coverts are white. Legs and feet are black. On breeding grounds, razorbills make a low guttural or croaking *urrr* sound.

Range and Habitat

The razorbill is found in arctic and subarctic marine waters from Maine to northern Russia. There are about 700,000 razorbills in the North Atlantic, and over 70 percent of the population nests in Iceland. About 330 pairs nest in the Gulf of Maine, which is the extreme



Linda Welch

southern edge of their range. Razorbills nest on rocky, isolated islands, although they occasionally nest on mainland cliff faces or headlands if mammalian predators are absent. Islands must have suitable nesting sites, which include ledges with crevices and boulder fields, and deep rock fissures. Razorbills only nest on three islands in Maine: Matinicus Rock, Freeman Rock, and Old Man Island. The largest colony in the Gulf of Maine is on Machias Seal Island on the Maine/New Brunswick border. After breeding, razorbills stay out to sea along pack ice areas of the North Atlantic. In the western Atlantic, razorbills winter at sea off Atlantic Canada south to Massachusetts.

Life History and Ecology

Razorbills breed for the first time when they are 4-6 years of age. Immatures return annually to breeding colonies, with the youngest birds arriving later in the breeding period and staying the shortest amount of time. As birds get older, each year they arrive at the breeding colonies progressively earlier and spend more time at the colony prospecting for mates and nesting sites. Most return to breed at the colony where they were born, and keep the same mate for several years. Razorbills return to breeding

colonies in Maine in February and early March, about three months before egg laying begins. During this period, they alternate time at the colony displaying and defending nest sites with time at sea feeding. Nest sites are typically under rocks and in crevices. Egg laying occurs during May and June, and is closely related to sea surface temperature. A single egg is laid on bare rock, and is incubated by both adults for about 35 days.

After hatching, the chick is closely brooded by the parents until it can regulate its own body temperature at about 9-10 days of age. When about 18 days old, the partially grown and flightless chick leaves the colony in the middle of the night to avoid gull predation. Primary and secondary wing feathers develop after the young bird has left the colony. The adult male accompanies its chick to sea, where it feeds the chick for several weeks. Adults feed primarily on fish, including sand lance, Atlantic herring, Atlantic cod, and capelin. Fall migration begins in mid-September in Maine. Longevity may exceed 30 years.

Threats

Historically, razorbills were more numerous, but not abundant, at the southern edge of their range. They declined from overharvest for food, feathers, and eggs. In the last 50 years, expanding populations of black-backed and herring gulls became serious predators of razorbills, their chicks and eggs. The presence of gulls inhibits razorbills from recolonizing some former nesting areas. The availability of food can affect breeding success. Incidental take in gill nets can be a serious problem in some areas. Oil pollution and spills have the potential to kill large numbers of birds. Maine razorbill nesting islands are remote and rarely visited by humans, so human disturbance is not typically a concern.

Conservation and Management

Historic data on razorbills in Maine are nonexistent. Hunting and egg collecting eliminated the species from Maine islands by 1890. At some time in the 1900s, they began to return to some former nesting islands, and by the 1970s there were about 25 pairs on two islands. About 180 pairs currently nest on three islands, and the population is believed to be slowly increasing. About 150 pairs nest on Machias Seal Island. Unlike most other endangered seabirds, razorbills still exist on unmanaged islands (Old Man Island and Freeman Rock). These rocky enclaves are unsuitable for nesting gulls, thus providing predator-free habitat for razorbills.

Ongoing gull control and management pro-

grams on Matinicus Rock and Machias Seal Island benefit razorbills. Active programs are underway to establish new colonies at Eastern Egg and Petit Manan Islands. Razorbills were listed as threatened in Maine in 1997 because of their small population size and limited distribution. All razorbill islands in Maine are in conservation ownership and protected by Significant Wildlife Habitat provisions of the Natural Resource Protection Act.

Recommendations:

- ✓ Protect seabird nesting islands and adjacent waters from further development, especially human dwellings, fishing piers, docks, and aquaculture facilities. Review Essential Habitat maps and guidelines prior to development near roseate tern islands. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service to assist with planning.
- ✓ Municipalities should strive to prevent development of seabird nesting islands and adjacent waters and identify these areas in comprehensive plans. Consider protecting a ¼ mile buffer around seabird nesting islands.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Stay off seabird nesting islands during the nesting season (April 1 to August 15). If visitation is approved (e.g., commercial tours to a seabird island), remain on designated paths and in blinds to minimize disturbance.
- ✓ Keep boat activity more than 660 feet from seabird nesting islands. If birds flush from the island, you're too close.
- ✓ Keep all pets off islands. Do not introduce mammalian predators.
- ✓ Locate aquaculture facilities farther than ¼ mile from seabird nesting islands.
- ✓ Avoid overfishing and polluting nursery areas for herring, hake, and other fish stocks important as food for seabirds.
- ✓ Do not use gill nets near seabird islands or known feeding areas.
- ✓ Do not dump oil, litter, or waste overboard. Even small amounts of oil can kill birds. Seabirds are often injured by eating plastic particles from trash that are mistaken for food.
- ✓ Avoid overboard discharge of fish waste or bait. Predatory gull populations have increased because of this readily available supply of food. 🐦

**STATE
THREATENED**

Atlantic Puffin

(Fratercula arctica)

Description

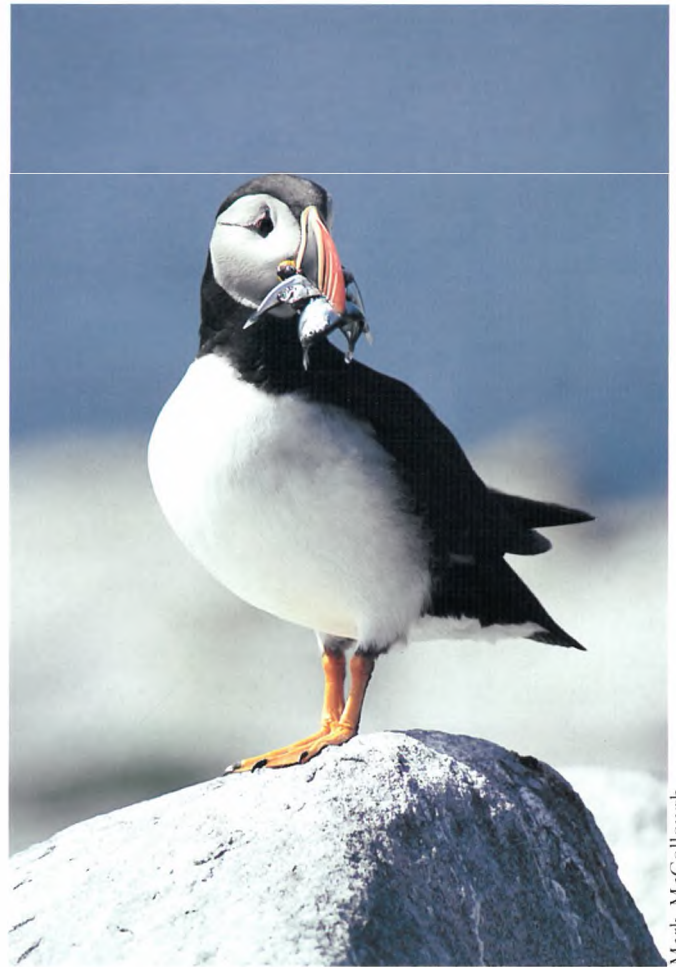
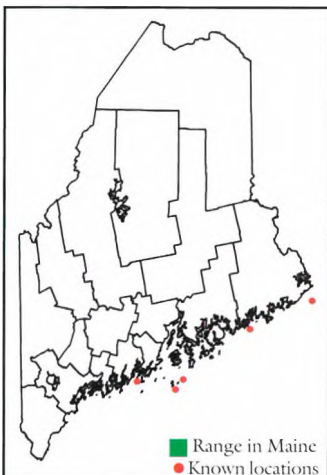
Although few people have seen a puffin, this comical-looking seabird is familiar to most Maine citizens and is one of the state's most popular wildlife species. It is a short (12 inches long), chunky seabird with short, stubby wings. During the summer breeding period, the adult has black wings, back, and tail, a white belly, gray and white cheek patches, and a colorful beak. The bill is triangular in shape with alternating stripes of bright red-orange, blue-gray, and yellow. The forehead, crown, and nape are black, extending in a collar across the throat. The legs and feet are bright orange. After breeding season, puffins lose their colorful summer dress. They shed the outer sheaths of the bill and horny ornaments around the eye, leaving the bill small and gray. The white face patch is lost, the belly becomes gray, and the legs turn to a dull yellow.

Range and Habitat

The Atlantic puffin breeds in arctic and subarctic marine waters from Maine, eastern Canada, Greenland, and Iceland to northern Europe and Russia. It is one of the most abundant seabirds in the North Atlantic (16 million birds), and over half of the population nests in Iceland.

Nesting populations in the Gulf of Maine comprise less than 1 percent of the total population and are at the extreme southern edge of the species' range.

Puffins nest on rocky, isolated islands, although they occasionally nest on mainland headlands if mammalian predators are absent. Islands must have suitable nesting surfaces, either rocks or boulders with suitable crevices, or a



Mark McCollough

peat-like sod of adequate depth to enable nesting birds to dig burrows. In Maine, puffins have been recorded nesting on seven islands, with the largest colonies on Matinicus Rock, Eastern Egg Rock, and Seal Island. There is also a large colony on Machias Seal Island on the Maine-New Brunswick border. Outside of the breeding season, puffins are pelagic, spending most of the winter at sea along pack ice areas of the North Atlantic.

Life History and Ecology

Puffins have an entirely pelagic existence until they mature at 4-6 years of age. Adult birds return to a breeding colony in mid-April. Young birds spend their first 2-3 years at sea, and subadults begin to return to colonies in early summer to look for prospective mates and nest sites. Puffins usually return to the same breeding colony where they were born and retain the same burrow and mate year after year.

Nest burrows end in an enlarged nesting chamber. Between April and July, a single egg is laid in the chamber on bare rock or bare soil. Seaweed, grass, feathers, and other material may be used to support the egg to keep it dry and protect it from being damaged. Incubation ranges from 40-45 days and both parents share responsibility. If the egg is destroyed, the female may lay a replacement egg. Peak hatching occurs the last week of June to the first week of July. The newly hatched chick is brooded continuously for the first 6-7 days until it can maintain its own body

temperature. The chick is then left alone while both parents search for food.

The adult diet is primarily fish, although crustaceans are also taken. Small fishes that are taken include Atlantic herring, sand lance, capelin, smelt, and various species of cod. Adults return to the colony typically with 5-12 small fish in their beaks, but they can carry over 20, depending on size! Chicks grow slowly, and fledging occurs at 38-41 days. When abandoning the colony, chicks leave at night to avoid gull predation, and travel far from the colony site before morning. After fledging, chicks are independent of their parents.

In Maine, most puffins leave breeding colonies by mid-August. Puffins are long-lived and may attain 20-30 years of age. One banded puffin lived to be 34 years old.

Threats

Puffins were never abundant in Maine at the southern edge of their nesting range. Historically, they declined from overharvest for food, feathers, and eggs. These ground-nesting birds were particularly vulnerable to introduced predators (rats and other mammals). In the last 50 years, expanding populations of great black-backed and herring gulls became serious predators of puffins, their chicks, and eggs. The presence of gulls prevents puffins from recolonizing former nesting areas. Unmanaged human disturbance on nesting islands diminishes feeding rates of young. Fluctuations in food supply also affect breeding success. Accidental capture of puffins in gill nets as they chase prey underwater is a serious problem in some areas. Oil pollution and spills can kill large numbers of birds.

Conservation and Management

Several hundred pairs of puffins nested on eight Maine islands prior to 1860. Hunting, egg collecting, and introduction of sheep to nesting islands nearly extirpated the species from the state by 1900. Puffins persisted in the Gulf of Maine on Matinicus Rock and Machias Seal Island where they were protected by lighthouse keepers. In 1977, there were 125 pairs breeding on Matinicus Rock. In the 1980s, the National Audubon Society established a puffin restoration program in Maine and pioneered seabird restoration techniques. Scientists spent years transferring hundreds of chicks from Newfoundland and attracting birds using decoys and sound recordings. Approximately 250 pairs of puffins now nest on four islands in Maine. An additional 1000 pairs nest on Machias Seal Island. Puffins were listed as threatened in Maine in 1997 because of their small population size and limited distribution.

All nesting islands (Petit Manan Island, Matinicus Rock, Seal Island, and Eastern Egg Rock) are intensively managed for seabird restoration. Herring and great black-backed gulls have been removed or populations reduced. Terns, laughing gulls, guillemots, eiders, and petrels share these managed nesting islands and benefit from the lack of gull predation. Biologists protect and observe puffin colonies during the nesting season. Puffins draw thousands of bird watchers each summer on puffin cruises. On-shore visits are prohibited on most islands and are highly regu-

lated on Machias Seal Island. All puffin islands in Maine are in conservation ownership and protected by Significant Wildlife Habitat provisions of the Natural Resource Protection Act or as Protection Fish and Wildlife areas under provisions of the Land Use Regulation Commission.

Recommendations:

- ✓ Protect seabird nesting islands and adjacent waters from further development, especially human dwellings, fishing piers, docks, and aquaculture facilities. Review Essential Habitat maps and guidelines prior to development near roseate tern islands. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service to assist with planning.
- ✓ Municipalities should strive to prevent development of seabird nesting islands and adjacent waters and identify these areas in comprehensive plans. Consider protecting a ¼ mile buffer around seabird nesting islands.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Stay off seabird nesting islands during the nesting season (April 1 to August 15). If visitation is approved (e.g., commercial tours to a seabird island), remain on designated paths and in blinds to minimize disturbance.
- ✓ Keep boat activity more than 660 feet from seabird nesting islands. If birds flush from the island, you're too close.
- ✓ Keep all pets off islands. Do not introduce mammalian predators.
- ✓ Locate aquaculture facilities farther than ¼ mile from seabird nesting islands.
- ✓ Avoid overfishing and polluting nursery areas for herring, hake, and other fish stocks important as food for seabirds.
- ✓ Do not use gill nets near seabird islands or known feeding areas.
- ✓ Do not dump oil, litter, or waste overboard. Even small amounts of oil can kill birds. Seabirds are often injured by eating plastic particles from trash that are mistaken for food.
- ✓ Avoid overboard discharge of fish waste or bait. Predatory gull populations have increased because of this readily available supply of food. 🐦

**STATE
ENDANGERED**

Golden Eagle

(Aquila chrysaetos)



Mark McCollough

Description

It can be safely said that the golden eagle is Maine's rarest breeding bird. For many years, only a single pair nested in the state, and its recent disappearance is distressing. The golden eagle rivals the bald eagle as the largest bird of prey in Maine. Golden eagle wingspans extend up to 6 feet, body length is up to 40 inches, and weight is 8-13 pounds. Females are larger than males, but otherwise the sexes look the same. Golden eagles are uniformly brown-bodied throughout their lives. They get their name from amber or golden-buff highlights on the head and neck. Adults have a black tail with faint gray zigzag banding. The bill is black. Immatures (1-4 years old) have white patches at the base of the primaries and a white tail with a dark terminal band. Golden eagles are easily confused with immature bald eagles. Golden eagles have shorter hawk-like bills, their lower legs are feathered to the ankles, and they soar with slightly uplifted wings.

Range and Habitat

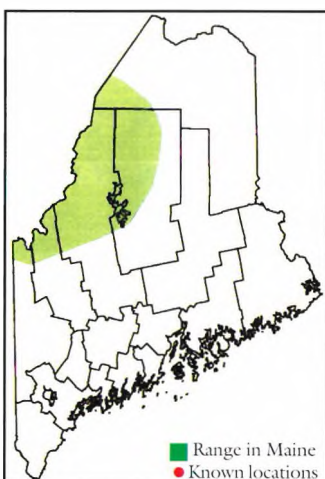
Golden eagles are found throughout the northern hemisphere. In North America, a large population is widespread throughout the western Rockies and north into Alaska. In the East, a small breeding population occurs in Maine, Labrador, and Quebec, although its range is greatly reduced from

its former extent down the Appalachians to North Carolina. Golden eagles are traditionally associated with rugged topography and open country including rangelands, tundra, and alpine areas. They often nest on cliffs in mountains, but tree-nesting prevails in forested regions. In Maine, golden eagles have typically been associated with mountainous areas in the western and northwestern portions of the state. Both cliff and tree nests have been documented in Maine.

Life History and Ecology

In Maine, the nesting season begins in February or March when birds return to nesting areas. Courtship displays include spiraling flights interspersed with aerial dives and talon grappling. During the breeding period, the pair may occupy a home range of 50-100 square miles. Within this area, the pair typically maintains more than one nest, often on separate cliffs. One to two eggs are laid in April. Females perform much of the 6-week incubation. Young birds remain at the nest for 10-12 weeks and are fed by both parents. Fledging occurs in July or August and young birds may remain in the vicinity of the nest for 10-12 weeks and follow adults to feeding areas. They eventually migrate south in September or October.

Wintering areas are from Maine and the Maritime Provinces to the southeastern states, depending on the availability of food. In Maine, food remains at the nest have consisted entirely of wading birds (bitterns and herons). Normal diets elsewhere include ground squirrels, marmots, ptarmigan, and seabirds (at coastal eyries). Maturity is reached at four years of age. Golden eagles remain with the same mate for life. Adults may live 15 to 20 years in



the wild, although they have lived to 46 years in captivity.


Threats

Marginal habitat conditions (lack of food, open space for hunting prey) limit golden eagles in the East. Historically, shooting, trapping, and poisoning reduced golden eagle numbers. Environmental contaminants, especially DDT, caused reproductive impairment during the post-World War II era. Golden eagle eggs recovered from a Maine nest in 1996 contained lethal concentrations of DDE (a variant of DDT), PCBs, mercury, dieldrin, and mirex. Many of these chemicals have been banned from use for years, but still persist in the birds' bodies. Maine's golden eagles relied heavily on wading birds as prey, which had high levels of contaminants. Five dead goldens have been recovered in Maine since 1985: two died of natural causes, one was trapped, one was shot, and another was killed on a logging road. Like bald eagles, goldens are very susceptible to disturbance during the nesting season.

Conservation and Management

Golden eagle populations have declined in the East throughout the last century, and were extirpated 20-40 years ago in other eastern states. Golden eagles have always been rare in Maine. Only 10 nesting territories have been documented with certainty, but at least 18 other localities are suspected. Six successful nesting attempts were recorded at three Maine eyries from 1955-1967. Goldens disappeared from Oxford, Franklin, and Somerset Counties during the 1980s. The last known nesting pair lingered in Maine until 1999, then disappeared from an eyrie that had probably been occupied by successive generations of eagles for hundreds of years. This pair was heavily contaminated and had not produced young since 1986. In recent years, sporadic observations of golden eagles have been documented during the nesting season, raising hope that individuals from Canada may reoccupy former eyries. Populations in eastern Canada are poorly documented, but may number 50 or more pairs. Counts of migrating golden eagles at hawk watch sites in the East indicate that the Eastern population is slowly increasing. Reintroduction programs have been conducted in Georgia, North Carolina, and Tennessee with little success. MDIFW monitors historic golden eyries annually with hopes that these majestic birds will once again grace our skies.

Recommendations:

- ✓ Prior to land development or forest harvesting near eagle nesting areas, consult with biologists from MDIFW to assist with planning.
- ✓ Birders, photographers, and others should stay away from nests during the nesting season. If a golden eagle nest is identified or suspected in an area, suspend activities that potentially disturb nesting eagles during the nesting season (February 1 to August 31). Avoid human activity within ¼ mile of a known nest during the nesting season.
- ✓ Report golden eagle sightings and suspected eagle nest locations to MDIFW.
- ✓ Avoid construction of permanent access roads within ¼ mile of a golden eagle nest, and possibly farther in areas highly visible from cliff nest sites.
- ✓ Forestry is compatible during the non-nesting season after consultation with MDIFW. Single-tree harvest or small patch cuts are acceptable within 660 feet of the nest, as long as the structural character of the area is maintained. Managing for large white pines that extend above the canopy can provide potential nest trees.
- ✓ Avoid applications of pesticides around nesting areas. 

**STATE
THREATENED**

**FEDERALLY
THREATENED**

Bald Eagle

(Haliaeetus leucocephalus)



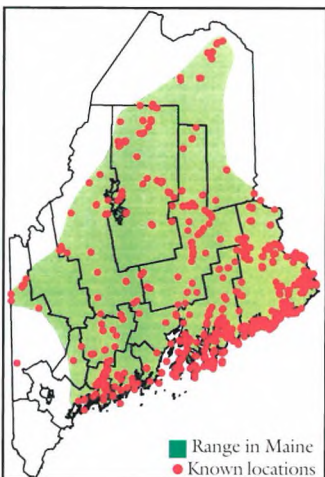
Mark McCollough

Description

The bald eagle vies with the golden eagle as the largest bird of prey in Maine. Bald eagles have a wingspan of seven feet, body length up to 43 inches, and weight from 9-13 pounds. Females are 10-20 percent heavier than males, but otherwise the sexes are indistinguishable in appearance. The adult bald eagle's white head and tail sharply contrast with a dark brown body, plumage widely recognized on this national symbol of the United States. The bill and legs are yellow. Adult plumage is attained at 4-5 years of age. Immature birds superficially resemble golden eagles and are brown, with various amounts of white blotches on the back, belly, and wings. Immature bald eagles have blackish-brown bills and brown eyes, and their bills and eyes become increasingly yellow as the birds mature.

Range and Habitat

Bald eagles are only found in North America. They nest along sea coasts, inland lakes and major rivers. Breeding habitat includes large trees, primarily old white pines, in close proximity (less than one mile) to water where food is abundant and human disturbance is minimal. Population centers along the Atlantic coast include Maine and the Maritime provinces, the Chesapeake Bay area, and Florida, although populations



are expanding throughout the Northeast. Eastern coastal areas of Maine have been the stronghold for state eagle recovery, but in the last two decades, populations have expanded west along the coast and north to the interior to reoccupy historic nesting habitat. Bald eagles seek quiet waterfront habitats away from human activity, but a few pairs have demonstrated increasing tolerance and nest closer to humans.

Life History and Ecology

Bald eagles first breed at about five years of age and may establish lifelong pair bonds. The breeding season begins in February and lasts to September. Courtship involves various elaborate aerial displays, including locking talons in flight. Nests are often used for many years in succession, and sticks are added to the nest each year. Nests used for multiple years have grown to over 20 feet deep and have been estimated to weigh several tons. Some pairs may have several nests in their territory. Territory sizes vary widely depending on season, food availability, and habitat, but may be as small as 1-2 square miles in ideal conditions, such as in Cobscook Bay.

One to three eggs are laid 2-4 days apart in early March and April. The incubation period lasts about 35 days, and the female does most of the incubating. After hatching, the chicks remain confined to the nest for the next 11-13 weeks. At first they are closely brooded, but later become increasingly independent. Both parents forage for food to feed the chicks. Young eagles make their first flights (fledging) in late June-July and remain near the nest for an additional 5-10 weeks before dispersing. Most bald eagles that breed in Maine remain throughout

the winter. Juveniles may stay in Maine or wander as far south as South Carolina.

Diets of Maine eagles vary from 90 percent fish in freshwater habitats to 60 percent birds on coastal islands. Fish are their primary prey, although mammals and birds are also taken. In interior Maine, chain pickerel, brown bullheads, and white suckers comprise most of the diet. Along the coast, sculpins, alewives, eels, cormorants, eiders, and gulls are the primary prey items. Bald eagles can catch their own food, but they often steal food from other fish-eating birds. Eagles concentrate where food is seasonally abundant and accessible.

Winter habitat requirements are similar to those for breeding: large perch trees with easy flight access that offer good visibility and are near an abundant food source. More sheltered settings may be used as nocturnal roosts. In the wild, eagles probably live 15-20 years.

Threats

Bald eagles, once abundant in Maine, were nearly extirpated because of widespread use of environmental contaminants. DDT and other contaminants caused eggshell thinning and impaired reproductive success. Problems for eagles still persist: habitat loss, human disturbance at nest sites, environmental contamination (especially mercury and PCBs), diminished water quality, and human-caused deaths and injuries are still primary conservation problems.

Conservation and Management


In 1972, only 29 pairs of bald eagles remained in Maine when eagles were nearly extirpated from other parts of the Northeast. DDT was banned in 1972, and populations slowly rebounded thereafter. In 1978, the bald eagle was listed as a federal endangered species. Bald eagles responded favorably to reduced use of persistent chemical contaminants, protected nesting habitat, and numerous reintroduction projects. The bald eagle was reclassified to threatened on the federal list in 1995.

In Maine, recovery actions have included fostering eggs and chicks into failed nests; incorporating eagle concerns into environmental reviews; designating Essential Habitat through provisions of the Maine Endangered Species Act to protect nesting habitat; feeding wintering eagles to enhance survival of young birds; and rehabilitating injured birds. Research projects on eagle ecology, status, contaminants, survival, winter feeding, and habitat modeling were conducted by the University of Maine.

Today, annual management includes an aerial

survey of all nests and a subsequent visit to determine the number of young produced. In 2002, 290 pairs nested and produced 280 eaglets. The Maine population has been growing at a rate of about 8 percent a year. The breakdown of DDT is slow in Maine's cool climate and acidic soils, and its persistence has slowed population growth and recovery compared to other eastern populations. However, given the level of recovery achieved in Maine and throughout the United States, the bald eagle may soon be taken off state and federal lists. Management will continue to ensure that declines of the past are not repeated, and that habitat and a clean environment persist to promote population growth and expansion. Because of Essential Habitat designation, all projects or activities funded and carried out by municipalities and state agencies within ¼ mile of eagle nests are reviewed by MDIFW.

Recommendations:

- ✓ Review Essential Habitat maps and guidelines prior to development and forest harvesting near eagle nests. Consult with a biologist from MDIFW and the U.S. Fish and Wildlife Service to assist with planning.
- ✓ Protect habitat within a ¼-mile (1,320-foot) radius of eagle nests. Maintain areas within 330 feet of nests as sanctuaries. Do not modify the physical habitat (buildings, new roads or trails, timber harvest) unless approved by a state or federal wildlife biologist.
- ✓ Avoid exterior construction, land clearing, timber harvests, and major disturbances within 330-1,320 feet of the nest during the sensitive nesting season (February 1-August 31). Establish setbacks for new construction of roads, buildings, or waterfront development comparable to conditions with which local eagles currently coexist. Maintain foraging perches, roosts, potential nest trees, and flight corridors. Partial timber harvests are compatible if they buffer existing nests and provide a lasting supply of trees suitable for nesting eagles. Employ guidelines in *Living with Eagles* (handbook available from MDIFW, 41 SHS, Augusta, ME 04333).
- ✓ Municipalities should follow Shoreland Zoning and LURC standards and strive to maintain areas adjacent to eagle nests and adjacent waterways in a low-density, rural setting. Identify these areas in comprehensive plans, and consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Report eagle nest locations to MDIFW.
- ✓ Remain a safe distance from nesting eagles when boating or hiking. The threshold for disturbance varies among individuals, but is typically 660-1320 feet, and occasionally more. If the birds vocalize or fly in response to your presence, you are too close!
- ✓ Avoid applications of pesticides around nesting areas. 

**STATE
ENDANGERED**

Peregrine Falcon

(*Falco peregrinus*)



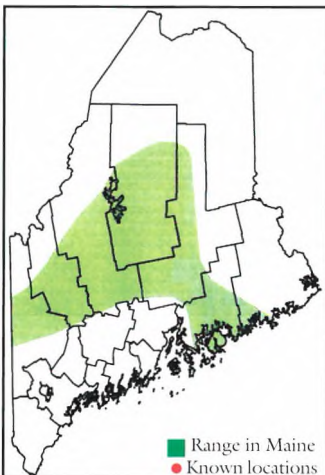
Ron Joseph

Description

The peregrine falcon is a sleek, rapid-flying bird of prey. Its wingspan measures 35-46 inches, body length ranges from 13-19 inches, and weight is 20-35 ounces. Females are about 30 percent larger than males; otherwise the sexes are similar in appearance. Adults have uniform blue-gray upperparts that extend as a “helmet” onto the head and face; light barring on the belly; white on the chest and throat; and a rufous wash on the lower chest and belly. The bold, distinct mustache mark is obvious on both adults and immatures. Immature birds have brown upperparts, heavy streaking on the underparts, and buff on the chest and throat. Wings are long and taper to a point. The tundra peregrine (subspecies *tundrius*), which typically is seen during migration in the East, is paler than the *anatum* subspecies. Maine’s reintroduced peregrines are a genetic blend of many subspecies and races from around the world and vary in plumage characteristics.

Range and Habitat

Peregrine falcons are found worldwide and breed on all continents except Antarctica. Although once broadly distributed in North America, they were extirpated throughout much of their historic range. Three subspecies occur in North America. *Falco peregrinus anatum* was native to



the East and bred in Maine. Breeding peregrines were reported in all mountainous and coastal headland regions of the state.

Breeding habitat requires cliffs for nesting and perching and an adequate prey base of small to medium-sized birds. Open water in proximity to cliffs may enhance foraging opportunities. Nests, or eyries, are located on ledges or overhangs that are inaccessible to mammalian predators and provide protection from the elements. More recently, peregrines have adapted to nesting on bridges and buildings in urban environments. Peregrines are coastal migrants. In September and October, many Canadian birds (*tundrius* and *anatum* subspecies from the North) are seen throughout Maine, particularly near offshore islands.

Life History and Ecology

Peregrine falcons generally reach sexual maturity at two years of age. They form permanent pair bonds and remain mated for life. Peregrines breeding in Maine return from wintering areas and establish territories in March or April. Courtship displays include high circling, undulating flights, and figure-eight flights. Both members of the pair engage in high circling and “flight play.”

The nest is a scrape or slight depression in gravel or debris on a cliff ledge. Eggs are laid at 2-3 day intervals, with completed clutches containing 3-4 eggs. Incubation begins with the laying of the last egg and lasts 30-36 days. Both sexes share incubation duties, although the female does the majority. Hatching in Maine occurs in May or early June. The young remain in the nest for about six weeks and fledge in late June or July. Fledglings remain at the nest through August. Both adults feed the young.

Peregrines attack and kill their prey in flight by a sharp blow from a vertical dive. Diving speeds have been estimated at 200 miles per hour. Primary prey items include shorebirds, seabirds, rock doves, and a variety of other small birds. Peregrines migrate in the fall, primarily to coastal areas in the Southeast or Central and South America. However, some adults breeding in the Northeast may remain year-round.

Threats

Shooting and collection of peregrines or their eggs were infrequently documented in Maine during the early 1900s. Increased use of pesticides after World War II, especially DDT, caused drastic declines in peregrine populations worldwide. Organochlorine compounds like DDE, a by-product of DDT, resulted in shell thinning, egg breakage, and reproductive failure. After peregrines were completely extirpated from the eastern United States by the early 1960s, DDT was banned in the U.S. in 1972. Although no longer used here, this chemical persists in our environment and is still used in South America where peregrines winter. Habitat is not limiting in Maine, where cliffs adjacent to large open areas are in good supply. Human disturbance (e.g., hiking and rock climbing) during the nesting season can cause nest failure.

Conservation and Management

There is little information on past populations of the eastern peregrine (subspecies *anatum*) in Maine. Only 16 eyries are referenced in the historic literature, but this likely is an underestimate. An eyrie occupied by peregrines during 1962 in Acadia National Park was among the last known active nests in the East.

Maine joined other states in a large-scale reintroduction program. Young, captive-reared peregrines were slowly released at former nest sites in a process called "hacking." A total of 144 birds were successfully released at eight different locations in Maine from 1984-1997. Peregrines began to nest in Maine in 1987. The first successful nesting of reestablished peregrines in Maine occurred in Oxford County. In 1988, the last site occupied by eastern peregrines in Acadia National Park was reoccupied. From 1988-2001, 5-8 pairs nested in the state at 13 different sites. Young have been produced at normal rates. The population dramatically increased to 15 pairs in 2002. Reintroduced peregrines have been successful in New Hampshire, Vermont, and New York, and undoubtedly young produced there have established eyries in Maine. With recovery of the species nationwide, the peregrine falcon was taken off the federal

endangered species list in 1999, but its breeding population remains listed as endangered on the Maine list, as its numbers here are still low.

Recommendations:

- ✓ Prior to land development near peregrine falcon eyries, consult with a biologist from MDIFW to assist with planning.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Prohibit climbing on the cliff and hiking near the cliff rim within ¼ mile of peregrine eyries during the March 15 to August 15 nesting season. Falcons are especially disturbed by nearby activity on the cliff or on trails that are line-of-sight from the nest or perches. (Where falcon nests are already established in proximity to humans, these recommendations can be relaxed, unless the birds show evidence of disturbance from human activity.)
- ✓ Maintain trail closures until five weeks after the last bird has fledged (usually late July to mid-August).
- ✓ Avoid construction of permanent roads within 660 feet of a known peregrine site.
- ✓ Avoid logging within ¼ mile of an active eyrie during the nesting season.
- ✓ Aircraft should not approach closer than 1,500 feet above a nest. Closer approaches may cause peregrines to attack planes or may cause a frantic departure from the nest. Falcons startled from the eyrie have been known to damage eggs or injure nestlings.
- ✓ Route powerlines and other wires away from eyries to avoid collisions and electrocution hazards.
- ✓ Avoid applications of pesticides around occupied eyries during the breeding season.
- ✓ Wetlands, especially intertidal mudflats, estuaries, and coastal marshes, are key feeding areas. Protect wetlands used regularly by peregrine falcons at any time of the year from filling, development, or other disturbances that could alter prey abundance and habitat quality.
- ✓ Maintain large trees and snags in areas where peregrines nest and feed. These perches are important for roosting and hunting. Leave snags and debris on mud flats for perching and roosting. 🐦

*STATE
ENDANGERED*

Sedge Wren

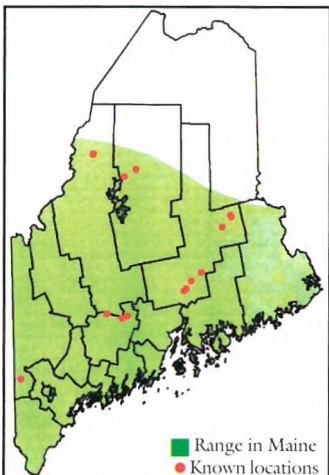
(Cistothorus platensis)

Description

The sedge wren is a small, brownish bird, roughly $3\frac{3}{4}$ inches long. The back and crown are brown with fine streaks of dark brown and tan. The breast, flanks, and underside of the tail are buff-colored. The wings and tail are brown with black barring. The chin, throat, and belly are white. The sedge wren has an indistinct whitish eyebrow and a short, thin bill. Although secretive and difficult to observe, the sedge wren is readily identified by its sharp, staccato trill (*chip chip chrrrrrrr*), which is given by the male wren while perched among tall grasses or sedges. Like other wrens, it tends to hold its short tail at an upward angle. The sedge wren is differentiated from the more common marsh wren by the buff color under the tail (the marsh wren's is white) and a streaked crown (the marsh wren's is uniformly brown).

Range and Habitat

The sedge wren is a will-of-the-wisp, sporadically breeding at only a handful of sites in Maine. It once bred here with greater regularity and even nested in "colonies" at some sites. The sedge wren is primarily a midwestern bird, found most commonly in the prairie states and provinces, and attains its greatest abundance in Minnesota, Wisconsin, North Dakota, and Manitoba. Lower densities occur west to Saskatchewan and parts of British Columbia, and south to northern Missouri. The species is less common in the eastern states and provinces. It is a rare breeder east to the Atlantic coast from New Jersey north to Maine. It also breeds in southern



Mark McCollough

Ontario and Michigan, and is a rare species along the St. Lawrence River in Quebec. This species winters in the southeastern United States.

The northeastern limit of the sedge wren's range is in Maine. It can occur almost statewide, but it is rare and distributed patchily throughout the state. In recent years, sedge wrens have been found in the towns of Smithfield, Winslow, Benton, Bangor, Old Town, Milford, Lee, Webster Plantation, and T5R18 WELS. However, these occurrences have not been consistent from year to year.

Sedge wrens breed in freshwater meadows dominated by grasses and sedges, and in grassy, upland borders of freshwater marshes dominated by sedges. Dense, tall growth forms of grasses and sedges (average $3\frac{1}{2}$ feet high), scattered shrubs 3- $6\frac{1}{2}$ feet high, and absence of standing water are often features associated with nesting habitat. Habitat patches can be fairly small, often less than 20 acres. Suitable nesting sites may be found in a small patch of wet sedge located in the midst of a large hayfield. Sedge wrens are somewhat fickle in selecting breeding sites, and a site that is used one year may not be used the next. They are very dependent on the water level at the nest site, preferring little if any standing water. Thus, amount of rainfall may determine whether a site will be suitable in a given year. Sedge wrens may be observed singing at a site in the spring, but will abandon the site later in the summer in favor of another breeding area.

Life History and Ecology

Sedge wrens have a unique, nomadic nesting chronology. In the spring, the population migrates into the interior U.S. and Canada for a first period of nesting in May and June. A second more widespread nesting occurs later in the summer (July-September). Nesting in the Northeast begins in June and can occur throughout late summer. The male establishes a territory of approximately ½ acre for courtship, nesting, and foraging. Territories may change in size and location throughout the season. Within a territory, the male constructs several nests, some of which are not used. Nests are built close to the ground, concealed amid vegetation, and attached to growing grass or sedge. Each nest is a hollow ball of grasses woven together with an opening on the side. The female adds a lining of grass, sedge, and feathers to the nest. Some male sedge wrens are monogamous, and others have more than one mate. When there are multiple females present, there is usually one “primary” female who lays her eggs earlier. She usually has better success fledging young than the other females. The typical clutch is seven eggs, which the female incubates for 12-14 days. The female provides most of the food and care of the young. Nestlings fly from the nest in 12-14 days. Feeding occurs primarily on the ground, and prey items are primarily insects. Fall migration begins in September or October.

Threats


Because nest locations vary each year and the breeding season lasts through the summer, it is extremely difficult to locate breeding sites. Because sedge wrens change sites so frequently, a large number of sites with suitable habitat are needed to ensure continued reproductive success of the species. Wetland loss, particularly of wet meadows, has decreased the amount of available breeding habitat, resulting in a decline in sedge wren populations throughout their range. Sedge and grass meadows, which are the preferred wetland type for sedge wrens, frequently have been drained and filled. In addition to habitat loss, sedge wrens are susceptible to burning, mowing, and grazing of grasses during the nesting season, when nestlings and fledglings may be harmed. During the winter and migration, populations can be greatly reduced by severe winter weather conditions. Grassland habitats have also been lost to vegetative succession and development throughout the Northeast, further decreasing the number of available breeding sites.

Since Colonial times, sedge wren populations have fluctuated dramatically because of human-induced changes in the landscape. Because of wetland loss, reforestation of farmlands, and a shift to high-intensity agriculture, sedge wren populations have declined throughout the region. The sedge wren was formerly a widespread breeder in Maine. Fifty pairs of sedge wrens were observed in Sunkhaze Meadow in Milford in 1934, but there were only seven pairs in 1941. In 1949, sedge wrens were found in breeding aggregations at approximately 21 locations in ten counties. In recent years, only individual singing males have been observed in five counties.

Conservation and Management

The sedge wren is listed as endangered in Maine because of low population size, a declining population trend, and a population distributed at a small number of sites. It is also listed as a species of management concern by the U.S. Fish and Wildlife Service. Conservation of potential breeding habitat is essential to the recovery of this species. Even small wet patches in the middle of hayfields and pastures can provide suitable breeding habitat. These areas should not be disturbed, especially during the breeding season. Protection of sedge meadows associated with streams may also help sedge wren populations, and simultaneously provide habitat for other wetland birds and the threatened Tomah mayfly.

Recommendations:

- ✓ Prior to land development or managing wetlands or wet pastures, consult with a biologist from MDIFW to assist with planning.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ When projects are proposed within 250 feet of wetlands providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Conserve a diversity of grassy wetlands throughout Maine to provide alternative nesting areas for sedge wrens.
- ✓ Avoid ditching or draining wet meadows. Maintain streams and associated sedge meadows in a natural state. Fluctuating water levels provide a range of breeding habitats.
- ✓ Avoid disturbing wet areas within hayfields and pastures, and exclude livestock from these areas, particularly during the breeding season (June 1-August 31). Any disturbance that must occur in these areas should be done after the young have successfully fledged and departed in September and October.
- ✓ Avoid or minimize herbicide and pesticide applications, or employ integrated pest management techniques.
- ✓ Avoid wetland crossings or use of heavy equipment in wetlands.
- ✓ Maintain moist grasslands with vegetation at least 8-12 inches high. Do not mow below this level.
- ✓ Use burning or mowing to prevent woody species from invading moist grasslands. Create a mosaic of burned and unburned areas that will provide nesting and feeding habitat for sedge wrens. Burn or mow only during the non-breeding season, in late fall and winter. 

STATE
ENDANGERED

American Pipit

(*Anthus rubescens*)



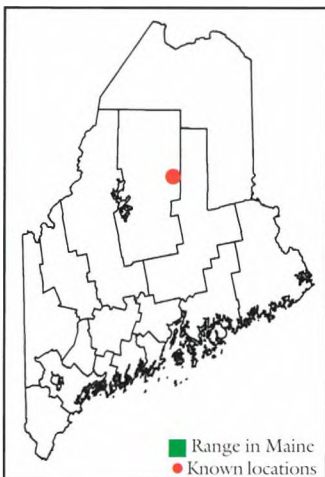
Mark McCollough

Description

Hikers who successfully climb Mt. Katahdin may share the summit with the American pipit, one of the few arctic birds that nest in Maine. American pipits are small birds (6-7 inches long), with males somewhat larger than females. Both sexes have similar coloring. The belly is buff-colored with brown streaking on the breast and flanks. The back is dark brown-gray. The throat and chin are white. Pipits have a dark cheek stripe, white eye ring, and white stripe over the eye. The wings are dusky brown with buffy edges. The tail feathers are dusky brown, and the outer tail feathers are white. The legs are dark, and the bill is slender. Male pipits emit a repeated *tjwee* call while displaying on their territories. This display involves a gradual upward flight, followed by a descent with the wings open and the tail raised. It frequently bobs its tail as it moves along the ground.

Range and Habitat

American pipits were formerly considered to be the same species as the water pipit (*Anthus spinoletta*), which occurs in Great Britain, Scandinavia, Europe, and Asia. The American pipit is now considered a separate species. American pipits breed throughout northern Canada including Labrador, around



Hudson Bay, the Northwest Territories and Yukon, and most of Alaska. Their range extends south in the Rocky Mountains to Colorado, with isolated populations in the mountains of California, Utah, Nevada, New Mexico, and Arizona. Isolated populations of American pipits also exist on a few exposed mountaintops in the Northeast: the Gaspé Peninsula in Quebec, Mt. Washington in New Hampshire, and Mt. Katahdin in Maine. It winters in the southern United States, Mexico, and northern Central America.

American pipits breed in arctic or alpine tundra habitats. They prefer grassy tundra in the North. In alpine areas they inhabit meadows of sedges, dwarf willows, and lichens. In the Northeast, there are few mountains with the appropriate plant communities. Mounts Washington and Katahdin are unique in this region because they have extensive alpine plateaus suitable as breeding habitat for pipits.

Life History and Ecology

The spring migration period in Maine is uncertain, although pipits probably return to Mt. Katahdin in May. Male pipits establish territories by singing, performing aggressive displays, and chasing each other. Pair formation can occur both during spring migration and on the breeding grounds. Nest building begins shortly after pair formation. The nest is constructed of grasses and sedges and is located on the ground, typically in wet and dry meadows, although rockfields and eroded banks are also used in other portions of the species' range. Nests are often hidden in tussocks of sedges, and often the nest is partially covered and protected by overhanging rock or vegetation. A clutch of 3-7 eggs is laid 1-3 days after the nest is completed. The

female incubates the clutch for 14 days before the eggs hatch. During incubation, the male brings food to the female. At hatching, chicks are born blind, covered in down, and helpless. Only the female broods the nestlings, but both parents feed the young. The young fledge in 14 days, and adults continue feeding them for an additional two weeks.

After family groups disperse, migratory flocks begin to form. The fall migration period is more prolonged than in spring, occurring from mid-September to late October, with some birds present in Maine into November and occasionally December. During migration, pipits forage in grassy fields, meadows, coastal beaches, marshes, mudflats, and along rivers. Their diet is primarily freshwater and terrestrial invertebrates supplemented with plant seeds during autumn and winter.

Threats


Maine's American pipits occur in one small population located on the talus slopes and tablelands of Mt. Katahdin in Baxter State Park. Breeding birds are affected when hikers walk off marked trails and disturb nesting pipits, crush unseen nests, and destroy the sedge vegetation that is crucial to the pipit's habitat. The tendency of hikers to walk off the trail is greatest when the trails are wet during spring and fall, a time when the vegetation is most susceptible to damage.

Conservation and Management

The American pipit is listed as endangered in Maine because of its small population and limited distribution. Only the breeding population is listed as endangered; migrating pipits are relatively common in the fall. The population on Mt. Katahdin has bred there since at least the 1930s, but possibly much longer. The public nature of this site makes detailed inventories of population size and nesting success difficult. Baxter Park rangers require that hikers stay off sensitive alpine vegetation, so annual counts are conducted from the trail system, but wind and poor weather often render these counts incomplete.

As yet, there are no specific management goals or plans for the American pipit. Because there are few potential habitats in Maine, management should be directed toward maintaining or enhancing the population on Mt. Katahdin. These objectives can be met primarily by protecting potential nest sites from human disturbance. The key to protecting the American pipit is educating hikers who climb Mt. Katahdin.

Recommendations:

✓ Stay on the trails when climbing Mt. Katahdin to avoid damaging the fragile alpine plant community. 

**STATE
ENDANGERED**

Grasshopper Sparrow

(*Ammodramus savannarum*)

Description

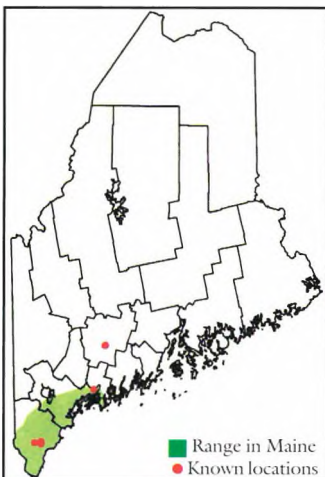
The future of the grasshopper sparrow is tied inextricably to the fate of large grasslands, a rare feature amid Maine's forest-dominated landscape. The grasshopper sparrow is a small, inconspicuous bird known for its buzzy, grasshopper-like song. This sparrow is five inches in length. It has a wingspan of about eight inches and a short, pointed tail. Its flat-topped head has a pale buffy-white central stripe. The unstreaked, cream-buff breast distinguishes it from other grassland sparrows. A yellow patch at the bend of each wing can be seen at close range. Its song is a high, hissing, insectlike buzz preceded by weak *tik* notes.

Range and Habitat

The grasshopper sparrow breeds in grasslands across the U.S., except in the Southwest. Maine is the northernmost extent of the breeding range in the East. Grasshopper sparrows only nest at four sites in southern and central Maine. Wintering areas are the southern U.S. and Central America.

This species requires grasslands of at least 30 acres and prefers fields greater than 100 acres. All breeding sites in Maine are greater than 200 acres. Preferred grasslands

have short, native bunch grasses, patches of bare ground, and scattered forbs and short shrubs. Fence posts provide perches. Patches of bare ground are important to allow adults and young to run to escape predators and search for insects. These habitat characteristics are most frequently found in glacial outwash plains dominated by sandy soils. Breeding sites in southern Maine include



MIDIFW

airports and intensively managed blueberry barrens. The Kennebunk Plains, at 600 acres, is one of Maine's largest grasslands. It supports 30-60 percent of the state's grasshopper sparrows, the largest population in the Northeast. Individual birds also have been observed in blueberry barrens in eastern Maine.

Life History and Ecology

Grasshopper sparrows first breed at one year of age. Males arrive at breeding areas in late May, 5-10 days before the females arrive. Males establish territories and display to prospective mates from perches on weed stalks, shrubs, or fence posts. Nest-building begins immediately following pair formation. A cup nest is built on the ground, usually at the base of a shrub or clump of grass. The nest is domed with overhanging grasses and has a side entrance. Females lay between 3-6 eggs, although 4-5 is typical. The female incubates the eggs for 11-13 days, after which she broods the chicks for about 9 days. Both parents share feeding duties.

After the young leave the nest, they remain concealed below the vegetation. Fledglings disperse from the nesting territory, but are still fed by the female for an additional 4-19 days. Adults may produce two broods during the breeding season, which lasts from May through the second week of August.

The grasshopper sparrow forages exclusively on the ground. During the breeding period, insects, primarily

grasshoppers, make up most of the diet. Seeds of various grasses and weeds comprise the remainder. Fall migration begins in mid or late August and continues through September.

Threats


Grasshopper sparrows were once common in New England; however, because of habitat loss and fragmentation, they now breed only at a few scattered locations in the Northeast, mostly at airports, military bases, large blueberry barrens, and a few remnant sandplain grasslands. In the past 100 years, there has been a decline in the quantity and quality of grasslands for wildlife. Maine agricultural lands have diminished from 33 percent of the landscape to 6 percent as farmland has reverted to forests or been converted to residential and commercial development or gravel pits. In the Northeast, hayfields were traditionally not harvested until late summer and so provided ideal habitat for birds throughout the breeding season. Today, most hayfields are mowed earlier and more frequently, or are planted to crops. Pastures can be suitable habitat for grassland birds unless they are subject to heavy grazing. Extensive row crops or fields uniformly covered with mat-forming grasses are not suitable. Some agricultural herbicides and pesticides negatively affect grassland bird habitat or their insect food.

Conservation and Management

The grasshopper sparrow was listed as endangered in Maine in 1986 because of small populations, declining habitat, and limited distribution in the state. At the peak of agricultural development, it was common in many large hayfields and pastures of southern and central Maine. After 1950, declining agriculture and increasing reforestation resulted in widespread loss of suitable breeding habitat. Since 1983, 50-80 territorial males have occurred annually at just four breeding sites in York and Cumberland Counties. Intensive site management, including prescribed burning, mowing, and curtailment of herbicide spraying, has been necessary to retain populations at Brunswick Naval Air Station, Kennebunk Plains, Sanford Municipal Airport, and the Wells Barrens. The continued existence of this species depends on maintaining large grassland communities. Additional research is needed to document populations, productivity, and limiting factors in different habitats and to assess management techniques. Reclamation of large sand or gravel pits with proper vegetation management may create suitable habitats. Grasshopper sparrow nests, eggs, and fledglings are strictly protected by the Maine Endangered Species Act.

The grasshopper sparrow shares its habitat with many other rare and declining bird species, such as the upland sandpiper (threatened), vesper sparrow, horned lark, killdeer, bobolink, meadowlark, northern harrier, and savannah sparrow. All these species are reliant on grasslands but are declining in the Northeast. Conservation of the grasshopper sparrow depends on protecting, maintaining, or enhancing the remaining grassland areas of the state, particularly fields greater than 100 acres.

Recommendations:

- ✓ Prior to land development or managing grasslands and barrens, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain important grasslands and barrens identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Maintain known nesting areas in native grasses, little bluestem, or low-growing shrubs like lowbush blueberry and do not develop or convert them to other land uses.
- ✓ When managing grasslands, employ best management practices using guidelines in Massachusetts Audubon Society's *Conserving Grassland Birds* publications (www.massaudubon.org).
- ✓ Avoid mowing nesting areas between May 1 and August 5. If mowing is necessary prior to early August, mark nest sites or locations of young birds and leave patches of unmowed grass or low-growing shrubs. Raise the mowing bar to greater than six inches to prevent destruction of nests and young birds.
- ✓ Keep grazing animals off known nesting fields during the critical nesting period (May 1 to August 5).
- ✓ Maintain approximately 40 percent of the vegetation cover at a height of 8-12 inches, with minimal litter and grass cover. Maintain some patches of bare ground, scattered tall forbs (8-25 inches), and short shrubs for song perches.
- ✓ Manage multiple, contiguous fields to provide a mosaic of grassland types by mowing, burning, or late-season grazing. Mow every 2-5 years to inhibit establishment of shrubs and trees.
- ✓ Burn fields every 5-10 years after September 1 or before May 1. Do not burn more than 50 percent of a grassland within a year.
- ✓ Avoid or minimize herbicide and pesticide applications, or employ integrated pest management techniques.
- ✓ Limit commercial gravel and sand mining in grasslands and blueberry barrens. Restore old gravel pits and agricultural fields to grasslands and low shrubs. 

**STATE
THREATENED**

Spotted Turtle

(Clemmys guttata)



Mark McCollough

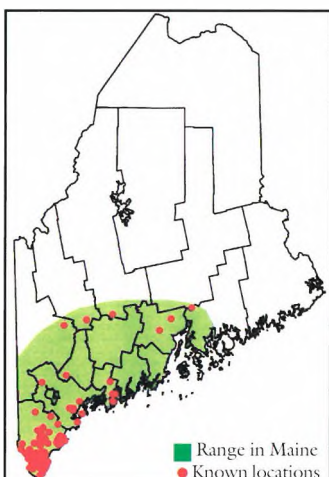
Description

Many consider the spotted turtle to be Maine's most attractive turtle. It shares its yellow-polka-dotted motif with the spotted salamander, which shares many of the same vernal pools. The spotted turtle is the only turtle in Maine with distinct yellow spots on a smooth, low, black carapace (upper shell). The skin on the head, limbs, and tail is gray to black and is also patterned with yellow spots. The undersurface of the limbs may be orange, pink, or salmon-red. The plastron (lower shell) is yellow or yellow-orange and patterned with black blotches on each scute (shell segment). These small turtles are only 4-5½ inches long. The male has a concave plastron, tan chin, brown eyes, and long, thick tail, whereas the female has a convex or flat plastron, yellow chin, orange eyes, and shorter tail.

Range and Habitat

This species occurs in the northern tier of states from Michigan to Maine and down the eastern seaboard to Florida. Maine is at the northern edge of its range. Populations in York and Cumberland Counties are contiguous with those in New Hampshire, but separate populations occur along the coast and interior central Maine as far north as Farmington and the Bangor area.

In Maine, spotted turtles are most frequently associated with complexes of small, acidic wetlands and vernal pools located in large, intact forested landscapes. They also use small streams, shrub swamps, wet meadows, bogs, and forested swamps. Although these turtles spend most of their time in the water, they readily travel overland



between wetlands during spring and summer. Upland habitats are critical for nesting, basking, estivating (a period of late summer dormancy), and as travel corridors for movements between isolated wetlands.

Life History and Ecology

Spotted turtle life history and movements are documented from radio-telemetry studies conducted throughout the species' range, including a study in southern Maine in the 1990s. Turtles emerge from hibernation in April and disperse to vernal pools and other wetlands used by breeding frogs and salamanders. The turtles eat amphibian eggs and larvae (tadpoles). This abundant food supply is critical to the survival of turtles because they likely consume much of their annual food needs in May and June. Most wetlands used are less than ¼ acre in size. Spotted turtles in Maine travel an average of ¾ mile annually and use up to three different wetlands. They attain sexual maturity at 7-10 years of age.

Mating occurs from March to May. During June, females leave the wetlands and travel up to ½ mile to a sunny site with sandy soils to lay a clutch of 3-7 eggs. Spotted turtles occasionally nest in natural forest openings, exposed bedrock areas, or sedge hummocks in swamps, but are frequently attracted to yards, pastures, gravel pits, and road edges. Nests are often concentrated in human-created habitats where nest loss may be high from predators or road grading. Incubation time depends on soil temperature, but typically lasts 88-125 days, and hatching occurs in September and October. Eggs may not hatch in cold, wet summers.

Hatchlings probably overwinter in nearby wetlands, but little is known of their habitat use and movements until they become adults. Adults bask on sphagnum mats, logs, brushpiles, hummocks, rocks, and wetland shores. As vernal pools dry and food supplies diminish, adults may estivate for 15-90 days in upland habitats in late summer. During estivation, they burrow into forest leaf litter within 260 feet of the nearest wetland.

With the coming of fall rains, spotted turtles move to wetlands for hibernation, typically using sites at vernal pools, under root hummocks in red maple swamps, or along undercut banks of small streams. They sometimes hibernate communally. Feeding begins in early spring as the ice thaws. Food items include amphibian eggs and larvae, worms, mollusks, and aquatic insects.

Threats

Turtles have evolved a strategy of long life expectancy (greater than 30 years for spotted turtles) to offset a late age at first reproduction and high nest mortality. Because of this unusual life history, spotted turtle populations occur at low densities (only about 21 turtles per square mile in Maine), and are extremely vulnerable to any source of adult mortality. Road mortality and collecting for pets reduce populations, and the loss of just a few individuals every year can lead to the long-term decline and extinction of a population. Habitat fragmentation and sprawl also threaten spotted turtles. Fragmentation isolates populations and greatly increases their risk of extinction. Roads result in mortality, separate wetlands from nesting sites, and act as barriers to movement. The sunny, gravel shoulders of roads attract nesting turtles. Roadside turtle nests are easily found by predators and graded by highway crews. Collecting spotted turtles for pets is illegal and negatively affects populations by removing valuable breeding adults. Secondary effects of human development – increased predator populations (e.g., dogs, skunks, raccoons), pollution, filling of small wetlands, and blocking upland travel corridors – also limit populations.

Conservation and Management


The spotted turtle was state-listed as threatened in 1986. Surveys of over 2500 wetlands conducted in Maine in the 1990s documented spotted turtles at about 100 new sites. It is believed that only a few thousand spotted turtles occur in the state in a highly fragmented landscape.

Recovery of this species entails identification and conservation of the largest populations and protection of large blocks of open space. Spotted and Blanding's turtles (endangered) overlap greatly in range and have similar conservation needs. They share their habitat with other rare species like the ringed boghaunter dragonfly, ribbon snake, and four-toed salamander. Rare turtle populations documented in York, South Berwick, Biddeford, Wells, Alfred, and Lyman have the greatest conservation potential, while smaller, peripheral populations isolated by physical barriers, like interstate highways and urban areas, may be in greater jeopardy of local extinction. Towns with spotted and Blanding's turtles should consult with MDIFW to develop strategies for conserving their remaining large blocks of forestland, and associated wetlands, as rural open space where further fragmentation, development, and road building should be discouraged. Spotted turtles are protected from collecting, possessing, or killing by the MESA.

Recommendations:

✓ Prior to land development or forest harvesting, consult

with a biologist from MDIFW to assist with planning.

- ✓ Conserve vernal pools, wetland complexes, and associated upland forest within ¼ mile of known occurrences of Blanding's and spotted turtles from further development and fragmentation.
- ✓ Municipalities should strive to maintain important Blanding's and spotted turtle habitats in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting wetlands and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Permit no activities that could lead to the loss or degradation of wetlands, including filling, dredging, sedimentation, or changing hydrology, unless approved by MDIFW.
- ✓ When projects are proposed within 250 feet of wetlands providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Road kill is the major source of adult mortality for all of the state's rare turtles. Avoid new roads and road improvement projects (e.g., paving, widening) that could lead to increased traffic volume and speed within ¼ mile of known turtle wetlands. All road projects should undergo thorough environmental review to avoid, minimize, and mitigate road mortality to endangered turtles.
- ✓ Avoid intensive development that concentrates human activity and road traffic within ¼ mile of turtle wetlands. Minimize the footprint of yards, buildings, and roads within this area to minimize loss of upland habitat and sources of mortality. Employ *Best Development Practices for Conserving Pool-breeding Amphibians in Residential and Commercial Development in the Northeastern U.S.* (handbook available from Maine Audubon, P.O. Box 6009, Falmouth, ME 04105).
- ✓ Low intensity timber harvesting (single tree, group selection, small patch cuts) is compatible as long as operators avoid wetlands. Winter harvests are recommended to avoid crushing turtles and minimizing impacts to the forest floor habitat used by amphibian prey species. Employ *Forestry Habitat Management Guidelines for Vernal Pool Wildlife in Maine* for timber harvesting around vernal pools and pocket swamps (handbook available from MDIFW, SHS #41, Augusta, ME 04333). 

STATE
ENDANGERED

Blanding's Turtle

(*Emydoidea blandingii*)



Susan Woodward

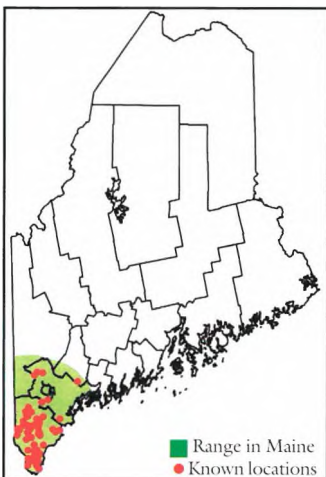
Description

This secretive denizen of southern Maine vernal pools and pocket swamps is rarely seen. With its helmet-shaped carapace (upper shell) and hinged plastron (bottom shell), the Blanding's turtle may be mistaken for a box turtle by the casual observer. The Blanding's turtle is 7-9 inches long and distinguished by a black or dark-olive carapace usually patterned with tan or yellow spots or streaks. The head is large with a notched upper jaw and a long, bright yellow neck, throat, and chin. The plastron varies from yellow with dark blotches to almost completely black, and has a moveable hinge used to partially close the shell. Males have a darkly pigmented upper jaw and concave plastron, whereas females have a yellow upper jaw and a flat plastron.

Range and Habitat

Blanding's turtles occur in the northern tier of states from Minnesota to Maine, but the range is not contiguous and there are several separate populations. Maine's population occurs only in southern York and Cumberland Counties and is linked with those in eastern New Hampshire and Massachusetts. Small, isolated populations also occur in Nova Scotia and New York.

In Maine, Blanding's turtles are found most frequently in complexes of small, acidic wetlands and vernal pools located in large blocks (over 500 acres) of forested habitat. They are occasionally found in large marshes, forested and shrub swamps, and slow-moving rivers and streams. Although these turtles spend most of their



time in the water, they readily travel overland from one wetland to another during spring and summer. Upland habitats are critical for nesting, basking, estivating (a period of late summer dormancy), and as travel corridors for migrating between isolated wetlands.

Life History and Ecology

Knowledge of Blanding's turtle life history and movements comes from radio-telemetry studies conducted throughout its range, including one study in southern Maine in the 1990s. Turtles emerge from hibernation in April and disperse to vernal pools and other wetlands used by breeding frogs and salamanders. The turtles eat amphibian eggs and larvae (tadpoles). This abundant food supply is crucial to the survival of turtles because they likely consume much of their annual food needs in May and June. Blanding's turtles readily travel overland (up to 1¼ miles) between wetlands and use up to six different wetlands per season. Most wetlands used are less than ¼ acre in size.

Female turtles reach sexual maturity at 14-20 years of age. Mating occurs from May to July. Nesting usually occurs in mid-June when females move up to one mile from wetlands to search for exposed sunny locations and sandy soils. Prior to human alteration of the landscape, turtles selected forest openings or exposed bedrock areas to nest. Now, most nest in yards, pastures, and along road edges. During nesting excursions, females may remain out of wetlands for 3-17 days. Nest digging is initiated in the evening and completed after dark, and clutches include 5-11 eggs. Nest predation varies, but is usually high and can be 100 percent for some populations in some years. Incubation time is dependent on soil temperature, but typically lasts 68-118 days, and hatching occurs from late August to October. Hatchlings likely overwinter in nearby wetlands.

Turtles bask on sphagnum mats, logs, brush piles, hummocks, rocks, and wetland shores up to 120 feet from the wetland. As vernal pools dry and food supplies dimin-

ish, turtles may estivate for periods of 3-22 days in July to September. Estivation sites are typically under leaf litter in forested areas up to 300 feet from the nearest wetland.

With the coming of fall rains, turtles move to hibernation wetlands, typically vernal pools and shrub swamps. Turtles may hibernate under 1-3 feet of water on the bottom of pools, either partially or completely covered with mud or leaves, slowing their metabolism so much that they need little oxygen. Feeding begins in early spring after water temperatures rise to 60 degrees. Food items include snails, fingernail clams, crayfish, frogs, fish, insects, worms, tadpoles, and plant material. Blanding's turtles may live to be more than 75 years old.

Threats

Turtles have evolved a strategy of long life expectancy to offset a late age at first reproduction and high nest mortality. Because of this unusual life history, Blanding's turtle populations occur at low densities (only about five turtles per square mile in Maine), and they are vulnerable to any source of adult mortality. It takes decades of reproductive effort before a female turtle replaces herself with a single offspring that survives to adulthood. The loss of just a few adults a year (e.g., killed on roads or collected for pets) leads to the long-term decline and extinction of a population.

Habitat fragmentation and sprawl also threaten Blanding's turtles. Fragmentation isolates populations and increases the risk of extinction. Roads cause direct mortality, separate wetlands from nesting sites, and serve as barriers to movement between wetlands. Turtles are attracted to the sunny gravel shoulder of roads for nesting. Roadside turtle nests are easily found by predators and are graded by highway crews. Collecting for pets is illegal and negatively affects local populations by removing valuable breeding adults. Secondary effects of human development – increased predator populations (e.g., dogs, skunks, raccoons), pollution, filling of small wetlands, and blocking upland travel corridors – also limit populations.


Conservation and Management

The Blanding's turtle was a former candidate for federal listing and was state-listed as threatened in 1986. Extensive surveys conducted in the 1990s demonstrated that fewer than 1000 individuals likely occur in southern Maine in a highly fragmented landscape. As a result, the species' status was upgraded to endangered in 1997.

Effective conservation entails identification and conservation of the largest populations and the remaining large blocks of habitat. Blanding's turtles often share their habitat with other rare species like spotted turtles, the ringed boghaunter dragonfly, ribbon snake, and four-toed salamander. Rare turtle populations documented in York, South Berwick, Biddeford, Wells, Alfred, and Lyman have the greatest conservation potential, while smaller, peripheral populations isolated by physical barriers (e.g., Interstate 95) may be in greater jeopardy of local extinction. Towns with Blanding's turtles should consult with MDIFW to identify opportunities to conserve large blocks of

forestland with vernal pools and wetland complexes as rural open space where further fragmentation, development, and road-building should be discouraged. Blanding's turtles are protected from collecting, possession, or killing by the MESA.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW to assist with planning.
- ✓ Conserve vernal pools, wetland complexes, and associated upland forest within ¼ mile of known occurrences of Blanding's and spotted turtles from further development and fragmentation.
- ✓ Municipalities should strive to maintain important Blanding's and spotted turtle habitats in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting wetlands and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Permit no activities that could lead to the loss or degradation of wetlands, including filling, dredging, sedimentation, or changing hydrology, unless approved by MDIFW.
- ✓ When projects are proposed within 250 feet of wetlands providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Road kill is the major source of adult mortality for all of the state's rare turtles. Avoid new roads and road improvement projects (e.g., paving, widening) that could lead to increased traffic volume and speed within ¼ mile of known turtle wetlands. All road projects should undergo thorough environmental review to avoid, minimize, and mitigate road mortality to endangered turtles.
- ✓ Avoid intensive development that concentrates human activity and road traffic within ¼ mile of turtle wetlands. Minimize the footprint of yards, buildings, and roads within this area to minimize loss of upland habitat and sources of mortality. Employ *Best Development Practices for Conserving Pool-breeding Amphibians in Residential and Commercial Development in the Northeastern U.S.* (handbook available from Maine Audubon, P.O. Box 6009, Falmouth, ME 04105).
- ✓ Low intensity timber harvesting (single tree, group selection, small patch cuts) is compatible as long as operators avoid wetlands. Winter harvests are recommended to avoid crushing turtles and minimizing impacts to the forest floor habitat used by amphibian prey species. Employ *Forestry Habitat Management Guidelines for Vernal Pool Wildlife in Maine* for timber harvesting around vernal pools and pocket swamps (handbook available from MDIFW, SHS #41, Augusta, ME 04333). 

**STATE
ENDANGERED**

Box Turtle

(Terrapene carolina)



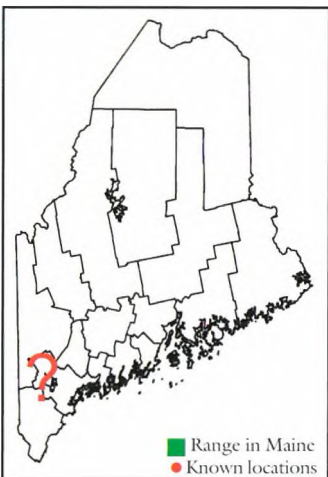
Phillip deMaynadier

Description

Box turtles are well-known for their remarkable ability to seal themselves tightly in their shell during times of danger. The box turtle is distinguished by a brownish carapace (upper shell). Each scute (segment of the shell) has yellow or orange radiating lines, spots, or blotches. The legs and neck have black to reddish-brown skin with yellow, red, or orange spots and streaks. The plastron (lower shell) is tan to dark brown. The box turtle's most distinctive feature is a hinged plastron, allowing the animal to withdraw its legs and head entirely within a tightly closed shell. Males have red eyes, a concave plastron, a thick tail, and long, curved claws on the hind feet. Females have yellowish-brown eyes; a flat or slightly convex plastron; a carapace that is more domed than the male's; short, slender, straighter claws on the hind feet; and a shorter, thinner tail.

Range and Habitat

The box turtle occurs throughout the eastern U.S. but reaches the northern extent of its range in southern Maine. This is undoubtedly the state's rarest reptile, and it has probably never been common here. Box turtles are locally common, but declining elsewhere throughout their range. No populations have been documented recently in Maine, but, if present,



would most likely occur in the southwestern part of the state. A few individual box turtles have been found in the last 20 years as far north as New Vinyard in Franklin County and Hermon in Penobscot County, although these may have been released pets.

Box turtles are the most terrestrial turtle in the state. They prefer moist woodlands and wet, brushy fields, especially where sandy soils are prevalent. Box turtles occasionally are found in meadows, bogs, and marshes.

Life History and Ecology

Box turtles emerge from hibernation in late April or early May following the first warm spring rains. They attain sexual maturity at 5-10 years old. Once they reach maturity, they mate anytime during the spring and summer, and females may produce fertile eggs for 2-4 years as a result of a single mating. In Maine, nesting likely occurs in June. Nest sites are typically patches of sandy or loamy soil with adequate solar exposure. Most nests are started in the evening and completed after dark. The female uses her back legs to dig the egg chamber and lays a clutch of 4-5 eggs. Incubation time is dependent on soil temperature, but typically lasts 70-90 days. Hatchlings emerge from September into October. They feed on land or in water and are omnivorous. Food items include snails, crayfish, insects, frogs, salamanders, fungi, flowers, and fruits.

Box turtles seek favorably sunny areas to warm themselves in morning and evening, and seek shelter under rotting logs, decaying leaves, or in shallow pools to escape the midday heat. They enter hibernation at about the time of the first killing frosts, and dig burrows into loose soil, sand, vegetative

debris, or mud of ponds or streams, or they may use mammal burrows. As the soil temperature drops, they dig deeper. Hibernation sites are located within their home range and may be used in successive years. They usually have a home range of 2-4 acres or an area of activity 300-700 yards in diameter. They may live more than 100 years.

Threats


Box turtle populations are declining in New England. Habitat loss and fragmentation stress populations by increasing adult mortality and nest predation. Predators (skunks, foxes, and other mammals), present at high densities in urban areas, dig up nests and consume eggs and young. Humans have a profound effect on box turtle populations. Slow-moving turtles are vulnerable to road mortality. They are popular in the pet trade, and commercial collection is a serious problem. Tens of thousands have been collected in the U.S. to be sold in foreign countries. Thousands have died during shipping or shortly after being taken into captivity. As an endangered species, it is illegal to collect box turtles from the wild or to possess any box turtle in Maine as a pet, even if purchased outside of the state. Pet turtles released in Maine may introduce diseases and critically alter the genetic make-up of native populations uniquely adapted to a northern existence.

Box turtles are likely stressed by colder temperatures at the northern edge of their range. During wet, cool summers, nests may not hatch. Deep frosts in winter may kill hibernating turtles; however, biologists have documented that box turtles at the northern edge of their range can withstand short periods of body freezing.

Conservation and Management

The box turtle was listed as endangered in Maine in 1986 because of its critically small population, stresses from living at the northern edge of its range, and threats to the population from habitat fragmentation and increased urbanization. No viable populations of box turtles have been discovered recently in the state, despite considerable effort to locate rare and endangered species in southern Maine. Focused surveys should be completed in some areas of southern Maine where large blocks of suitable habitat and populations may still persist. Reintroduction techniques have not been developed. Towns with box turtle occurrences should protect remaining areas of open space in a forested, rural environment.

Recommendations:

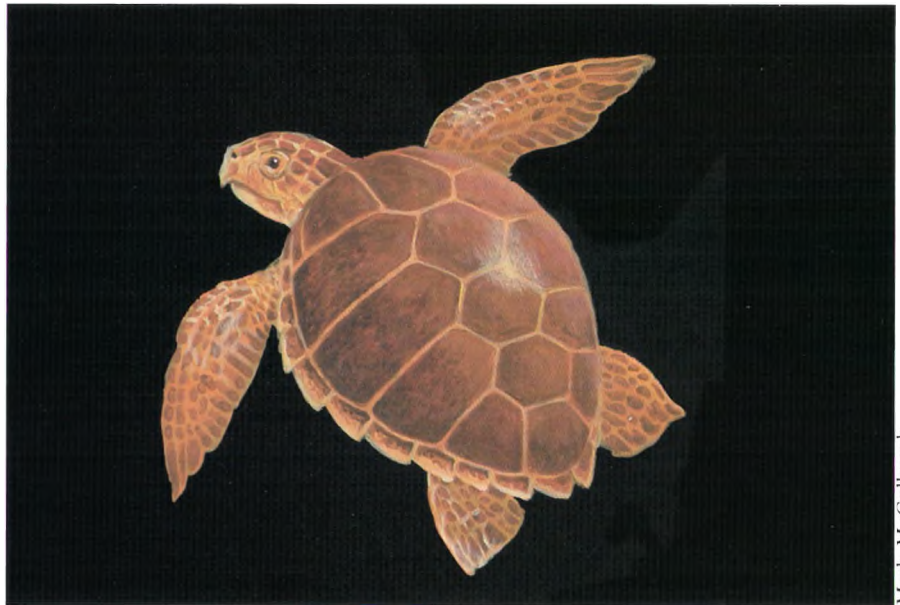
- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain important habitat areas identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Minimize potential sources of mortality where box turtles are known to occur. Heavy machinery for construction, landscaping, plowing, or forestry should be used during the winter months when turtles are hibernating.
- ✓ Avoid constructing new roads in the remaining large blocks of open space in southern Maine. Road kill is the major source of adult mortality for all of the state's rare turtles. 

**STATE
THREATENED**

**FEDERALLY
THREATENED**

Loggerhead

(*Caretta caretta*)



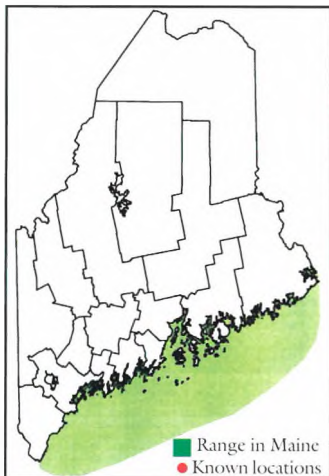
Mark McCollough

Description

The loggerhead is the second largest sea turtle, exceeded in length and weight only by the leatherback. Adults are typically 2-3 feet in carapace length and weigh about 300 pounds. The carapace (top shell) is reddish brown and may be tinged with olive, and the edges of the scutes (hard bony shell plates) may be yellow. The plastron (bottom shell) is yellow and hingeless, with two longitudinal ridges that disappear with age. The head varies in color from reddish or yellow-chestnut to olive-brown, and many scales have yellow borders. Skin on the limbs and tail is dark above and yellowish along the borders and below. Males are distinguished by their wider shells that taper toward the rear, a long, thick tail, a large recurved claw on each forelimb, and more yellow pigmentation on the head.

Range and Habitat

Loggerheads are widely distributed through most of the world's warm oceans. In the western Atlantic they range northward in the summer as far as Newfoundland, although sightings in the Gulf of Maine are rare. Loggerheads wander widely throughout their range and are found in both inshore and pelagic habitats. Hatchling turtles use driftlines of *Sargassum* (or sea grass) for refuge and food. Subadults use



shallow coastal regions. Along the northern limits of their range they can become cold-stunned and may die from hypothermia. Primary nesting areas in North America are South Carolina, Georgia, and Florida.

Life History and Ecology

Loggerheads attain sexual maturity at 10-30 years of age and may reproduce for an additional 30 years. In Atlantic waters, nesting may occur from January to September, although peak nesting months are May through July. Adults travel long distances from feeding areas to nesting beaches. Females typically return to nest at 1-7 year intervals at the same beach. Nests are constructed on beaches above the high-tide line typically within 4-5 hours of sunset. The female excavates a nest chamber using her flippers and deposits 45-200 soft, leathery eggs, then buries them and returns to the water. A female may lay up to nine clutches a season separated by intervals of 11-15 days. Incubation lasts 49-76 days. Hatchlings emerge at night and crawl across the beach to the sea.

Loggerheads are omnivorous and prey items include sponges, jellyfish, squid, shrimp, amphipods, sea urchins, and fish. Behavior is affected by water temperature. At temperatures of 13-15°C they become lethargic, at 10°C they adopt a stunned floating posture, and at colder temperatures they may hibernate. When cool they bask on the water surface, and when overheated they seek out cooler waters. Loggerheads may live to be over 60 years old.

Threats

Sea turtles face many natural obstacles to their

survival. Predators such as raccoons, ants, and crabs consume eggs in the nest. Hatchlings are eaten by fish, seabirds, and a host of other marine predators. Like other turtle populations, high loss of young is balanced by the longevity of adults. Any additional sources of mortality can cause population declines. The decline of the loggerhead turtle is attributed to increased mortality in shrimp trawls, coastal development, disturbance of nesting females, pollution and marine litter, and increased nest predation. Lights from coastal development discourage nesting adults and disorient hatchlings. New research suggests that a disease now killing many sea turtles (fibropapillomas) may be linked to pollution in the oceans and in nearshore waters. Oil spills, urban runoff of chemicals, fertilizers, and petroleum all contribute to water pollution. Discarded plastic bags and wrappers, helium balloons, and monofilament fishing line that end up in the ocean can also be deadly to sea turtles, as well as to other marine life. Balloons and plastic bags, when floating in water, resemble jellyfish. When turtles mistakenly eat these items or fishing line, their digestive systems become blocked and they eventually die.

Conservation and Management

Loggerhead populations are declining worldwide, but they are still the most abundant marine turtle in U.S. coastal waters. About 50,000-70,000 nesting females occur in the southeastern U.S. The species was federally listed as threatened in 1978. Before protective measures were implemented in the 1970s, 5,000-15,000 turtles (primarily juveniles) drowned annually in shrimp nets in the southeastern United States.

From 1986-1997, the loggerhead was state-listed as threatened in Maine because of its federal listing status. In 1996, the Maine Legislature changed the Maine Endangered Species Act to discontinue the automatic state-listing of federally-listed species. However, because of an oversight, the loggerhead was the only marine turtle retained on the state list.

Recommendations:

The Maine Department of Marine Resources has lead management authority for marine turtles, including the loggerhead, and makes the following recommendations.

- ✓ Loggerheads are rarely encountered in the Gulf of Maine; however, specially designed gear and frequent tending of traps and nets may help to prevent deaths from entanglement.
- ✓ Enforce national and international laws to minimize the dumping of pollutants and solid waste

into the ocean and nearshore waters. Prohibit overboard discharge of waste in Gulf of Maine waters.

- ✓ Avoid use of balloons, especially in coastal areas. The National Wildlife Federation, Center for Marine Conservation, and other marine conservation groups discourage the use of helium-inflated balloons because they may drift into marine waters and become a hazard to marine wildlife when ingested. More information on the hazards of plastics in the marine environment to marine turtles and whales can be found at www.pacificwhale.org/childrens/fsdebris.html.
- ✓ Include in Gulf of Maine marine oil spill contingency plans strategies for rehabilitating oiled marine turtles, especially in late summer.
- ✓ Develop protocols for rescuing and resuscitating cold-stunned sea turtles.
- ✓ To reduce adult mortality in Southeast and Gulf of Mexico fisheries, encourage use of turtle excluder devices (TEDs) and gill net regulations. 🐢

**FEDERALLY
ENDANGERED**

Atlantic Ridley

(*Lepidochelys kempii*)



Mark McCollough

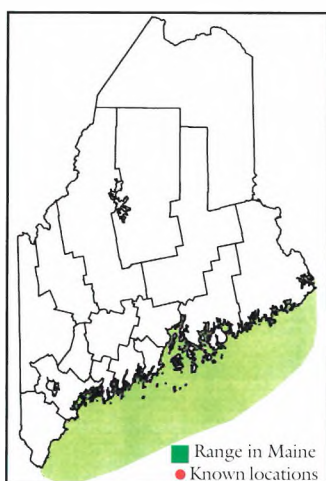
Description

The Atlantic or Kemp's ridley turtle is a small marine turtle about 20-28 inches in length. The adult has an almost circular or slightly heart-shaped grayish-green carapace (top shell) that is typically wider than long, and serrated along the rear margin. The plastron (bottom shell) is white, and the head and limbs are gray. The beak is parrot-like and the paddle-like limbs are used for swimming. The male has a long tail, a thick, curved claw on each forelimb, and a concave plastron. The female has a short tail that barely extends past the edge of the carapace and lacks recurved claws on the forelimbs.

Range and Habitat

Adult ridleys are primarily restricted to the Gulf of Mexico. Immatures range from the Gulf of Mexico north to Long Island Sound, New England, and Nova Scotia. In late summer and fall, juveniles are frequently seen south of Cape Cod. North of the Cape, Atlantic ridleys often become cold-stunned

and hypothermic, especially in the fall. They are rarely reported in the cold waters of the Gulf of Maine. They frequently feed on the bottom in shallow coastal and estuarine areas (typically less than 150 feet in depth). Juveniles may use mats of *Sargassum* or sea-grass for hiding and foraging.



Life History and Ecology

Atlantic ridleys may attain sexual maturity at 7-15 years. Most nesting occurs along beaches of the Gulf of Mexico from April to July. Courtship and mating occur offshore in close proximity to nesting beaches. Most females return annually or every other year to nest. Females nest in groups, which once numbered in the thousands. One to four clutches are laid each nesting season at 20- to 28-day intervals. Females lay successive clutches on beaches within five miles of their previous nest. Nests are excavated in fine sand, either on the beach or on the dunes up to 180 feet from water. Clutch size varies from 100 to 110 eggs. Females bury the eggs and leave them to incubate on their own for 45-60 days. Following nesting, adults migrate to their principal feeding areas in the Gulf of Mexico, where they remain until the following nesting cycle. Juveniles travel as far north as the marine waters off the New England coast. Prey items include crabs, shrimp, sea urchins, snails, bivalves, squid, jellyfish, fish, marine plants, and algae.

Threats

Sea turtles face many natural obstacles to their survival. Predators such as raccoons, ants, and crabs consume eggs in the nest. Hatchlings are eaten by fish, seabirds, and a host of other marine predators. Like other turtle populations, high loss of young is balanced by the longevity of adults, which can reach at least 20 years in captivity, but probably much longer in the wild. Any additional sources of mortality can cause population declines. The decline of the Atlantic ridley is attributed to heavy harvest of eggs, killing adults for meat and other products, and high level of accidental capture by shrimp trawlers.

Degradation of beach habitat, dredging and channelization projects, boat collisions, oil spills, and entanglement in and ingestion of marine debris also cause mortality.

Conservation and Management


The Atlantic ridley is one of the most endangered sea turtles. Populations have declined since the 1940s when tens of thousands could be observed nesting in a single day. Today fewer than 1,500 to 3,000 individuals nest annually. The species was federally listed as endangered in 1970. Protection of individuals and nests and the use of turtle excluder devices in shrimp trawls have contributed to slight population increases. Recovery programs include captive-rearing of juveniles and establishment of an introduced nesting colony at Padre Island, Texas. Increasing human encroachment and access to marine areas in Mexico is a major concern.

Given the rarity of this turtle in Maine, little can be done in Maine to contribute effectively to its recovery. Entanglement in fishing gear and nets may take some sea turtles in the Gulf of Maine each year. From 1986-1997, the Atlantic ridley sea turtle was state-listed as endangered in Maine because of its federal listing status. However, in 1996, the Maine Legislature chose to terminate automatic state listing of federally listed species. As a result, this species was removed from the Maine Endangered Species List in 1997.

Recommendations:

The Maine Department of Marine Resources has lead management authority for marine turtles, including the Atlantic ridley, and makes the following recommendations.

- ✓ Atlantic ridleys are very rarely encountered in the Gulf of Maine; however, specially designed gear and frequent tending of traps and nets may help to prevent deaths from entanglement.
- ✓ Maine should enforce national and international laws to minimize the dumping of pollutants and solid waste into the ocean and nearshore waters. Prohibit overboard discharge of waste in Gulf of Maine waters.
- ✓ Avoid use of balloons, especially in coastal areas. The National Wildlife Federation, Center for Marine Conservation, and other marine conservation groups discourage the use of helium-inflated balloons because they may drift into marine waters and become a hazard to wildlife when ingested. More information on the hazards of plastics in the marine environment to marine turtles and whales can be found at www.pacificwhale.org/childrens/fsdebris.html.

- ✓ Include in Gulf of Maine marine oil spill contingency plans strategies for rehabilitating oiled marine turtles, especially in late summer.
- ✓ Develop protocols for rescuing and resuscitating cold-stunned sea turtles.
- ✓ To reduce adult mortality, encourage use of turtle excluder devices (TEDs) and gill net regulations in Southeast and Gulf of Mexico fisheries. 

**FEDERALLY
ENDANGERED**

Leatherback

(Dermochelys coriacea)



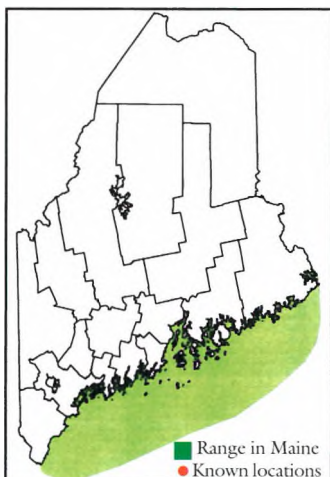
FWC's Florida Marine Research Institute

Description

The leatherback is the world's largest living marine turtle. Adults reach 11 feet in length and weigh 650-1,500 pounds. This turtle has a smooth shell covered with rubber-like skin and lacks the scutes, or hard bony plates, characteristic of most other turtles. The carapace (top shell) is teardrop-shaped and tapers to a point at the tail. Seven prominent keels run the length of the carapace, which is dark brown to black and covered with small, white to yellowish blotches. The head and neck are black or dark brown with a few white, yellow, or pink blotches. Limbs are paddle-like with black and white spotting. The front flippers are proportionately longer than those of any other sea turtle. The male has a concave plastron (bottom shell), a more tapered carapace, and a tail longer than the hind limbs. Females have extensive pink blotches on the head, and a tail half as long as a male's.

Range and Habitat

Leatherbacks are found in all the world's oceans except the Antarctic. In the Atlantic, they range from the Gulf of Mexico and Caribbean Sea, north to Newfoundland and Labrador, and east to Norway and the British Isles. They are the most frequently encountered marine



turtle in the Gulf of Maine, and are common enough to be observed in most years. Leatherbacks are pelagic unless nesting on tropical and subtropical beaches. Nesting locations in the Atlantic are scattered throughout the Gulf of Mexico, Caribbean, and southeast United States. The largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Small numbers of leatherbacks also have been reported nesting in Texas and Georgia.

Life History and Ecology

Leatherbacks have the unique ability among reptiles to regulate their body temperature. Adaptations include heat exchange in the blood vessels in the limbs, a thick insulating layer of oil-saturated fat under the skin, and a large body mass that can retain heat. With these adaptations, individuals can range as far north as the Labrador coast in summer. Because of these and other distinctive features, leatherbacks have been placed in a unique taxonomic family (Dermochelyidae).

Females reach sexual maturity at about four feet of carapace length (about 10 years old). Size at maturity for males is unknown. Female leatherbacks may nest at 2-3 year intervals. They emerge from the sea around midnight and excavate a nest chamber into which they deposit 80-90 eggs, then cover them with sand and depart. Incubation lasts 60-65 days, and hatchlings emerge after dark. A female may lay six clutches a season at 8- to 12-day intervals.

Jellyfish, comb jellies, salps, and other related animals are the preferred food of the leatherback. Its mouth, throat, and esophagus are lined with numerous backward-pointing spines to aid in

swallowing slippery prey. Leatherbacks follow the migration of jellyfish, their primary food, along the Gulf Stream and into the Gulf of Maine in late summer, then return to southern waters by winter. In some years, they are locally common south of Long Island and in central and eastern portions of the Gulf of Maine. They winter in the Gulf of Mexico and along the Florida coast. Since the leatherback's preferred food is the arctic jellyfish, the outer Gulf of Maine is an important feeding area. Though leatherbacks are pelagic, they occasionally enter shallow waters in bays and estuaries. They more typically occur west of the Gulf Stream at water depths greater than 200 feet. They dive almost continuously to depths of up to several thousand feet. They may live to be over 30 years old.

Threats

Sea turtles face many natural obstacles to their survival. Predators such as raccoons, ants, and crabs consume eggs in the nest. Hatchlings are eaten by fish, seabirds, and a host of other marine predators. Like other turtle populations, high loss of young is balanced by the longevity of adults. Any additional sources of mortality can cause population declines. Declines are attributed to tremendous overharvest of eggs, killing of adults, and incidental take by shrimp trawlers. Leatherbacks may become entangled in longlines, fish traps, buoy anchor lines, and other ropes and cables. Entanglement in fishing gear and mortality from trawlers occasionally occur in the Gulf of Maine and usually results in drowning. Turtles are also vulnerable to boat collisions. Nesting habitat is degraded by beachfront development, dredging, and channelization projects. Lights from coastal development discourage nesting adults and disorient hatchlings. New research suggests that a disease now killing many sea turtles (fibropapillomas) may be linked to pollution in the oceans and in nearshore waters. Oil spills, urban runoff of chemicals, fertilizers, and petroleum all contribute to water pollution. Discarded plastic bags and wrappers, helium balloons, and monofilament fishing line that end up in the ocean can also be deadly to sea turtles, as well as to other marine life. Balloons and plastic bags, when floating in water, resemble jellyfish. When turtles mistakenly eat these items or fishing line, their digestive systems become blocked and they eventually die.

Conservation and Management

Leatherback populations are declining rapidly. The worldwide population may be only 20,000-

30,000 nesting females. Only a few hundred nest in the southeastern U.S. The leatherback was federally listed as endangered in 1970. Strict protection of individuals and nests, and the use of turtle-excluding devices in shrimp trawls, have contributed recently to slight population increases.

From 1986-1997, the leatherback was state-listed as endangered in Maine because of its federal listing status. However, in 1996, the Maine Legislature changed the Maine Endangered Species Act and discontinued the automatic state-listing of federally listed species. As a result, this species was removed from the Maine Endangered Species List in 1997.

Recommendations:

The Maine Department of Marine Resources has lead management authority for marine turtles, including the leatherback, and makes the following recommendations.

- ✓ Leatherbacks are regularly encountered in the Gulf of Maine. Specially designed gear and frequent tending of traps and nets may help to prevent deaths from entanglement.
- ✓ Enforce national and international laws to minimize the dumping of pollutants and solid waste into the ocean and nearshore waters. Prohibit overboard discharge of waste in Gulf of Maine waters.
- ✓ Avoid use of balloons, especially in coastal areas. The National Wildlife Federation, Center for Marine Conservation, and other marine conservation groups discourage the use of helium-inflated balloons because they may drift into marine waters and become a hazard to marine wildlife when ingested. More information on the hazards of plastics in the marine environment to marine turtles and whales can be found at www.pacificwhale.org/childrens/fsdebris.html.
- ✓ Include in Gulf of Maine marine oil spill contingency plans strategies for rehabilitating oiled marine turtles, especially in late summer.
- ✓ Develop protocols for rescuing and resuscitating cold-stunned sea turtles.
- ✓ To reduce adult mortality in Southeast and Gulf of Mexico fisheries, encourage use of turtle excluder devices (TEDs) and gill net regulations. 🐢

**STATE
ENDANGERED**

Black Racer

(*Coluber constrictor*)



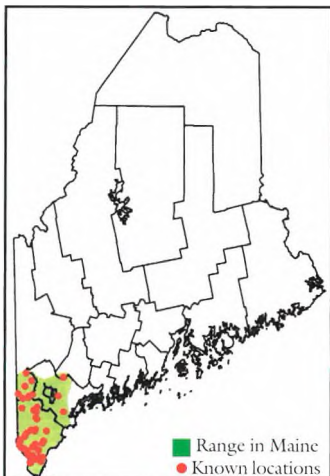
Mac Hunter

Description

The experience of having a large black snake slithering out from underfoot has given many a startle in southern Maine. This, the largest of Maine's snakes, is lightning fast. The black racer or eastern racer can grow up to six feet long. The adult is uniformly black to bluish-black with shiny, smooth scales, and has a white chin, neck, and throat. The underside is pale to medium gray. A thin white line extends from the snout over the eye to the neck and is only observable at close range. The juvenile is gray or bluish gray with a patterned row of dark gray, brown, or reddish brown blotches along the top of the back; dark spots on flanks and underside; and an unpatterned tail. As the snake matures, the patterned blotches fade, the dorsal surface darkens, and all patterning disappears by the time the snake reaches 30 inches long.

Range and Habitat

Racers occur across most of the United States except the Southwest. The northern black racer, *Coluber constrictor constrictor*, is the subspecies in Maine. The species is at the northern extent of its range in Maine. Although it was common as far north as Cobboosecontee Lake in the 1930s, the black racer is now rare, and its range is limited to York, Cumberland, and



southern Oxford counties.

The black racer occurs in a variety of moist and dry habitats, including deciduous and coniferous forests, fields, woodlands interspersed with fields, and swamps or marshes. In southern Maine, open grasslands, power line rights-of-way, orchards, rocky ridges, and the edges between forests and fields seem to be preferred habitats.

Life History and Ecology

Racers reach sexual maturity in August and September when they are just over a year old, but do not mate until the following spring. Mating occurs in May to early June. Pheromones released by a female may attract several males. In the East, egg laying occurs from early June to early August. Clutch size ranges from 2-31, although 9-16 is most common. Favored nesting sites include mammal burrows, rotting logs and stumps, and sawdust piles. Individuals typically nest singly, although communal nesting occurs occasionally. Incubation lasts 43-65 days depending on temperature. Hatching occurs from late July to September.

Despite their scientific name, racers do not kill by constriction, but bite and hold their prey. Typical prey includes frogs, toads, small birds and their eggs, small mammals, insects, and other snakes. In the Northeast, small mammals and snakes are the primary prey.

Black racers are territorial and have an average home range size of 30 acres. They are active from March to October, although they also may become active during warm winter days. Winter hibernation sites include mammal burrows, caves, rock crevices, gravel banks, and rotting logs and stumps. Racers show high fidelity to winter hibernacula and may

hibernate communally with other snake species. They may live to be over 10 years old. As their name implies, they are a fast snake, and if pursued they often escape by climbing into low branches and bushes.

Threats

Black racers are still locally common throughout New England, but are declining in some areas. The racer is at high risk of extirpation in Maine because of a drastic reduction in range, rarity at the northern edge of its range, and habitat loss. Historic accounts suggest the racer was formerly more abundant and widespread in Maine. At the height of farming in Maine, the species ranged farther north to the Belgrade Lakes area. Its numbers and range declined drastically as agricultural land reverted to forest land or was developed. Habitat fragmentation resulted in shrinking patches of habitat that no longer support a viable population of these snakes. Increased road density and traffic results in mortality. Racers also are killed by people and pets when they appear in yards. In Maine, at the northern edge of the racer's range, cold temperatures may limit survival of eggs and overwintering of adults.

Conservation and Management

The black racer was listed as endangered in Maine in 1986 because of its reduced range and small population. A few racers are sporadically reported from southern Maine each year. Recurring records of racers are limited to only three locations in York County: agricultural land in Alfred and sandplain grasslands at Wells Barrens and the Kennebunk Plains. Racers seem to do well in blueberry and grassland habitats if such areas are not fragmented. Effective conservation of racers will require conserving large blocks of unfragmented, rural, agricultural lands. Habitat protection is the most important means of conserving the species in the state.

Other recovery techniques may include providing supplemental hibernation structures and nesting areas in suitable habitat. Reintroduction techniques have not been developed, and snakes from source populations to the south may not be well-adapted for life in the North. Very little is known about the life history of racers in Maine, and studies of habitat use, movements, and ecology are needed. It is illegal to collect, possess, or kill a black racer because of protection provided by its endangered status.

Recommendations:

✓ Prior to land development or forest harvesting,

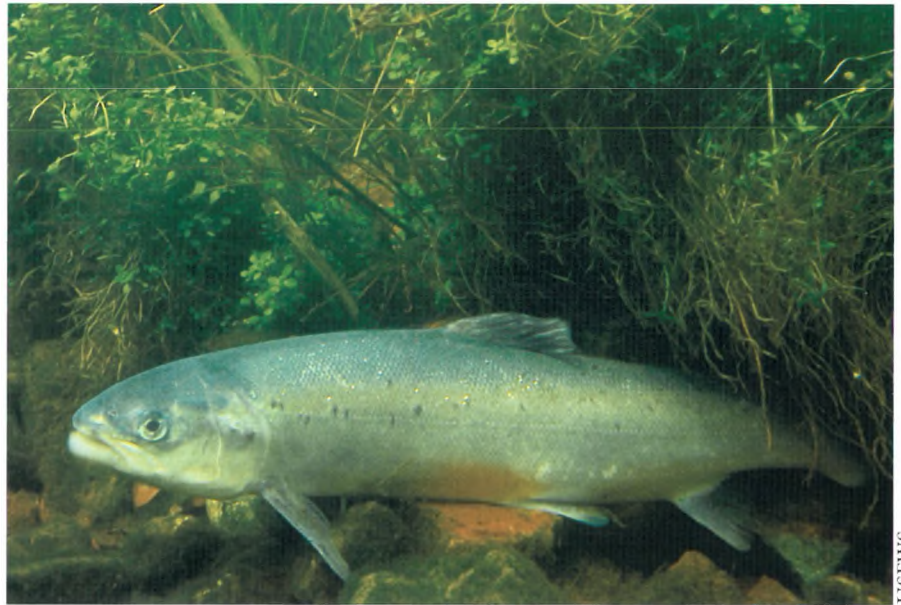
consult with a biologist from MDIFW to assist with planning.

- ✓ Municipalities should strive to maintain important habitat areas identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Avoid new roads and road improvement projects (e.g., paving, widening) that could lead to increased traffic volume and speed within ¼ mile of known racer occurrences. All road projects should undergo thorough environmental review to avoid, minimize, and mitigate road mortality to endangered snakes.
- ✓ Avoid human persecution of racers by educating the public about this endangered snake and its protected status, and seek voluntary information on the location of populations. 🐍

**FEDERALLY
ENDANGERED**

Atlantic Salmon

(*Salmo salar*)



USFWS

Description

The allure of fly fishing for Atlantic salmon and the anticipation of the first bright fish returning to spawning rivers each spring explain the devotion of anglers and conservationists to bringing back this remarkable fish. Sea-run Atlantic salmon are bright, silvery, large fish, over 30 inches in length and 7-15 pounds. They can reach much larger size (especially those that return several years to spawn), and the world record is 79 pounds. When at sea, they are bluish-brown on the back shading to white below. Dark spots are scattered over the upper half of the fish. They may resemble brown trout, but the tail is slightly forked rather than square, and there are no spots on the adipose fin (the small fin on the back just in front of the tail). In fresh water, Atlantic salmon turn dark gray to reddish brown and become darker colored and mottled. By fall, they are almost bronze-colored and have large reddish spots on the head and body. Juvenile salmon look very similar to trout but have a shorter mouth. The landlocked form (also known as ouananiche) is nearly identical in coloration to sea-run salmon, but is much smaller. The average landlocked salmon is about 20-25 inches long and weighs 3-5 pounds. Both are revered sport fish and are

known for their long, powerful runs and their willingness to take a fly or lure.

Range and Habitat

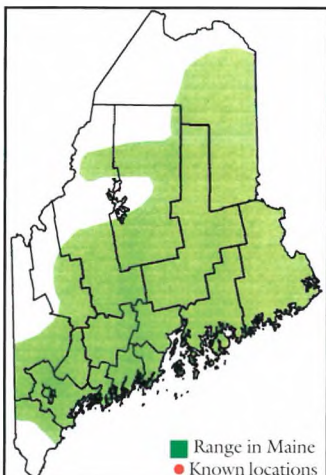
The Atlantic salmon's historic range encompassed the North Atlantic Ocean and its freshwater tributaries from Ungava Bay in Canada to Russia's White Sea. In eastern North America, they ranged as far south as Connecticut. In Maine,

Atlantic salmon were historically found in all major river systems and many of their tributaries with suitable spawning habitat. Today, Atlantic salmon have disappeared from much of their historic range including rivers in southern Maine and New England. In Maine they are still found in the Saco, lower Kennebec, lower Androscoggin, Sheepscot, Penobscot, Cove Brook, Passagassawakeag, Ducktrap, Narraguagus, Pleasant, Machias, East Machias, Dennys, and St. Croix Rivers. Freshwater habitat includes clear, coldwater streams and rivers having relatively unobstructed passage to the sea. Spawning habitat is characterized by coarse gravel or rubble bottom with suitable well-oxygenated, clean water of appropriate velocity and depth.

Life History and Ecology

Atlantic salmon have a complex life cycle. They are usually anadromous, migrating from the ocean to fresh water to reproduce in the river of their birth. Adults ascend rivers beginning in the spring. Migration peaks in June, but continues into the fall. Adults stop eating when they enter fresh water and live off fat reserves for up to one year. They seek coldwater areas to spend the summer and move to swift-running, gravelly tributaries to spawn in October and November. Unlike Pacific salmon species, they do not die after spawning and can return to the ocean and migrate back to spawn again.

The eggs are buried in gravel nests, called redds, and hatch in March and April. After hatching, the tiny larvae, or alevins, retain their yolk sacs and remain buried in the gravel for up to six weeks. After they lose their yolk sacs, the fry emerge to seek food and establish feeding territories. Young salmon, called parr, spend 2-3 years in their natal stream. When they are about six inches long, the salmon, now called smolts, undergo a physiological change to adapt to life in salt water. They become silvery in color and migrate to the ocean. Traveling thousands of miles to the North Atlantic near Greenland and Labrador, they remain in feeding grounds for 1-3 years before returning to their natal streams to reproduce. Salmon that return to



ivers after one year in the ocean are smaller and are called grilse. Salmon that survive spawning and return to the ocean to resume feeding are called kelts. Salmon have been known to spawn up to four times and may live to the ripe old age of 10. In the ocean, smolts feed on small shrimp and zooplankton, and adults feed on herring, sand lance, capelin, and shrimp.

Threats

Many factors influence the survival of Atlantic salmon populations. Dams impede fish migration, expose fish to increased predation by birds and anglers, alter water chemistry, increase temperature, and reduce flow. Beavers may intermittently prevent access to some spawning habitat. Land use adjacent to spawning rivers can be a source of siltation, water withdrawals for irrigation, and chemical contaminants – all of which can affect juvenile, adult, and smolt survival. Additional sources of mortality include predation by seals and cormorants, commercial fishing, recreational angling, and poaching. Introduced sport fish (smallmouth bass, pickerel, brown and rainbow trout) are predators on parr and smolts. Atlantic salmon aquaculture may be a source of genetic contamination, disease, and parasites. Global warming may affect surface temperatures in the ocean and trigger ecosystem-level changes, including loss of forage fish. Acid precipitation may affect young fish that are sensitive to changes in water chemistry. Biologists are investigating which of these factors may be limiting populations.

Conservation and Management

Atlantic salmon have been the focus of restoration efforts for over 150 years. Historic runs in the U.S. were about 500,000 fish; however, by the mid-1850s Atlantic salmon were extirpated from most of the rivers in southern New England and had declined noticeably throughout Maine. Hatcheries were established in Maine as early as the 1870s. The Craig Brook hatchery in Orland was established in 1890 for the purpose of stocking salmon. Since that time, approximately 96 million parr, smolts, and adult salmon have been stocked in Maine rivers and millions of dollars have been spent on salmon restoration.

The number of adults returning to Maine rivers has fluctuated, but remained at several thousand fish into the 1980s. From 0.5-15 percent (average 3-5 percent) of the smolts survive to return as spawning adults. In the mid-1990s, marine survival declined dramatically, causing salmon runs to plummet. The sport catch of wild salmon on the Downeast rivers dropped from several hundred per year to just a few dozen. Adult salmon returns declined statewide from 6,000-10,000 to 1,500-3,000 annually despite increased stocking efforts.

In 1999, the USFWS listed the Atlantic salmon as endangered in eight Maine rivers. The Atlantic salmon has no state listing status at this time.

Numerous recovery actions are being implemented. Sport fishing for sea-run salmon is now prohibited in all Maine waters. Habitat is being protected through management agreements with forest and blueberry landowners and

land acquisition along Downeast rivers. Research is being conducted to better determine factors limiting salmon. Both Canada and the U.S. have developed treaties with Greenland to reduce commercial harvest. Hatcheries are being managed to preserve the Downeast genetic stocks. Salmon aquaculturists are taking measures to eliminate escapes and reduce disease and parasite transmission to wild stocks. Weirs are installed on Downeast rivers to count returning fish and cull aquaculture escapees.

The prognosis for the salmon is uncertain. If current declines continue, endangered species listing may expand to other rivers in Maine. If limiting factors cannot be reversed, the salmon may be headed for extirpation.

Recommendations:

Management and recovery of salmon in Maine is the responsibility of the Maine Atlantic Salmon Commission.

- ✓ Prior to land development or forest harvesting near Atlantic salmon rivers, consult with biologists from the U.S. Fish and Wildlife Service, NOAA Fisheries, Maine Atlantic Salmon Commission, and MDIFW to assist with planning.
- ✓ Municipalities should follow Shoreland Zoning standards and maintain areas adjacent to salmon rivers in a low-density, rural setting. Identify these areas in comprehensive plans, and consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at least 250 (preferably 600) feet from Atlantic salmon rivers.
- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of Atlantic salmon rivers.
- ✓ When projects are proposed within 250 feet of waterways providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid road or pipeline crossings or use of heavy equipment in streams or rivers.
- ✓ Avoid stream alteration projects (water withdrawals, dredging, rip-rap, channelization, dams) that would alter flow or remove natural stream features such as riffles and pools. Do not remove large woody debris, an important habitat component.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ Educate anglers to promptly return Atlantic salmon unharmed if they are caught accidentally.
- ✓ It is illegal to introduce fish species. Introductions could alter aquatic invertebrate communities and introduce new competitors, predators, or disease. 🟡

**STATE
THREATENED**

Swamp Darter

(Etheostoma fusiforme)



Mark McCollough

Description

Darters are a diverse and colorful group of fish in eastern North America, but only one, the swamp darter, extends its range as far north as Maine. The swamp darter is one of Maine's smallest freshwater fish, with a maximum length of about two inches. It has a slender, compressed body and small, blunt head, and is cryptically colored brown-olive with dark brown speckles on the body and fins. The tail is marked by four dark spots in a vertical row at the base. The lateral line (horizontal line along the side) arches upward toward the head, and ends below the front of the dorsal (upper) fin. Two dark bars extend from the eye, one forward and the other downward. The maxillary bone (upper jawbone) extends to beneath the front third of the eye. The entire body, cheeks, and gill coverings are covered with scales. The two dorsal fins are contiguous with no space between them. There are 8-12 spines on the front dorsal fin and 9-12 soft rays on the rear dorsal fin. The tail fin is square with rounded corners. The anal

fin originates directly beneath the third soft ray of the second dorsal fin. Pelvic fins are pointed, with the third ray longer than the others. The pectoral (side) fins are paddle-shaped.

Range and Habitat

The swamp darter is associated with Atlantic coastal lowlands from extreme

southern Maine south to Louisiana, north along the Mississippi River drainage into Kentucky and southeastern Missouri, and up the Red River drainage to southeastern Oklahoma. The subspecies in Maine is *Etheostoma fusiforme fusiforme*, which ranges south to North Carolina. In Maine, the swamp darter is known from only three locations in southern York County: the York River, Great Works River, and Neddick River drainages. Within these drainages, MDIFW biologists have documented the species in Chase's Pond, Folly Pond, Chicks Brook, Boulder Pond, and Hooper's Brook.

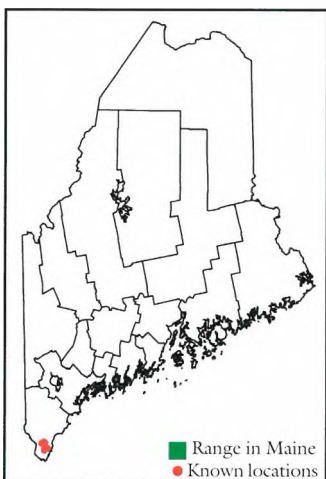
The swamp darter inhabits weedy, freshwater swamps, ponds, and slow-moving streams. It is usually associated with muddy bottoms that have a layer of detritus, and plenty of aquatic vegetation. Occasionally, the swamp darter is found over open sandy bottoms. Swamp darters can tolerate low oxygen levels and acidic conditions.

Life History and Ecology

Little is known about the ecology of this species. The swamp darter lives in the lower parts of the water column, and thus has little competition from other small fish. Food consists of small invertebrates including fly larvae, small crustaceans (amphipods, copepods), and worms. Swamp darters generally live only one year. Spawning likely occurs from late April to June, with northern populations spawning later in the season. Eggs are deposited on the leaves of aquatic vegetation. Swamp darters are food for herons and larger fish.

Threats

Because the swamp darter is at the northern limit of its range in Maine, it is susceptible to cold



temperatures beyond its tolerance levels. The region of southern Maine where the swamp darter occurs is under heavy developmental pressure. Although the swamp darter is tolerant of some level of acidification and eutrophication, changes in the upland landscape could influence the chemistry of the water and the vegetation to an extent that the darter could not survive. Introduced predatory fish will eat swamp darters and alter aquatic communities.

Populations of this species are probably relatively small and fragmented, but individuals should be expected to occur throughout the river drainages wherever suitable habitat exists. However, the three river drainages inhabited by the swamp darter have been altered by dams, and fish passage is restricted. Thus, it will be difficult for this species to disperse to new sites or to recolonize sites where it has been extirpated.

Conservation and Management

The swamp darter is listed as threatened in Maine because of its extremely limited distribution in the state, human alterations to its habitat, and its location at the northern extent of its range in southern Maine. No active management or conservation strategies have been developed for this species. The swamp darter is a hardy species able to tolerate a variety of water conditions. It is listed as threatened in New York, where some wetlands have been protected for its benefit on Long Island. Much of its habitat in Maine is under watershed protection from the York and Kittery Water Districts. Surveys are needed in Maine to better document its distribution. Monitoring is also needed to track species populations.

Recommendations:

- ✓ Prior to land development or forest harvesting near waterways with swamp darters, consult with a biologist from MDIFW or the Maine Natural Areas Program to assist with planning.
- ✓ Municipalities should follow Shoreland Zoning standards and strive to maintain areas adjacent to waterways providing habitat for threatened and endangered species in a low-density, rural setting. Identify these areas in comprehensive plans, and consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at

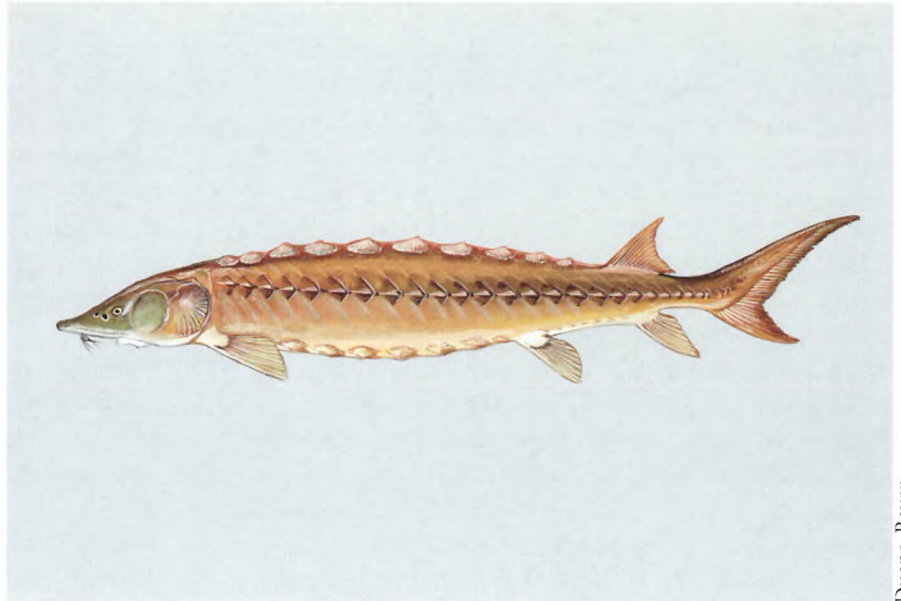
least 250 (preferably 600) feet from waterways providing habitat for threatened and endangered species.

- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of waterways providing habitat for threatened and endangered species.
- ✓ When projects are proposed within 250 feet of waterways providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid stream alteration projects (water withdrawals, dredging, rip-rap, channelization, pipeline crossings, dams) that would alter flow or remove natural stream features such as riffles and pools. Do not remove large woody debris, an important habitat component.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ It is illegal to introduce fish species. Introductions could alter aquatic invertebrate communities and introduce new competitors, predators, or disease. 🟡

**FEDERALLY
ENDANGERED**

Shortnose Sturgeon

(Acipenser brevirostrum)



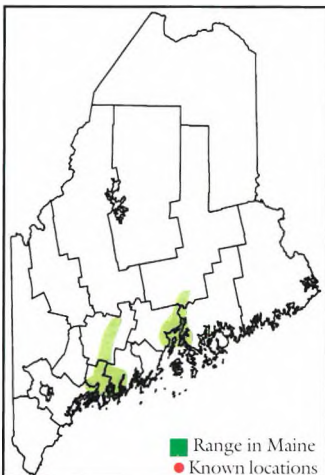
Duane Raver

Description

The shortnose sturgeon is among the most primitive of the bony fishes. It grows to a length of 48 inches and weight of about 15 pounds. It is much smaller than the Atlantic sturgeon that reaches nine feet. The shortnose sturgeon has a short, conical snout (as compared to the longer snout of the Atlantic sturgeon). It lacks scales, but has five rows of bony plates or scutes that run the length of the body. Its coloring is olive-yellow to gray or bluish on the back, and milky-white to dark yellow on the belly. The tail is long and pointed. The mouth is located on the underside of the head, and is well suited for bottom-feeding. Barbels (sensory organs) projecting from the chin and mouth are used to detect food.

Range and Habitat

The shortnose sturgeon is found along the Atlantic seaboard from the St. John River in New Brunswick to the St. John's River in Florida. In Maine, populations inhabit the Sheepscot, Kennebec, Androscoggin, and Penobscot Rivers, and Merymeeting Bay. Throughout their range, shortnose sturgeon are found in larger rivers and associated estuaries.



Life History and Ecology

Shortnose sturgeon are anadromous, spending a portion of their lives in salt water, but returning to fresh water to spawn. However, in some northern populations (e.g., in the Kennebec River), a portion of the population forages in the saline estuary while others forage in fresh water. The normal habit is to migrate to fresh water to spawn, usually from April to May.

The shortnose sturgeon exhibits delayed sexual maturity, high reproductive capacity, and long life expectancy. Males and females mature at the same length (about 18 inches), but age at maturity varies with latitude. Sturgeon in the northern part of the range grow slower and mature later than those in the southern part of the range. Males reach sexual maturity in the north at 10-11 years and females at 12-18 years. Females usually breed every three years, and males may breed every year.

Spawning occurs in the spring at or above the head of tide. The female broadcasts her eggs in fresh water over a rubble bottom, and the male fertilizes them. Females lay 40,000-200,000 eggs, which hatch in about 13 days. After hatching, the larvae drift downstream and inhabit the deeper sections of river channels. Young of the year remain in fresh water. Juveniles (3-10 years old) move to the freshwater/saltwater interface. Adults are found in freshwater or tidal areas of rivers in summer and winter. They concentrate in small sections of the river, usually in areas of decreased river flow. These "concentration areas" may be associated with conditions suitable for the sturgeon's primary prey, freshwater mussels and crayfish. Juveniles feed primarily on insects and small crustaceans. Both adults and juveniles feed on the river bottom day

and night. Adult sturgeon in Merrymeeting Bay feed over submerged tidal flats and can tolerate rapid changes in salinity with the fluctuating tide. Other individuals feed in shallow and deep tidal channels. Female shortnose sturgeon may live to be 67 years old, while males seldom live beyond 30 years of age.

Threats

Pollution and overharvesting for commercial fisheries caused declines in shortnose sturgeon populations and were the primary reason for endangered species listing. During the 1800s and early 1900s, large tidal rivers, such as the Penobscot, were heavily polluted, resulting in high fish losses. At the same time, sturgeon were in high demand for caviar (eggs) and the fish's smoked flesh. Many rivers were dammed near the head of tide, preventing fish from swimming upriver. Maintenance dredging of large river channels to accommodate large ship traffic may also disturb habitat.

Conservation and Management

Shortnose sturgeon declined dramatically in Maine rivers by the early 1900s, and were nearly extirpated from the Penobscot River (only a single adult was found in 1997). However, the population in the estuarine complex of the Kennebec, Androscoggin, and Sheepscot Rivers is the largest population in the U.S. north of the Hudson River and numbers about 7,000 adults. The shortnose sturgeon was listed as a federal endangered species in 1967, and a federal recovery plan was completed in 1998.

This fish has been the subject of considerable research by Maine's Department of Marine Resources and others. Studies have included mark-recapture estimates of populations and radio-telemetry to track movements and habitat use. The Merrymeeting Bay area, critical habitat for the shortnose sturgeon, has been the recent focus of conservation efforts by state and federal conservation agencies, land trusts, and local conservation groups. Recently protected lands will help maintain the ecological integrity of this habitat for sturgeon and many other species of wildlife. The Maine Department of Marine Resources (DMR) has management authority for anadromous fish, including the shortnose sturgeon, and makes the following recommendations.

Recommendations:

✓ Maintain or enhance water quality in the Kennebec, Sheepscot, Androscoggin, and Penobscot

Rivers by protecting riparian habitat and reducing or eliminating pollutants in these watersheds.

- ✓ Educate anglers to promptly return shortnose sturgeon unharmed if they are caught accidentally.
- ✓ Municipalities should follow Shoreland Zoning standards and strive to maintain areas adjacent to waterways providing habitat for threatened and endangered species in a low-density, rural setting. Identify these areas in comprehensive plans, and consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at least 250 feet from waterways providing habitat for threatened and endangered species.
- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of waterways providing habitat for threatened and endangered species.
- ✓ When projects are proposed within 250 feet of waterways providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid stream alteration projects (water withdrawals, dredging, rip-rap, channelization, pipeline crossings, dams) that would alter flow or remove natural stream features such as riffles and pools. Do not remove large woody debris, an important habitat component.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ It is illegal to introduce fish species. Introductions could alter aquatic invertebrate communities and introduce new competitors, predators, or disease. 🟡

**STATE
THREATENED**

Tidewater Mucket

(*Leptodea ochracea*)



Mark McCollough

Description

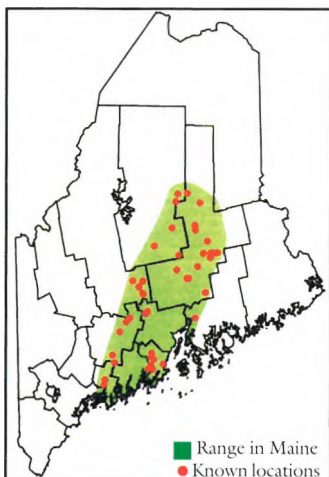
The tidewater mucket is a medium-sized (usually less than 3-inch) freshwater mussel that superficially resembles a marine clam. Its shell is rounded or oval in outline, and is usually yellowish or greenish-brown tinged with bronze or reddish-yellow. Fine green rays are sometimes evident, especially in younger specimens. The nacre, or pearly lining of the inside of the shell, is translucent pinkish or salmon color. This species can be confused with the yellow lampmussel, which is of similar shape and coloration but lacks the bronze tinge. The structure and placement of the hinge teeth, plus color of the nacre, help to distinguish these two rare species. (For more detailed information on identification, see MDIFW's book, *The Freshwater Mussels of Maine*.)

Range and Habitat

The tidewater mucket is found in Atlantic coastal drainages from Georgia to Nova Scotia. In Maine it is known only from Merrymeeting Bay, and the Penobscot, St. George, lower Kennebec, and lower Androscoggin River watersheds. Its distribution is very similar to that of the yellow lampmussel, and they are often found together.

Despite its name, the tidewater mucket can be found quite far inland – as far north as Millinocket Lake in the Mt. Katahdin region.

This species prefers coastal lakes, ponds, and slow-moving portions of rivers, and will tolerate impoundments. It occurs in a variety of bottom types, including silt, sand, gravel, cobble, and occasionally clay.



Life History and Ecology

Freshwater mussels have a curious way of reproducing that depends on the presence of fish. The tidewater mucket breeds in late summer, when males release sperm into the water and females filter it out of the water with their gills. Once the eggs are fertilized, females brood the growing larvae, called glochidia, in a modified portion of their gills called a marsupium.

The following spring, each larvae-bearing female releases thousands of mature glochidia. At this stage, glochidia require fish hosts to transform into the subadult form of a mussel. They can only survive for a short time on their own and must quickly encounter a suitable host fish. They then attach to the fish's fins or gills (without apparent harm to the fish) for a period of weeks or months before transforming into a tiny mussel and dropping off to settle in the bottom. Each mussel species requires one or more fish species to serve as suitable hosts. Currently, the host fish for the tidewater mucket is unknown. Because of the mussel's coastal distribution, it seems likely that at least one of its hosts is an anadromous fish (which migrates from salt to fresh water to reproduce). However, in the upper Penobscot River watershed there are no anadromous fish, and other species must serve as hosts.

Freshwater mussels grow rapidly during their first 4-6 years of life, before they become reproductively mature. Longevity of the tidewater mucket is likely 15 years or more. Mussels continually filter vast quantities of water and consume bacteria, algae, and plant and animal debris. They burrow into the bottom and anchor themselves with a muscular foot. They have a limited ability to move slowly around the lake or river bottom to find the best sites for feeding and reproducing. Mussels are an important food item for some aquatic mammals, especially otters, muskrats, and raccoons, as evidenced by piles of shells (middens) often seen along shorelines.

Threats

Freshwater mussels are the most endangered group of animals in North America. Of the nearly 300 species native to North America, approximately 75 percent are state or federally listed as endangered, threatened, possibly warranting listing status, or already extinct. Their population declines are the result of more than a century of industrialization and development of our waterways, causing alteration and loss of habitat and degradation of water quality.

The tidewater mucket has declined throughout its range and has been extirpated from many rivers in the Northeast. The specific reasons for its decline are unknown, but probably reflect the cumulative effects of habitat degradation and pollution. Unlike many species of mussels, however, the tidewater mucket does seem able to survive in impoundments.

Another serious threat to native mussels is the exotic zebra mussel, which was accidentally introduced to the Great Lakes and is spreading across North America. It carpets the bottom of lakes and rivers, and out-competes native mussels for space and food. Although it has not been found in Maine, the zebra mussel could represent a major threat to tidewater mucket populations if introduced here. The largest population of tidewater muckets known in the Northeast, located in the lower Hudson River, was nearly eliminated by the zebra mussel.

Conservation and Management

Population declines have been documented for the tidewater mucket throughout much of its range, prompting many states to add it to their lists of endangered and threatened species. In 1997, the species was listed as threatened in Maine. It is known from only four watersheds in the state, and is usually only found in low numbers at most sites.

Conservation of mussels requires identification and protection of their habitats, and suitable populations of their fish hosts. MDIFW completed a seven-year survey of the state's freshwater mussels in the 1990s. Populations of tidewater muckets are well documented and information is being provided to towns, land trusts, and lake and watershed associations. In 2001, research was initiated at the University of Maine to document the fish host(s), population size and structure, and genetic uniqueness of populations. Monitoring is needed to assess population trends, and additional life history studies are needed to learn more about the species' habitat requirements, reproduction, and interaction with fish host populations.

Maine has some of the largest remaining populations of tidewater muckets in the East, and will play an important role in the species' conservation. Protection of clean, unaltered, forested watersheds and associated forested riparian areas is necessary for the long-term existence of this species. The tidewater mucket shares much of its habitat in Maine with the yellow lampmussel (threatened), shortnose sturgeon (federally threatened), Atlantic salmon (federally endangered), and other rare species like the brook floater (mussel), wood turtle, and New England

bluet (damsselfly). Adhering to state wetland and Shoreland Zoning laws and water quality Best Management Practices contributes greatly to maintaining the quality of aquatic habitats for this species. Shoreland zoning and LURC zoning standards provide protection of habitat up to 250 feet from larger rivers. Some forest companies voluntarily extend the conservation of intact, forested riparian zones to 330-600 feet for larger rivers.

Recommendations:

- ✓ Prior to land development or forest harvesting near waterways providing habitat for threatened and endangered species, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain areas adjacent to waterways providing habitat for rare mussels in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow Shoreland Zoning and LURC standards.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at least 250 feet from waterways providing habitat for threatened and endangered species.
- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of waterways providing habitat for threatened and endangered species.
- ✓ When projects are proposed within 250 feet of waterways providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid road crossings or use of heavy equipment in streams or rivers.
- ✓ Avoid stream alteration projects (water withdrawals, dredging, rip-rap, channelization, pipeline crossings, dams) that would alter flow or remove natural stream features such as riffles and pools.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ It is illegal to introduce fish species. Such introductions could alter aquatic invertebrate communities and affect host fish populations. 🐟

**STATE
THREATENED**

**Yellow
Lampmussel**
(*Lampsilis cariosa*)



Mark McCollough

Description

The yellow lampmussel is a large (up to 4½-inch) freshwater mussel that superficially resembles a marine clam. Its shell is oval-shaped and distinctly yellow, occasionally with faint green rays. The nacre, or pearly lining of the inside of the shell, is usually white or bluish-white. This species can be confused with the tidewater mucket, which is of similar shape and coloration but usually has a bronze tinge in adult specimens. The structure and placement of the hinge teeth, plus color of the nacre, help to distinguish these two species. (For more detailed information on identification, see MDIFW's book, *The Freshwater Mussels of Maine*.)

Range and Habitat

The yellow lampmussel is found in Atlantic coastal drainages from Georgia to Nova Scotia. In Maine it is currently known only from the Penobscot, St. George, and lower Kennebec River watersheds. This species typically prefers medium to large rivers, but in Maine is often found in lakes and ponds, and will tolerate impounded sections of rivers. It occurs in a variety of bottom types, including silt, sand, gravel, and cobble.

Life History and Ecology

Freshwater mussels have a curious way of reproducing that depends on the presence of fish. The yellow lampmussel breeds in late summer, when males release sperm into the water and females filter it out of the water with their gills. Once the eggs are fertilized, females brood the growing larvae, called glochidia, in a

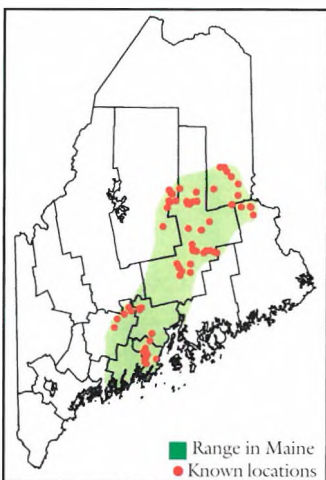
modified portion of their gills called a marsupium.

The following summer, each larvae-bearing female releases thousands of mature glochidia. At this stage, glochidia require fish hosts to change into the subadult form of a mussel. They can only survive for a short time on their own and must quickly encounter a suitable host fish. To aid the glochidia in finding a host, larvae-bearing female yellow lampmussels use a fleshy modification of their mantle (flap-like tissue lining the shell) that is shaped like a small minnow to attract fish. When a fish bites the lure, glochidia are released. They then attach to the fish's gills (without apparent harm to the fish) for a period of weeks or months before transforming into tiny mussels and dropping off to settle in the bottom. Each mussel species requires one or more specific fish species to serve as suitable hosts. Currently, known fish hosts for the yellow lampmussel are yellow and white perch.

Freshwater mussels grow rapidly during their first 4-6 years of life, before they become reproductively mature. Longevity of the yellow lampmussel is likely 15 years or more. Mussels continually filter vast quantities of water and consume bacteria, algae, and plant and animal debris. They burrow into the bottom and anchor themselves with a muscular foot. They have a limited ability to move slowly around the lake or river bottom to find the best sites for feeding and reproducing. Mussels are an important food item for some aquatic mammals, especially otters, muskrats, and raccoons, as evidenced by piles of shells (middens) often seen along shorelines.

Threats

Freshwater mussels are the most endangered group of animals in North America. Of the nearly 300 species native to North America, approximately 75 percent are state or federally listed as endangered, threatened, possibly warranting listing status, or already extinct. Their population declines are the result of more than a century of industrialization and development of our waterways, causing alteration and loss of habitat and degradation of water quality.



The yellow lampmussel has declined throughout its range and has been extirpated from many rivers in the Northeast. Habitat degradation and pollution have eliminated some populations. Unlike many species of mussels, however, the yellow lampmussel is able to survive in impoundments.

Another serious threat to native mussels is the exotic zebra mussel, which was accidentally introduced to the Great Lakes and is spreading across North America. It carpets the bottom of lakes and rivers, and out-competes native mussels for space and food. Although it has not been found in Maine, the zebra mussel could represent a major threat to yellow lampmussel populations if introduced here.

Conservation and Management

Population declines have been documented for the yellow lampmussel throughout much of its range, prompting many states to add it to their lists of endangered and threatened species. It also is a former candidate for federal listing. In 1997, the species was listed as threatened in Maine. It is known from only three watersheds in the state, and is usually found in low numbers at most sites.

Conservation of mussels requires identification and protection of their habitats, and suitable populations of their fish hosts. MDIFW completed a seven-year survey of the state's freshwater mussels in the 1990s. Populations of yellow lampmussels are well documented, and information is being provided to towns, land trusts, and lake and watershed associations. In 2001, research was initiated at the University of Maine to document the fish host(s), population size and structure, and genetic uniqueness of populations. Monitoring is needed to assess population trends, and additional life history studies are needed to learn more about the species' habitat requirements, reproduction, and interaction with fish host populations.

Maine may have some of the largest remaining populations of yellow lampmussels in the East, and will play an important role in the species' conservation. Protection of clean, unaltered watersheds and associated forested riparian areas is necessary for the long-term existence of this species. The yellow lampmussel shares much of its habitat in Maine with the tidewater mucket (threatened), shortnose sturgeon (federally threatened), Atlantic salmon (federally endangered), and other rare species like the brook floater (mussel), wood turtle, and New England bluet damselfly. Adhering to state wetland and Shoreland Zoning laws and water quality Best Management Practices contributes greatly to maintaining the quality of aquatic habitats for this species. Shoreland zoning and LURC zoning standards provide protection of habitat up to 250 feet from larger rivers. Some forest companies voluntarily extend the conservation of intact, forested riparian zones to 330-600 feet for larger rivers.

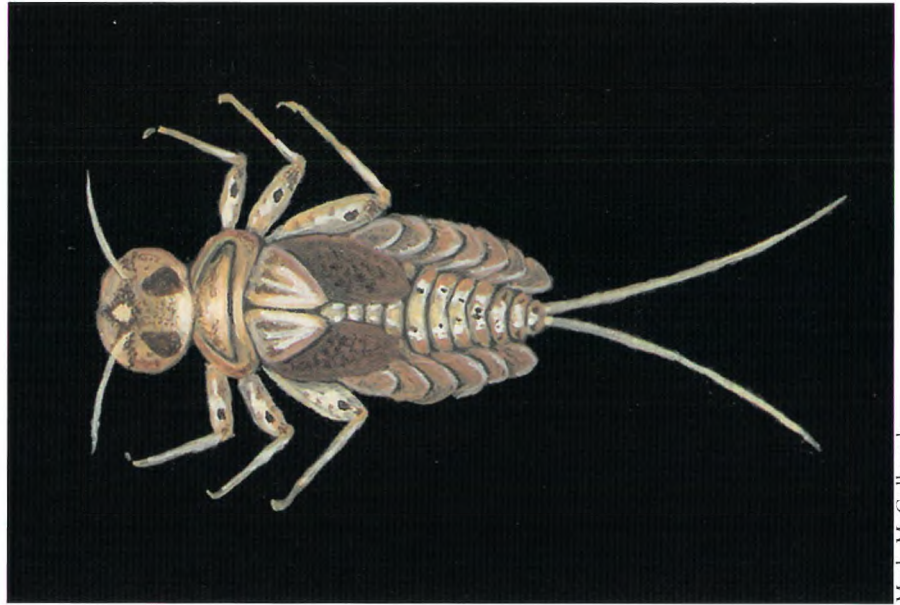
Recommendations:

✓ Prior to land development or forest harvesting near waterways providing habitat for threatened and endangered species, consult with a biologist from MDIFW to assist with planning.

- ✓ Municipalities should strive to maintain areas adjacent to waterways providing habitat for rare mussels in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow Shoreland Zoning and LURC standards.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at least 250 feet from waterways providing habitat for threatened and endangered species.
- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of waterways providing habitat for threatened and endangered species.
- ✓ When projects are proposed within 250 feet of waterways providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid road crossings or use of heavy equipment in streams or rivers.
- ✓ Avoid stream alteration projects (water withdrawals, dredging, rip-rap, channelization, pipeline crossings, dams) that would alter flow or remove natural stream features such as riffles and pools.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ It is illegal to introduce fish species. Such introductions could alter aquatic invertebrate communities and affect host fish populations. 🟡

**STATE
ENDANGERED**

**Roaring
Brook
Mayfly**
(Epeorus frisoni)



Mark McCollough

Description

The Roaring Brook mayfly is less than ½ inch long. Its upright wings are of a similar length. Two long cerci, or tails, protrude from the abdomen. The body is light yellowish tan, and the thorax (midsection) is light golden-brown. It can be distinguished from other flat-headed mayflies by a complex pattern of veins in its wings and the structure of its genitalia. The nymph has not been described.

Range and Habitat

The Roaring Brook mayfly is currently known only from Roaring Brook at the base of Mt. Katahdin. It is a high-gradient, clear mountain stream characterized by cascades, large boulders, and coarse granite bottom. The stream is subject to annual flooding from snowmelt, and flows year-round. Although it is believed this mayfly may be endemic to this locality, it could be present in other cold subalpine streams in the Katahdin area. A recent statewide survey of mayflies failed to locate

this species in similar streams in mountainous regions of Maine.

Life History and Ecology

Mayflies have three life stages: nymph (aquatic phase), subimago (pre-adult that emerges from the stream), and imago (adult). The life history of the Roaring

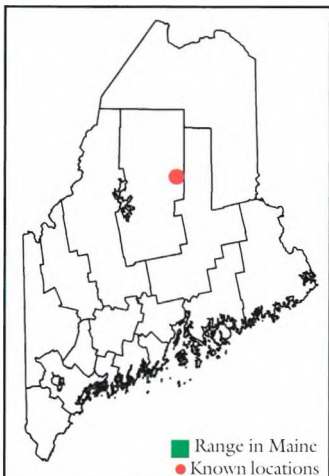
Brook mayfly is poorly known. It likely has a single-year life cycle. Adults emerge in late August. Subimagos probably remain close to the stream, where they cling to streamside vegetation and molt into final adult form. Adults only live for a few days and do not feed. Males and females gather over the brook in mating swarms. Females lay their eggs over the water surface. Eggs likely overwinter in the stream bottom and hatch the following spring. Nymphs undergo several instars, or size classes, as they molt and grow. Nymphs occur in stream bottoms scoured by the currents and ice. Mayfly nymphs feed on leaf detritus that fell into the stream the previous fall and has been broken down by other aquatic insect larvae and bacteria. Nymphs travel to the surface and emerge as adults, usually on summer evenings. Mayflies in Roaring Brook are likely an important source of food for brook trout, bats, dragonflies, and other wildlife.

Threats

There are no known threats to the species other than the inherent vulnerability of potentially being located at only a single site in the world, which is why this species is state-listed as endangered. Roaring Brook is protected for its entire length in Baxter State Park.

Conservation and Management

In 1946, Dr. B.D. Burks of the Illinois Natural History Survey described five new species in the family Heptageniidae, or flat-headed mayflies. Among these was a mayfly discovered by T.H. Frison on August 26, 1939 in Roaring Brook at the base of Mt. Katahdin in Baxter State Park. To date, it has been found nowhere else. Despite being one



of the rarest mayflies in the world, it is notable that no one has visited Roaring Brook to look for it since its initial discovery. Therefore, its current status and populations are unknown. Biologists are initiating surveys in 2003 to reconfirm the existence of this rare insect. Additional high-elevation streams need to be surveyed also to determine whether this mayfly may occur at other locations. Because its location is well-protected, there are no specific conservation recommendations except maintaining the water quality of Roaring Brook. 🟡



Mark McCollough

The icy waters of Roaring Brook in Baxter State Park are habitat for the Roaring Brook mayfly.

**STATE
THREATENED**

Tomah Mayfly

(Siphonisca aerodromia)



Mark McCollough

Description

The Tomah mayfly has sometimes been referred to as a living fossil. Nymphs have greatly expanded, wing-like flanges on the abdomen, which are reminiscent of characteristics of fossil mayflies from the Carboniferous era. These large abdominal flanges, as well as small bumps on the thorax (midsection) of both nymphs and adults, distinguish the Tomah mayfly from all other mayflies. It is also an unusually large mayfly, measuring nearly an inch in length. This species is the only representative of its genus in the world.

Range and Habitat

The Tomah mayfly was first discovered in the early 1900s in northern New York. Unfortunately, in the 1930s a dam was constructed at this original location, and the species was apparently extirpated. It was rediscovered in 1978 at Tomah Stream in Codyville, Maine by a researcher from the University of Maine. It is this site from which the mayfly gets its common name. Extensive surveys in Maine have since located an additional 15 occurrences, and it is possible more may be found. The existing sites are widely distributed throughout western, central, eastern, and

northern Maine. The species has also been recently relocated at a new site in New York. Historic collections were made in Quebec (1941, 1963) and Labrador (1952). Attempts to locate the species in the Maritime Provinces during the early 1990s were unsuccessful.

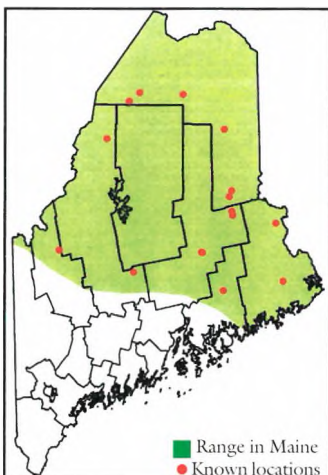
The Tomah mayfly inhabits small rivers and streams bordered by extensive areas of seasonally flooded sedge

meadow. This is a dynamic habitat, characterized by a short period of flooding from snow and ice melt during April-May, followed by receding water from the floodplain during summer months. Standing water often remains until May or June as pools, channels, or isolated ponds. Tussock sedge and rushes are typically the dominant vegetation in these habitats. The inundated, decomposing sedge provides shelter, bottom surface, and abundant food for an unusually diverse and abundant aquatic invertebrate community.

Life History and Ecology

Tomah mayflies complete their life cycles in a single year. Eggs are laid in the stream channel during June, and the larvae, or nymphs, hatch the following November or December. The immature mayflies grow slowly beneath the ice, feeding on decomposing vegetation and algae. After snowmelt in March or April, the nymphs migrate from the stream channel to the adjacent inundated floodplain. Here they become predaceous and feed on other species of mayfly nymphs. This predatory behavior is highly unusual for mayflies, most of which feed on dead plant material. In the floodplain, the nymphs grow rapidly.

During the last two weeks of May, the nymphs molt to the final stage of larval development. Finally, in late May and early June, they crawl out of the water onto an upright stem or leaf and molt to the winged subadult form. This “hatching” period occurs mainly during the late morning and early afternoon hours, and the population emerges over a period of about 10 days. The newly emerged subadults then fly to the forest canopy along the stream, and in about 3-4 days molt to the final adult stage. The adults live from 1-9 days, during which mating and egg laying take place over the stream in the early evenings. They do not feed as adults. Female Tomah mayflies have the ability to reproduce parthenogenetically – that is, they do not require a male to fertilize their eggs. Young produced in this manner are identical genetic copies of their mother.



Threats

Because most of the Tomah mayfly's life is spent in the aquatic stage, it is affected by alterations of the river and stream ecosystems where it lives. Dams have caused extirpation of this species in New York, and the long history of damming rivers in Maine has likely resulted in the loss of some populations. Pollution sources that degrade water quality could affect the survival of eggs and nymphs. Aerial spraying of insecticides could directly affect all life stages. Habitat alteration from dredging, filling, or introduction of non-native plants or fish is detrimental.

Conservation and Management

The Tomah mayfly is one of the rarest mayflies in the world, and all but one of its currently known populations are found in Maine. Consequently, Maine has an important responsibility in protecting the species. In 1997, the Tomah mayfly was listed as threatened in the state because of its limited number, distribution, and size of populations, and its near-endemic status. It is also a former candidate for federal listing. Despite extensive statewide surveys of over 150 suitable locations, it is currently known from only 16 sites in Maine. Three of these sites – Tomah Stream meadow, Mattagodus Stream, and Thompson Deadwater – are either partly or wholly under conservation ownership by the state, and have the potential to be maintained and managed for the mayfly. The Tomah mayfly shares its habitat with other rare species including the brook floater mussel, yellow rail, Atlantic salmon (endangered), yellow lampmussel (threatened), and bald eagle (threatened).

Researchers at the University of Maine have done many studies to document the life history and habitat requirements of this mayfly. MDIFW is continuing surveys throughout the state to search for new populations, and recovery plans are being drafted to identify conservation goals.

The greatest conservation concern for the Tomah mayfly is protecting its wetland habitat from alteration or degradation resulting from damming, dewatering, alteration of flow, and deterioration of water quality. Adhering to state wetland and Shoreland Zoning laws and water quality Best Management Practices contributes greatly to maintaining the quality of aquatic habitats for this species. Shoreland zoning and LURC zoning standards provide protection of habitat up to 250 feet from larger rivers. Some forest companies voluntarily extend the conservation of intact, forested riparian zones to 330-600 feet for larger rivers.

Recommendations:

- ✓ Prior to land development or forest harvesting near waterways providing habitat for threatened and endangered species, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain areas adjacent to waterways providing habitat for threatened and endangered species in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.

- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow Shoreland Zoning and LURC standards.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at least 250 feet from waterways providing habitat for threatened and endangered species.
- ✓ To preserve adult feeding and maturation habitat for threatened and endangered dragonflies and mayflies, maintain forested buffers and wetlands up to 600 feet from rivers where they occur.
- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of waterways providing habitat for threatened and endangered species.
- ✓ When projects are proposed within 250 feet of waterways providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
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- ✓ Avoid stream alteration projects (water withdrawals, dredging, rip-rap, channelization, pipeline crossings, dams) that would alter flow or remove natural stream features such as riffles and pools.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ It is illegal to introduce fish species. Such introductions could alter aquatic invertebrate communities. 🟡

STATE
ENDANGERED

Ringed Boghaunter

(*Williamsonia lintneri*)



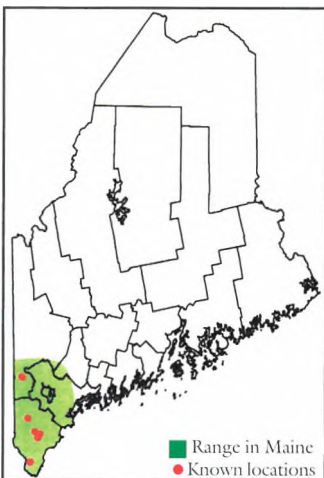
Mark McCollough

Description

This small dragonfly, only 1½ inches in length, is identified by a distinct orange ring on each black abdominal segment. It has a straw-yellow face, bright yellow mouthparts, and bluish-green eyes.

Range and Habitat

The ringed boghaunter is one of the rarest dragonflies in North America. It is found in acidic fens, bogs, and small wetlands dominated by *Sphagnum*, and is sometimes associated with forests of Atlantic white cedar, black spruce, or larch. Fewer than 60 populations are known, primarily in the Northeast (Maine, Rhode Island, Connecticut, Massachusetts, New Jersey, and New Hampshire), but it has recently been discovered in Michigan and Wisconsin. It is currently believed to be at the northern extent of its range in southwestern Maine, where it has been found at only six sites in York and southern Oxford Counties.



Life History and Ecology

Ringed boghaunters are among the first dragonflies to emerge in early spring. The flight period begins in late April to early May and extends to mid-June. Adults are typically observed in forested areas up to ⅓ mile from breeding wetlands. Here they

forage on small insects and mature for a week or two before returning to the wetlands to breed. Adults bask near the ground in warm, sunny openings in the forest, along road edges, and on tree trunks or rocks. They are docile and easily approached, sometimes landing on observers. Adults at breeding wetlands are not territorial. Mating occurs in forested areas associated with breeding sites to avoid harassment and predation from birds and other dragonflies. Oviposition (egg laying) occurs in open, sedge-dominated wetlands, where eggs are deposited in small pools overlaying mats of *Sphagnum*. The eggs hatch in summer and the larvae mature over a one-year period. Emerging larvae crawl out of the water onto plants, split their larval skins (exuvia), and fly away as immature adults (called teneral).

Threats

Loss and degradation of breeding wetlands and surrounding forests from development, roads, utility rights-of-way, and water level manipulations have resulted in the extirpation or declining populations in the Northeast. Direct and nonpoint sources of pollution (e.g., agricultural and residential lawn fertilizers and chemicals), siltation, and filling of small wetlands degrade water quality and boghaunter habitat. Use of broad-spectrum pesticides (e.g., for gypsy moth or mosquito control) directly affects boghaunters and their insect food supply. Vehicle mortality, especially of basking adults on cool spring days, reduces populations.

Conservation and Management

The ringed boghaunter was listed as state endangered in Maine in 1997 because of its extreme rarity

and the vulnerability of its habitat to development. This species was also a former candidate for federal listing and is listed as vulnerable by the International Union for the Conservation of Nature.

Conservation of the ringed boghaunter requires protecting both breeding wetlands and adjacent forested uplands, especially those areas within 600 feet of breeding wetlands. Many breeding wetlands are less than an acre in size and may be overlooked during routine municipal or state environmental permit review. Data on known locations are available from MDIFW. State wetland laws do little to protect adjacent forested upland. Boghaunters are strictly protected from take (possession, collecting, or killing) by the MESA without a scientific collecting permit.

Some boghaunter populations are comprised of individuals from multiple breeding wetlands located near each other, while others persist only as isolated populations. These isolated populations are at greatest risk from habitat loss and degradation. In many instances, boghaunters share their habitat with Blanding's turtles (endangered), spotted turtles (threatened), and ebony boghaunters, a closely related Species of Special Concern. Some boghaunter breeding wetlands are vernal pools. Boghaunter habitat is best protected by preserving wetlands and adjacent forested upland buffer by acquisition and easement, landowner outreach, and land use regulations. Techniques for population enhancement or augmentation are unknown at this time.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain ringed boghaunter wetlands in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting breeding wetlands and a 250-foot upland buffer as Resource Protection Districts.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ To preserve adult feeding and maturation habitat for threatened and endangered dragonflies and mayflies, maintain forested buffers and wetlands up to 600 feet from wetlands where they occur.
- ✓ Permit no activities that could lead to the loss or degradation of wetlands, including filling, dredging, sedimentation, or changing hydrology, unless approved by MDIFW.

- ✓ When projects are proposed within 250 feet of wetlands providing habitat for endangered or threatened species, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).

- ✓ Avoid intensive development within 600 feet of boghaunter wetlands. Minimize the footprint of yards, buildings, and roads within this area to minimize loss of upland habitat and sources of mortality.

- ✓ Low intensity timber harvesting (single tree, group selection, small patch cuts) is compatible as long as operators avoid wetlands. Employ *Forestry Habitat Management Guidelines for Vernal Pool Wildlife in Maine* for timber harvesting around vernal pools and pocket swamps (handbook available from MDIFW, SHS #41, Augusta, ME 04333). 🟡

Small wetlands and vernal pools are home to the ringed boghaunter in southern Maine.



Mark McCollough

**STATE
THREATENED**

Pygmy Snaketail

(Ophiogomphus howei)



Blair Nikula

Description

The snaketail dragonflies are indicators of clean, free-flowing waters, and Maine has more species than any other state. The pygmy snaketail is a small, 1¼-inch, olive-green dragonfly with brown stripes and bright yellow markings on a black abdomen. The wings have a distinctive yellow-orange cloud at the base which encompasses about half or more of the rear wing. The larvae and exuviae (cast larval skins) can be identified by the shape of their wing pads and structures on their abdomen.

Range and Habitat

This dragonfly occurs in eastern North America from Kentucky north to Minnesota and east to New Brunswick. It has a patchy distribution throughout this range, and is typically not abundant at most sites where it is found. The pygmy snaketail prefers clean, fast-flowing, moderate to large-sized rivers with gravel or sand bottoms in predominantly forested watersheds. In Maine it occurs in the Saco,

Crooked, Aroostook, Penobscot (East and West Branch and main stem), St. Croix, Machias, and Allagash Rivers.

Life History and Ecology

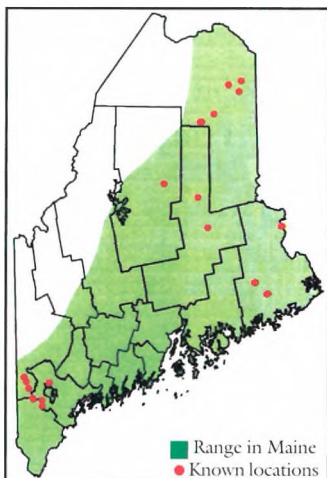
Dates of nymph emergence depend on water temperatures, but typically the pygmy snaketail emerges in

early June in southern Maine and mid to late June in the north. The aquatic nymphs crawl out of the river onto rocks, detritus, and vegetation along riverbanks, split their larval skins (exuvia), and fly away as immature adults (called teneral). The young adults may fly significant distances from the river to feed in forested environments. They are believed to feed on smaller flying insects high in the forest canopy, where the adults are exceedingly difficult to find. Adults require about a week to mature. Because of their small numbers and cryptic behavior, populations are most frequently located and assessed by finding exuvia.

Adults are not territorial along the river, but have been observed returning in small numbers to patrol the river in search of mates, and to lay eggs. Because of their diminutive size, they probably cannot compete with larger territorial dragonflies along the river (and may even be consumed by some!). Their flight period may last through July. Studies on the Aroostook River suggest that nymphs undergo 10-12 instars (periods of growth) and require two years to mature. Nymphs burrow into clean gravel and sand, usually in deeper water where they prey on other aquatic invertebrates. Local emergence of all the nymphs at once takes place over a 1-4 day period and peaks between 10:00 a.m. and 2:00 p.m. Mass emergence may serve as a survival strategy to saturate potential predators, especially birds.

Threats

The distribution of dragonflies in the genus *Ophiogomphus* (the “snaketails”) is limited by the availability of clean, free-flowing rivers and streams having appropriate sand and gravel bottoms and



forested riparian areas. They are one of the least tolerant groups of dragonflies to changes in water quality. Increased sedimentation and other sources of nonpoint pollution (e.g., runoff from roads and storm sewers, agricultural fertilizers, pesticides) contribute to their demise. Dams and intensive watershed development have caused past declines. Shoreline development, roads in riparian habitats, excessive riparian logging, and use of broad-spectrum pesticides further threaten populations. In the Midwest, *Ophiogomphus* species are no longer found in watersheds that are less than half to two-thirds forested.

Conservation and Management

The pygmy snaketail was a former candidate for federal listing. It was state-listed as threatened in Maine in 1997 because of its limited distribution and low numbers. This dragonfly has declined and disappeared from many rivers in the Northeast. Surveys have shown that Maine, with its relatively clean, free-flowing rivers in forested watersheds, has some of the best populations remaining in the Northeast. As such, Maine will play a major role in the future conservation of this species.

Conservation of the pygmy snaketail and other riverine dragonflies and damselflies requires protection of clean, unaltered rivers with natural forested riparian areas. This species shares much of its riverine habitat in Maine with other listed species, such as the Atlantic salmon (endangered), yellow lampmussel (threatened), tidewater mucket (threatened), and other rare species like the brook floater (mussel) and wood turtle. Adhering to state wetland and Shoreland Zoning laws and water quality Best Management Practices contributes greatly to maintaining the quality of aquatic habitats for this species. Shoreland zoning and LURC zoning standards provide protection of habitat up to 250 feet from larger rivers. Some forest companies voluntarily extend the conservation of intact, forested riparian zones to 330-660 feet for larger rivers. Pygmy snaketails are strictly protected from take (collecting, possessing, or killing) without a scientific collecting permit.

Recommendations:

- ✓ Prior to land development or forest harvesting near waterways providing habitat for threatened and endangered species, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain areas adjacent to waterways providing habitat for threatened and endangered species in a low-density, rural

setting and identify these areas in comprehensive plans. Consider protecting waterways and a 250-foot upland buffer as Resource Protection Districts.

- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow Shoreland Zoning and LURC standards.
- ✓ To preserve water quality and river functions, maintain contiguous, forested riparian habitats at least 250 feet from waterways providing habitat for threatened and endangered species.
- ✓ To preserve adult feeding and maturation habitat for threatened and endangered dragonflies and mayflies, maintain forested buffers and wetlands up to 600 feet from rivers where they occur.
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- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution.
- ✓ It is illegal to introduce fish species. Such introductions could alter aquatic invertebrate communities. 🟡

**STATE
ENDANGERED**

Clayton's Copper

(Lycaena dorcas claytoni)

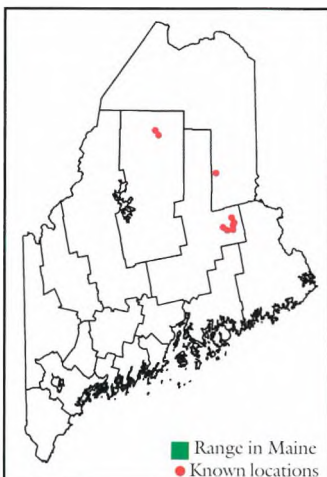
Description

Maine has an important role in conserving the rare Clayton's copper butterfly. This small metallic purple and bronze jewel is found only in Maine and just over the border in New Brunswick. The Clayton's copper is a small, orange-brown butterfly with a wingspan of about one inch. The upper surface of the wings is mostly brown, with small black spots scattered throughout and a few faint, orange-red spots near the rear angle of the hindwing. The underside is orange-brown, also with scattered black spots, and with light orange markings along the outer margin of the hindwing. Males have a distinguishing purple iridescence over the upper surface of the wings. The Clayton's copper is an isolated subspecies of the more widely distributed Dorcas copper (*L. d. dorcas*), which is typically larger, brighter in color, and has more and larger wing spots.

Range and Habitat

Although the Dorcas copper ranges across North America from Newfoundland to the Great Lakes states and the Northwest Territories, it is not found in the eastern United States, and it occurs no closer to Maine than the St. Lawrence River/Gaspé region of Quebec. The Clayton's

copper is believed to be a separate subspecies, occupying a very small area centered on eastern Penobscot County. It is currently known from only eleven sites worldwide – nine in Maine and two sites just over the border in New Brunswick. Most populations are concentrated within a 10 square mile area in the vicinity of Lee and Springfield in northeastern Penobscot County, but the butterfly



Beth Swartz

is also known from two sites in northern Piscataquis County and one site in southern Aroostook County.

Clayton's copper is found only in association with its sole larval host plant, the shrubby cinquefoil (*Potentilla fruticosa*). This uncommon shrub requires limestone soils and has a scattered distribution throughout Maine. Although not considered rare, there are relatively few cinquefoil stands large enough to support viable Clayton's copper populations. Shrubby cinquefoil is intolerant of shade and can only thrive in open areas. It typically occurs along the edge of calcareous (limestone) wetlands. It can also be found in old fields, but these stands are typically short-lived because of forest succession. All of the currently known occurrences for Clayton's copper are in non-acidic fens and bogs, and streamside shrublands or meadows.

Life History and Ecology

Clayton's copper butterflies take one year to complete their life cycle. Eggs are laid singly in August on the underside of cinquefoil leaves, usually near the top of smaller plants. 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. The larva then has five instars, or molts, before it turns into a pupa. Adult butterflies emerge during a period when shrubby cinquefoil is blooming, typically late July through August. Throughout the flight period, Clayton's coppers remain near cinquefoil stands, where the abundant

yellow flowers provide a primary nectar source. Adults are most active during warm, sunny, windless days when they fly short distances to feed and seek mates. They are not strong fliers, and generally fly low over the vegetation.

Threats

In 1997, Clayton's copper was listed as endangered in Maine because of the extremely limited number, size, and distribution of its populations, the limited availability of its habitat, and its near-endemic status in Maine. Threats to the host plant also threaten the butterfly. Flooding of wetlands caused by beavers or artificial impoundments can destroy eggs, larvae, and stands of cinquefoil. Conversely, water drawdown for irrigation or other purposes can dry wetlands sufficiently to allow trees and shrubs to invade cinquefoil stands. Forest succession is often the most serious threat to both upland and wetland sites, and several of the existing locations are in need of management to ensure continuing suitability for the butterfly and host plant. Aerial insecticide spraying could also directly harm the Clayton's copper. Although collecting is not known to be an issue, illegal poaching could pose a threat. As a state-endangered species, the Clayton's copper is protected from take (possession, collecting, or killing) by the Maine Endangered Species Act.

Conservation and Management

Clayton's copper was first discovered in Maine and described as a distinct subspecies by A.E. Brower in 1940. Much remains unknown about the life history requirements and conservation needs of both the butterfly and its host plant. Prior to the early 1980s, Clayton's copper was thought to be restricted to a small region of the state near the towns of Lee and Springfield. Surveys for Clayton's copper in the mid-1980s and early 1990s located several new sites, and the butterfly's known range was expanded to the north and east. Only one site, Dwinal Pond flowage in Lee and Winn, is known to support a relatively large population of the butterfly. Because of the rarity of large, persistent stands of shrubby cinquefoil, it is not likely that any additional large populations will be discovered.

The Clayton's copper is listed as endangered in Maine. It is also a former candidate for federal listing. Three of the best sites for the butterfly – Dwinal Pond flowage, Mattagodus Meadows, and Little Crystal Bog – are in conservation ownership and have the greatest potential to be managed for the butterfly. In 2000, MDIFW began studies to assess and monitor the butterfly's population and habitat characteristics at Dwinal Pond flowage. Management efforts will be completed to improve existing stands of cinquefoil and create and maintain new upland stands of the host plant.

Recommendations:

- ✓ Prior to land development or forest harvesting near wetlands providing habitat for Clayton's coppers, consult with a biologist from MDIFW to assist with planning.
- ✓ Municipalities should strive to maintain areas adjacent to Clayton's copper sites in a low-density, rural setting and

identify these areas in comprehensive plans. Consider protecting wetlands and a 250-foot upland buffer as Resource Protection Districts.

- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Follow Shoreland Zoning and LURC standards.
- ✓ To preserve water quality and wetland functions, maintain contiguous, forested riparian habitats at least 250 feet from wetland habitat for Clayton's coppers.
- ✓ Avoid placing roads, houses, yards, and other developments within 250 feet of wetland habitat for Clayton's coppers.
- ✓ When projects are proposed within 250 feet of wetland habitat for Clayton's coppers, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Manage encroachment of woody vegetation in cinquefoil stands by removing trees. Maintain upland sites in an early successional stage that provides open, uncrowded growing conditions for shrubby cinquefoil. Managing fields for shrubby cinquefoil near known Clayton's copper sites may help provide additional habitat or establish new populations.
- ✓ Avoid road crossings or use of heavy equipment in streams or rivers.
- ✓ Avoid stream or wetland alteration projects (water withdrawals, dredging, rip-rap, pipeline crossings, channelization, dams) without approval from MDIFW.
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of waterways providing habitat for threatened and endangered species.
- ✓ To maintain or improve water quality, conduct thorough reviews of dam and wastewater discharge proposals. Avoid land uses that would contribute to non-point sources of pollution. 🟡

**FEDERALLY
ENDANGERED**

Karner Blue

(Lycaeides melissa samuelis)

Description

This butterfly is one of the few invertebrates known to be extirpated from Maine. The Karner blue is a small butterfly with a wingspan of just one inch. Males have attractive deep violet-blue wings with bold, black margins fringed in white. Females have dusky brownish-blue wings with irregular bands of orange crescents and metallic spots along the bottom back portion of each wing. The underside of the wings of both sexes is gray to fawn in color with orange crescents and tawny spots near the edges. The caterpillar is green with short pale lines. The Karner blue was first described more than a century ago in Karner, New York.

Range and Habitat

At one time, the Karner blue was found in a nearly continuous band across ten states and one province, from Minnesota and southern Ontario to western Maine. It has since been extirpated from three states, including Maine. It was known to occur only in the Oxford Plains near Norway in western Maine. Today most remaining populations are found in southwestern Michigan and Wisconsin. A small Karner blue population persists near Concord, New Hampshire, and there are several populations in New York.

Within its range, the species is restricted to dry, sandy areas with open woods and clearings supporting wild lupine (*Lupinus perennis*) (this is not the familiar European lupine that has successfully spread throughout Maine). This habitat is usually associated with pitch pine or scrub oak woodlands that are maintained by fire at an early stage of plant succession.



USFWS

Life History and Ecology

The Karner blue cannot live without the wild lupine plant. It relies on wild lupines for nearly all of its life stages: egg, larva (caterpillar), pupa (chrysalis), and adult (butterfly). The Karner blue produces two generations each year. The first generation of adults emerges in late May to mid-June. Females lay their eggs on the underside of lupine leaves or stems. The eggs hatch in 7-8 days, and the larva and pupa stages last about 5-6 weeks. The second generation of adults emerges in mid-July to early August. Females of this generation lay their eggs singly on dried lupine seedpods or low on lupine stems. Adults die by the end of August or early September. Winter snows protect the eggs of the second generation until they hatch the following May. Adults feed on nectar from a variety of wildflowers, especially dogbane and New Jersey tea. The Karner blue is found only within the portion of the wild lupine's range where long periods of winter snow occur.

Threats

Because of their reliance on native lupine, populations were extirpated as pitch pine barrens that supported large stands of lupine were lost. Pitch

pine-scrub oak barrens are now a very rare natural community in Maine. Less than half of the historic acreage of pine barrens remains, and is restricted to just seven locations in the southern portion of the state. Habitat alterations from land development, sand and gravel extraction, and timber harvesting have resulted in habitat loss. The pine barrens community requires periodic burns or other disturbances to maintain vegetative structure. Fire suppression policies have resulted in the decreased vigor and extent of this natural community.

Conservation and Management

Karner blues underwent a precipitous decline in population size and distribution during the early 20th century, and were extirpated from Ohio, Pennsylvania, Maine, and Ontario. In Maine, the butterfly's sole location was also the only known site in the state for the native blue lupine. This extensive pitch pine community was lost to farming, development, pine plantations, and gravel and sand mining in the early 1900s, and the lupine and butterfly were extirpated. The Karner blue shared its habitat with many other rare butterflies and moths, including the persius duskywing and frosted elfin, two other butterflies that are believed to be extirpated in Maine. The Karner blue was listed as a federally endangered species throughout its former range in 1992. Attempts to protect and restore habitat and reintroduce populations of the butterfly are underway at several sites, including New Hampshire.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW or the Maine Natural Areas Program to assist with planning.
- ✓ Municipalities should strive to maintain important pitch pine barrens identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Where possible, expand existing public and conservation ownership of pine barren acreage to conserve large, contiguous blocks of habitat with a mix of young and old stands.
- ✓ If areas must be developed, minimize footprints of buildings, yards, and roads and landscape with indigenous pine barrens plants. Maintain fuel breaks around homes to minimize danger from wildfire. Compensate loss of pine barrens habitat by creating new pine barrens, restoring degraded habitat, or

placing existing habitat in long-term conservation.

- ✓ Encourage forest management plans that perpetuate pine barrens. Avoid plantations and site conversion, and encourage native species, particularly pitch pine.
- ✓ Consider controlled burning, mowing, and mechanical vegetation management to create a mix of young and mature pitch pine and scrub oak stands.
- ✓ Limit commercial extraction of gravel and sand in pine barrens. Restore old gravel pits and agricultural fields to pitch pine habitat.
- ✓ Apply ¼ mile wide spray buffers around sections of pine barrens hosting rare and endangered species when spraying insecticides for control of gypsy moths and other pests. 🟡

**STATE
ENDANGERED**

**Edwards'
Hairstreak**
(Satyrium edwardsii)



Phillip deMaynadier

Description

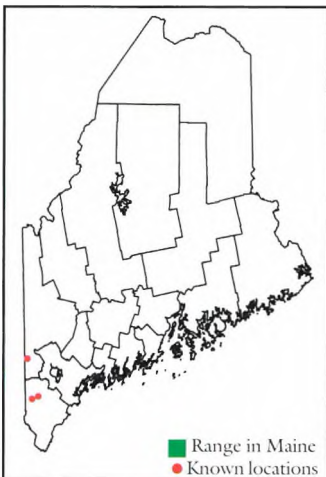
The Edwards' hairstreak is a small (1¼-inch), pale brown butterfly with a tiny tail on each hindwing. As with most North American hairstreaks, the upper sides of the wings are a uniform gray-brown and the undersides are paler. Unique among hairstreaks, the hindwing of the Edwards' hairstreak has a band of *oval*-shaped brown spots that are ringed by white near the rear margin of the wing. Another distinguishing characteristic is that the blue spot near the tail does not have an orange cap.

Range and Habitat

The Edwards' hairstreak occupies an extensive range across the eastern United States. It is found from northeastern Texas, central Missouri, and northern Georgia, north to extreme southeastern Saskatchewan, southern Manitoba, Ontario, Quebec, and southern Maine. Quebec and Maine represent the northeastern limit of this species.

Edwards' hairstreak has been found at only three sites in York County, including the towns of Fryeburg, Waterboro, and Shapleigh.

The Edwards' hairstreak inhabits dry oak thickets in pine woodlands or open areas. These sites typically have poor soil and sparse vegetation. Maine sites are all in pitch pine-scrub oak barrens, a rare and declining forest type.



Rare habitats such as pitch pine-scrub oak barrens support a unique assemblage of rare insects, including many moths and butterflies. The Edwards' hairstreak is found only where its host plant, scrub oak, grows in profusion.

Life History and Ecology

Edwards' hairstreaks have a one-year life cycle in Maine. A single flight period occurs from mid-June to early August. Males typically perch on the leaves and twigs of scrub oak where they await mating opportunities with females. Eggs are laid in the bark crevices of young host plants, which include scrub oak and occasionally black oak. Caterpillars that are nearly full-grown hide during the day in ant nests at the base of the host tree. In return for protecting the caterpillars, the ants feed on sugary secretions the caterpillars produce. Adults feed on the nectar of various flowers, including dogbane, goldenrod, meadowsweet, and milkweeds. Edwards' hairstreak hibernates as a larva or pupa and emerges the following summer.

Threats

Edwards' hairstreak may be susceptible to severe winter conditions at the northern extent of its range in Maine. A more important threat is limited habitat. There are only seven remaining pitch pine-scrub oak barrens in Maine, all located in the southwest part of the state. Formerly extending farther north along the coast, pine barrens were reduced to less than half of their historic acreage. Land development, sand and gravel extraction, timber harvesting, and fire suppression all contributed to the loss of pine barrens. In many areas, forest succession threatens to replace healthy scrub oak thickets with

less disturbance-adapted species like red oak and white pine. Historically, fire played a major role in regenerating and maintaining extensive areas of pitch pine and scrub oak barrens. Aggressive fire suppression has reduced the natural role of fire in the pitch pine-scrub oak forest type in Maine and elsewhere in the Northeast. The Edwards' hairstreak is also vulnerable to forest pesticide spraying for gypsy moth and other insect pests. Off-road vehicles may destroy fragile plant communities.

Conservation and Management

Edwards' hairstreak is listed as endangered because it is very rare at the northern extent of its range in Maine, it occupies habitat that has a very limited distribution in the state, its populations are highly fragmented, and it has experienced historical population declines.

Scrub oak stands are maintained in pitch pine barrens where periodic fires and dry conditions occur. Maintaining a pine barrens community requires periodic burns or other disturbances to maintain vegetative structure. Considerations should be made to reintroduce prescribed fires in discrete locations to maintain this disturbance-dependant community. Alternatively, carefully designed forest harvesting practices may be beneficial if they successfully regenerate patches of pitch pine woodland or open scrub oak barrens. Pitch pine barrens, formerly considered wastelands suitable for development, are ecologically important for species such as Edwards' hairstreak, pine barrens buck moth, several species of rare tiger beetles, pine barrens zanclognatha (threatened), twilight moth (threatened), and several rare plant species.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW or the Maine Natural Areas Program to assist with planning.
- ✓ Municipalities should strive to maintain important pitch pine barrens identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Where possible, expand existing public and conservation ownership of pine barren acreage to conserve large, contiguous blocks of habitat with a mix of young and old stands.
- ✓ If areas must be developed, minimize footprints of buildings, yards, and roads and landscape with

indigenous pine barrens plants. Maintain fuel breaks around homes to minimize danger from wildfire. Compensate loss of pine barrens habitat by creating new pine barrens, restoring degraded habitat, or placing existing habitat in long-term conservation.

- ✓ Encourage forest management plans that perpetuate pine barrens. Avoid plantations and site conversion, and encourage native species, particularly pitch pine.
- ✓ Consider controlled burning, mowing, and mechanical vegetation management to create a mix of young and mature pitch pine and scrub oak stands.
- ✓ Limit commercial extraction of gravel and sand in pine barrens. Restore old gravel pits and agricultural fields to pitch pine habitat.
- ✓ Apply ¼ mile wide spray buffers around sections of pine barrens hosting rare and endangered species when spraying insecticides for control of gypsy moths and other pests. 🟡

**STATE
ENDANGERED**

Hessel's Hairstreak

(*Callophrys hesseli*)

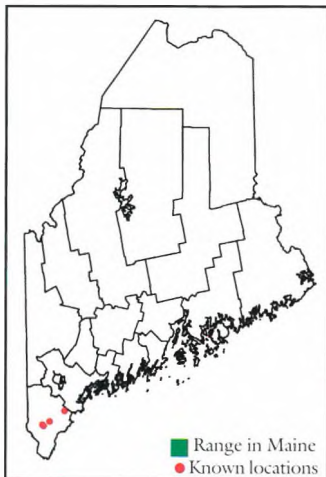
Description

Flitting high in the canopy of the cedars, this butterfly is often a challenge to capture or observe closely. The Hessel's hairstreak is a small butterfly, about one inch long. The wings are a beautiful emerald green and have a tiny tail on each hindwing. The green background color of the underside of the wings is highlighted with red-brown patches surrounding white spots and lines. This species can be differentiated from the related juniper hairstreak (*C. gryneus*) by the outward offset of the first white spot in a band of spots on the underside of the forewing. Habitat preference is also a key distinguishing feature, since the juniper hairstreak is generally restricted to dry fields and ridge tops that have red cedar stands.

Range and Habitat

The Hessel's hairstreak is restricted primarily to the coastal plain from southern Maine to Florida. Across its range, populations are widely scattered.

For unknown reasons, many areas with appropriate habitat do not support populations. Southern Maine is at the northern edge of the species' range, with only three populations documented from York County in Sanford, Saco, and Alfred. Hessel's hairstreak is found exclusively in or near swamps and bogs



M.C. Thomas

where its host plant, Atlantic white cedar (*Chamaecyparis thyoides*), is present. Atlantic white cedar also reaches its northern limit in Maine.

Life History and Ecology

Adult Hessel's hairstreaks emerge in mid to late May and fly into early to mid June in Maine. Adults are observed during fair weather while nectar-feeding on flowering shrubs (e.g., highbush blueberry, mountain holly, sheep laurel, rhodora, leatherleaf, huckleberry) in proximity to Atlantic white cedar (but sometimes up to ½ mile away). Males are also found perched on the tips of host tree branches where they await mating opportunities with females. Females lay their eggs singly on cedar foliage. Following a brief egg stage, the highly cryptic greenish larvae (caterpillars) consume cedar foliage, often near the tips of branches. After the larvae grow to full size, they hibernate as pupae (a sedentary, dormant stage), with the new generation of adults emerging the following spring.

Threats

Because Atlantic white cedar swamps are naturally rare in Maine, the Hessel's hairstreak was probably never abundant. However, the butterfly is

vulnerable to extirpation because of the incremental loss and conversion of cedar swamps from development and logging for their valuable rot-resistant timber. Some white cedar swamps are in southern Maine in areas of rapid residential growth. Furthermore, the quality of Atlantic white cedar swamps has been degraded by partial filling, deteriorated water quality, and water level changes. Insecticide spraying for gypsy moth control has reduced or eliminated Hessel's hairstreak populations in other parts of its range and may account for absences of the butterfly in some of Maine's cedar swamps. Excessive collection of adults could affect some small, isolated populations.

Unlike northern white cedar, Atlantic white cedar is shade-intolerant and requires periodic disturbance (e.g., fire, blowdown) to facilitate regeneration. As a substitute for natural disturbance, careful logging practices could be beneficial if designed to regenerate patches of mature cedar forest and reduce the threat of succession by other competing forest species (e.g., red maple, eastern hemlock).

Conservation and Management

The Hessel's hairstreak is generally rare and listed by many states throughout its range. Protection of Maine's few remaining Atlantic white cedar swamps and bogs is essential to secure a viable future for this butterfly in the state. In addition, efforts should be made to conserve as much of the surrounding upland forest as possible to serve as a water quality buffer. Maine's Atlantic white cedar swamps also host several rare plants including sweet pepperbush, smooth winterberry holly, spicebush, and clammy azalea.

State wetland laws protect the habitat for Hessel's hairstreak. However, the Natural Resources Protection Act (NRPA) offers only limited protection for upland development buffers, and no protection from potentially excessive logging practices. Hessel's hairstreak is protected from take (possession, collecting, or killing) by the MESA.

Recommendations:

- ✓ Prior to land development or forest harvesting near Atlantic white cedar swamps with Hessel's hairstreaks, consult with a biologist from MDIFW or the Maine Natural Areas Program to assist with planning.
- ✓ Municipalities should strive to maintain areas adjacent to Hessel's hairstreak sites in a low-density, rural setting and identify these areas in comprehensive plans. Consider protecting Atlantic white cedar

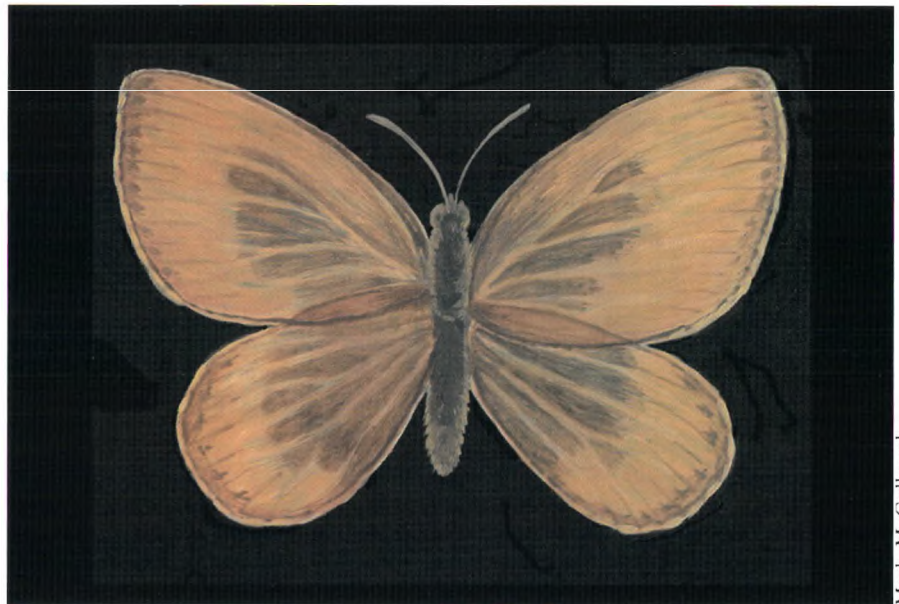
swamps and a 250-foot upland buffer as Resource Protection Districts.

- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Avoid projects that could result in the loss or degradation of Atlantic white cedar swamps hosting the Hessel's hairstreak, including filling, ditching, polluting, pipeline or road crossings, or changes to water level.
- ✓ When projects are proposed within 250 feet of Atlantic white cedar swamps, adhere to forestry Best Management Practices (handbook available from the Maine Forest Service, SHS #22, Augusta, ME 04333) and Maine Erosion and Sediment Control Recommendations (available from the Maine Department of Environmental Protection, SHS #17, Augusta, ME 04333).
- ✓ Avoid the use of broad-spectrum pesticides within ¼ mile of Atlantic white cedar swamps. 🟡

**STATE
ENDANGERED**

Katahdin Arctic

(Oeneis polixenes katahdin)



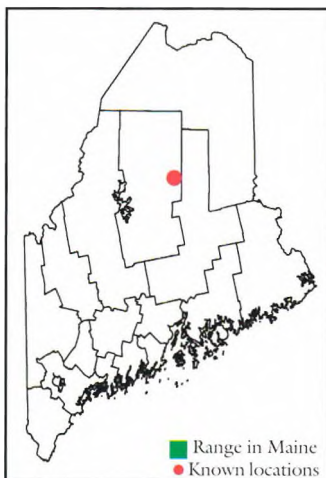
Mark McCollough

Description

The Katahdin arctic is a medium-sized butterfly (1½ inches) in the family Nymphalidae. Like other arctics, it is a dull yellowish-brown. This species is distinguished by its semi-translucent wings. The upperwing is gray-brown and females may have one tiny spot near the tip (other arctics and satyrs in Maine have more and larger spots). The underside of the hindwing is a mottled gray, brown, and black, and has a pronounced, dark medial band, edged with white. The body is covered with long, dark, hair-like scales. The larvae (caterpillars) are dark colored, thickly covered with short hair, and marked lengthwise with light-colored, broken stripes. The Katahdin arctic is often difficult to observe, flying only during calm days in July. It is inactive during periods of wind or rain.

Range and Habitat

The Katahdin arctic is a subspecies of the polixenes arctic (*Oeneis polixenes*), which occurs in the arctic tundra from Alaska through northern Canada to Labrador. The Katahdin subspecies is found nowhere else in the world but the summit of Mt. Katahdin in Baxter State Park in Maine.



The Katahdin arctic is found in alpine tundra-like habitat. It inhabits granite boulder fields interspersed with

sedges and grasses at elevations over 4,000 feet. This encompasses Katahdin's large Tableland area where other alpine species such as the American pipit (endangered) and northern bog lemming (threatened) also reside. The Katahdin arctic rests on lichen-covered rocks, and is restricted to treeless portions of the Tablelands dominated by sedges, alpine plants, sphagnum, and other mosses.

Life History and Ecology

The life history of the Katahdin arctic is not well documented. Its population size is unknown, but significant annual fluctuations are reported, perhaps related to climatic conditions. Adults emerge in early July and fly for about a month, although this is somewhat weather-dependent and can vary year to year. Females lay eggs on or close to sedges, the host plants for the species. After the eggs hatch, the larvae feed on sedges and grasses and grow slowly. When winter comes the larvae hibernate. Feeding resumes the following spring when warmer temperatures return. During this second year, the larvae grow to their maximum size and transform into pupae late in the summer. The pupae overwinter and adults emerge the following year, completing a two-year life cycle.

Threats

Collection of Katahdin arctic butterflies has threatened the population in the recent past. Currently, it is illegal to collect or possess this butterfly. However, there is still the potential for illegal collection, and two individuals were apprehended while illegally collecting the butterfly in the 1990s. Because the population fluctuates annually, excessive collecting during a population ebb could

deplete the numbers of butterflies beyond recovery.

Hikers on Mt. Katahdin who walk off the marked trails damage host plants or habitat, and crush eggs, larvae, and possibly adults. Sedge host plants and other fragile alpine vegetation are easily damaged by hikers. Soil erosion and damage to alpine plants is particularly prominent in the spring, when conditions prompt many people to walk around wet areas on the trails.

Conservation and Management

The Katahdin arctic is listed as endangered in Maine because of its isolated, limited distribution and small population. Butterfly counts are hindered by unfavorable weather and a desire by Park staff not to draw attention to the butterfly. MDIFW has not developed specific management plans for the Katahdin arctic. Because there is virtually no other potential habitat in Maine, management should be directed toward maintaining or enhancing the population on Mt. Katahdin. For now, it is important to protect alpine habitats and prevent illegal collecting. Protection of alpine areas on Mt. Katahdin will also benefit the American pipit, northern bog lemming, and many rare plants.

Recommendations:

- ✓ Stay on the trails when climbing Mt. Katahdin to avoid damaging the fragile alpine plant community.
- ✓ Collecting butterflies in Baxter Park is illegal. If

you observe someone collecting the Katahdin arctic butterfly or any other plant or animal on Mt. Katahdin, notify Park staff immediately. 🟡

*In the footsteps of Thoreau,
a MDIFW biologist surveys the
Tablelands of Mt. Katahdin for
Katahdin arctic butterflies and
American pipits.*



**STATE
THREATENED**

Twilight Moth

(Lycia rachelae)



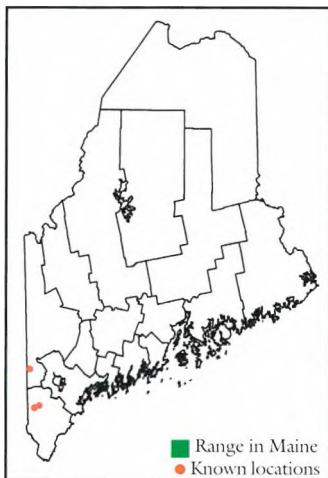
Mark McCollough

Description

Few people would recognize the inconspicuous twilight moth. However, this moth and a host of other invertebrates are only found in Maine's pitch pine-scrub oak woodlands. The twilight moth is a small, grayish-white moth that has a wingspan of about 1½ inches (males). Wings are reduced or nearly absent in the female. The wings are grayish-white or translucent with prominent dark grayish-brown veins. Blackish-brown stripes run perpendicular to the wing veins, and spots occur on the rear margin. The body is dark gray and is densely hairy in both sexes.

Range and Habitat

The twilight moth is found from Maine to Pennsylvania and west to Colorado and Manitoba. Its range in New England is highly scattered, and populations are restricted to pitch pine-scrub oak barrens. Maine seems to be at the northeastern extent of its range. Here the moth has been found only in pine barrens on sandy soils in glacial outwash plains in Fryeburg, Waterboro, and Shapleigh. The full range of habitats it uses is poorly understood. The twilight moth may also occur in other sand plain forests, including oak-pine forests or early successional aspen-birch thickets.



Life History and Ecology

Little is known of this moth's life history. Adults apparently emerge in early spring (April) and males begin searching for females. Males find females at night by searching for their scent (or pheromones) on the wind currents. Females are apparently flightless, or nearly so. After mating, the female lays eggs on or near host plants for the larvae, which include apples, birches, chokecherries, elms, poplars, willows, and other trees. It is unknown which trees serve as host plants in Maine. Eggs likely hatch in late spring or summer, and larvae mature and overwinter as larvae or pupae before emerging the following spring as adults.

Threats

Threats to this moth are not well understood. Small, separate populations at only three sites justified state listing of the moth as threatened in 1997. Loss of pine barren habitats to commercial and residential development in Maine is the greatest threat. Once development occurs within pine barrens, it is extremely difficult to manage and perpetuate pitch pine stands by fire. Aerial spraying of pesticides (including *Bt*), especially for other Lepidoptera like the gypsy moth, could eliminate populations. Conversion of forests to pine plantations destroys habitat. Off-road vehicles may destroy fragile plant communities. Gravel mining permanently destroys habitat.

Conservation and Management

Pitch pine-scrub oak barrens are rare habitats in Maine and are found at only seven sites. All have been surveyed for the twilight moth, but it has been found at only three sites. Pine barrens are host to a

suite of rare species, especially plants and invertebrates that depend on this unique habitat, such as the pine barrens zanclognatha (threatened), Edwards' hairstreak (endangered), and Karner blue butterfly (extirpated). Currently, there are 15 species of butterflies and moths recognized as "Special Concern" species associated with the state's pine barrens.

Maine has over half of the remaining pine barrens in New England. Much of Maine's pine barren habitat is now in conservation ownership. Even so, these sites need active management to maintain their diverse plant and invertebrate fauna. Large blocks of appropriate habitat are necessary for the long-term viability of moth populations.

Pine barrens are rejuvenated by fire, and the twilight moth may depend on this natural disturbance to create young, lush plants for the larvae to eat. Fire suppression may limit the viability of populations. If fire is suppressed, pine barrens will slowly mature to red oak and white pine forests that would not support the twilight moth. Prescribed burns are a routine management technique in New Jersey where the largest pine barrens remain.

More work is needed to assess populations, document life history, and determine appropriate habitat management for this species. Population introduction and management techniques are unknown at this time. As a state-threatened species, the twilight moth is protected from collection and possession by the Maine Endangered Species Act.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW or the Maine Natural Areas Program to assist with planning.
- ✓ Municipalities should strive to maintain important pitch pine barrens identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Where possible, expand existing public and conservation ownership of pine barren acreage to conserve large, contiguous blocks of habitat with a mix of young and old stands.
- ✓ If areas must be developed, minimize footprints of buildings, yards, and roads and landscape with indigenous pine barrens plants. Maintain fuel breaks around homes to minimize danger from wildfire. Compensate loss of pine barrens habitat by creating new pine barrens, restoring degraded habitat, or placing existing habitat in long-term conservation.

- ✓ Encourage forest management plans that perpetuate pine barrens. Avoid plantations and site conversion, and encourage native species, particularly pitch pine.
- ✓ Consider controlled burning, mowing, and mechanical vegetation management to create a mix of young and mature pitch pine and scrub oak stands.
- ✓ Limit commercial extraction of gravel and sand in pine barrens. Restore old gravel pits and agricultural fields to pitch pine habitat.
- ✓ Apply ¼ mile wide spray buffers around sections of pine barrens hosting rare and endangered species when spraying insecticides for control of gypsy moths and other pests. 🟡

STATE
THREATENED

Pine
Barrens
Zanclognatha
(*Zanclognatha martha*)



Mark McCollough

Description

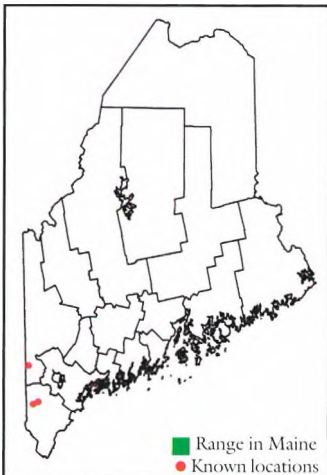
This small moth with a long name is one of many rare and endangered butterflies and moths found only in pitch pine-scrub oak barrens. The pine barrens zanclognatha is a small, nondescript, brown moth having a wingspan of slightly more than an inch. The wings are nearly uniformly tan with small brown spots and flecks. The body is brown and hairy.

Range and Habitat

The pine barrens zanclognatha is found in the Northeast from Virginia to Maine. For much of this range, it is only found in pitch pine-scrub oak barrens. In Maine it is found in pine barrens on sandy soils in glacial outwash plains in Fryeburg, Waterboro, and Shapleigh. It seems to prefer a closed pitch pine canopy.

Life History and Ecology

Little is known of this moth's life history. The adults fly at night from June to mid-August. It is locally abundant at many sites where it is found. Eggs are likely laid on or near the host plant, which is thought to be pitch pine. Eggs probably hatch in late spring, or perhaps they overwinter and hatch the following spring. Pupae are suspected to be found on the forest floor. It is believed that



this moth is more tolerant of fire suppression than other barrens moths.

Threats

Threats to this moth have not been well-documented. Small, separate populations at only three sites led to its listing as threatened in 1997. It is state-listed by other states in the Northeast. Loss of pine barren habitats to commercial and residential development in Maine is the greatest threat. Once pine barrens are developed, it is extremely difficult to manage and perpetuate remaining pitch pine stands by fire. Aerial spraying of pesticides (including *Bt*), especially for other Lepidoptera like the gypsy moth, can eliminate populations. Conversion of forests to pine plantations destroys habitat. Off-road vehicles may destroy fragile plant communities. Gravel mining permanently destroys habitat.

Conservation and Management

Pitch pine-scrub oak barrens are rare habitats in Maine and are found at only seven sites in the state. Not all have been surveyed for the pine barrens zanclognatha. Pine barrens are host to a suite of rare species, especially plants and invertebrates that depend on this unique habitat, such as the twilight moth (threatened), Edwards' hairstreak (endangered), and Karner blue butterfly (extirpated). There are 15 species of butterflies and moths recognized as "Special Concern" species associated with the state's pine barrens.

Maine has over half of the remaining pine barrens in New England. Much of Maine's barrens are in conservation ownership. Even so, these sites need active management to maintain their diverse plant and invertebrate fauna. Large blocks of

appropriate habitat are necessary for the long-term viability of moth populations.

Pine barrens are rejuvenated by fire, and the pine barrens *zanclognatha* may depend on this natural disturbance to create young, lush plants for the larvae to eat. If fire is suppressed, pine barrens will slowly mature to red oak and white pine forests that likely would not be able to support the moth. Prescribed burns are a routine management technique in New Jersey.

More work is needed to assess populations, document life history, and determine appropriate habitat management for this species. Population introduction and management techniques are unknown at this time. As a state-threatened species, the pine barrens *zanclognatha* is protected from possession and collection by the Maine Endangered Species Act.

Recommendations:

- ✓ Prior to land development or forest harvesting, consult with a biologist from MDIFW or the Maine Natural Areas Program to assist with planning.
- ✓ Municipalities should strive to maintain important pitch pine barrens identified by MDIFW as open space, identify these areas in comprehensive plans, and conserve accordingly.
- ✓ Use voluntary agreements, conservation easements, conservation tax abatements and incentives, and acquisition to protect important habitat for threatened and endangered species.
- ✓ Where possible, expand existing public and conservation ownership of pine barren acreage to conserve large, contiguous blocks of habitat with a mix of young and old stands.
- ✓ If areas must be developed, minimize footprints of buildings, yards, and roads and landscape with indigenous pine barrens plants. Maintain fuel breaks around homes to minimize danger from wildfire. Compensate loss of pine barrens habitat by creating new pine barrens, restoring degraded habitat, or placing existing habitat in long-term conservation.
- ✓ Encourage forest management plans that perpetuate pine barrens. Avoid plantations and site conversion, and encourage native species, particularly pitch pine.
- ✓ Consider controlled burning, mowing, and mechanical vegetation management to create a mix of young and mature pitch pine and scrub oak stands.
- ✓ Limit commercial extraction of gravel and sand in pine barrens. Restore old gravel pits and agricultural fields to pitch pine habitat.
- ✓ Apply ¼ mile wide spray buffers around sections of pine barrens hosting rare and endangered species

when spraying insecticides for control of gypsy moths and other pests. 🌟

*Most pitch pine-scrub oak barrens in Maine are in conservation ownership and are being managed for rare species like the pine barrens *zanclognatha*.*



Mark McCollough

**FEDERALLY
ENDANGERED**

American Burying Beetle

(Nicrophorus americanus)



Chris Raithel

Description

The striking red-on-black coloration and large size of the American burying beetle is remarkable (at least in invertebrate terms!), and it is unfortunate that this extraordinary “king of the carcass” is no longer commonly seen. The American burying beetle is the largest member of its genus in North America. Adults vary in body length from 1 to 1½ inches. This beetle is identified by its distinctive coloration of a black body with orange-red marks on the upper frontal head plate and on the plate just behind the head. Each wing has two bright orange-red spots. The antennae have large, orange tips, which are used to detect scent. Sexes are distinguished by the shape of an orange-red facial mark on the front of the head: males have a large rectangular mark, while females have a smaller triangular mark. American burying beetles are often covered with swarms of small red mites that help to keep the beetles clean and free of parasitic insect eggs.

Range and Habitat

Formerly, the American burying beetle ranged widely across eastern North America, occurring in 35 states from Nebraska to Maine, and south to Texas and Florida. However, the species has disappeared from most of its range and is currently found in significant numbers at only two locations. Block Island off the coast of Rhode Island supports a population of approximately 500 beetles, and a more widely dispersed and smaller population exists in Oklahoma. Individuals have also been found in Arkansas and Nebraska. The American burying beetle historically occurred in southwestern Maine, with a few locations in central Maine. However, recent searches for the beetle have been unsuccessful.

ful. The beetle likely has been extirpated in Maine as it has throughout much of its range. However, it is still officially classified as endangered and may yet be found here.

The American burying beetle is associated with several habitat types, ranging from grasslands and forest edges to woodlands. The Block Island habitat occurs on glacial moraine and has a variety of vegetation types ranging from mowed and grazed fields to shrub thickets. More important than the vegetative and physical characteristics of the habitat is the presence of adequate food in the form of small bird and mammal carcasses. Reduced availability of carcasses may have caused the decline of the beetle. Soil conditions conducive to digging and burying are also important. Well-drained soils with some clay, a detritus layer, and level topography are typical of American burying beetle sites.

Life History and Ecology

The American burying beetle has a fascinating life history and ecological role. It is active from late April through September. Adults are nocturnal and use their keen sense of smell to find remains of dead vertebrate animals on which they feed. Beetles can detect a carcass from two miles away.

Reproduction occurs primarily in June and July and depends on the availability of carrion. Carcasses of small vertebrates weighing approximately 100g (birds and small mammals) are used as a food source during the breeding period. Large carcasses (over 100g) of birds and mammals are needed for successful reproduction. Males locate carcasses after dark and emit pheromones to attract females. Fights between arriving males and females ensue until one male and female drive the others away and claim

the carcass for themselves. The two then crawl underneath the carcass and drag it to a suitable substrate for burying. They excavate a hole, bury the carcass, remove hair and feathers, cover it with secretions that slow the growth of bacteria, and lay up to 30 eggs in a brood chamber next to the carcass.

The eggs hatch in about four days, and the young are fed by the adults. Such parental care is unusual in insects other than social bees, wasps, and ants. The larvae develop over a 6-12 day period, then they disperse into the nearby soil to metamorphose into adults. They emerge as adults in 48-60 days, overwinter in the soil, and reproduce the following summer. Adults die after reproducing or during the overwintering period.

Threats

The American burying beetle underwent a precipitous decline in population and distribution during the 20th century. East of the Appalachians, most of the decline occurred prior to the 1920s. Elsewhere the decline occurred later. Reasons for the decline of the American burying beetle are unclear, but the most plausible explanation is habitat fragmentation and reduced food supply. Fragmented habitats decrease the reproductive success of many birds and smaller mammals, while increasing the presence of mid-sized predators such as raccoons, skunks, and foxes. These predators reduce the number of small birds and mammals and also compete with the American burying beetle for carcasses. Young passenger pigeons and greater prairie chickens were within the size range of carcasses favored by the American burying beetle, but are now extinct. Their demise may have affected burying beetle populations.

Conservation and Management

The American burying beetle was listed as federally endangered in 1989. Federal recovery efforts have been focused on preventing extirpation of existing populations, locating additional populations, and captive breeding for reintroduction of the species. Reintroductions have occurred on Nantucket and Penikese Islands in Massachusetts, and have shown initial signs of success.

Current recovery efforts are underway to protect existing populations and establish new ones in suitable sites. Habitat fragmentation should be limited in these areas, to prevent competition from predators that are common in disturbed environments. Other factors that would limit the prey base should be ascertained and steps taken to reduce their impact. 🍌

