



2021-2022

RESEARCH + MANAGEMENT REPORT

Endangered Species Conservation Strategies



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2021-22 RESEARCH & MANAGEMENT REPORT

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

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The Department of Inland Fisheries and Wildlife receives Federal funds from the U.S. Department of the Interior.

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

Cover photo: Short-eared owl – This threatened species nests on the ground in large open grassy landscapes, but can often be seen roosting on fenceposts or lone trees between hunting flights.

ENDANGERED SPECIES CONSERVATION STRATEGIES

Alexander Fish

A Mandate to Conserve Maine's Wildlife Diversity

In 1975, the State Legislature enacted Maine's Endangered Species Act (Maine ESA). Its primary directive reads:

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 or wildlife found in the State, as well as the ecosystems upon which they depend.

(Title 12, Maine Revised Statutes § 12801).

The Legal Framework Behind Listing Species under Maine's Endangered Species Act

Maine's state Endangered and Threatened (E/T) listing process is quite different from that of other states. Whereas other states typically do this by agency rulemaking alone, Maine follows a process wherein the legislature makes statutory changes in response to agency recommendations. This extra legislative oversight has perhaps averted legal petitions and court challenges that can confound endangered species conservation.

Authority to make those recommendations is split between three different agencies: The Maine Department of Inland Fisheries and Wildlife (MDIFW) holds that authority for all terrestrial animals, all birds (regardless of habitat), and all freshwater fauna. The Maine Department of Marine Resources has jurisdiction for animals (except birds) that occur in tidal waters. And Maine's Natural Areas Program in the Department of Agriculture, Conservation, and Forestry maintains the list of E/T plants.

Within MDIFW, staff and administrators review potential changes to the E/T list internally, then open them up to further scrutiny from peer scientists. Then we present proposals: first to the MDIFW Advisory Council, then at legally mandated public hearings. A formal 30-day com-



Edward's hairstreak – This endangered butterfly only occurs at three known sites in Maine and is dependent on pitch pine-scrub oak barrens, a rare forest type in the state. ©T. Persons

ment period follows, in compliance with Maine's Administrative Procedures Act. Next, we present our final recommendations as a bill to the Maine Legislature's Joint Standing Committee on Inland Fisheries and Wildlife, which considers such bills during the first year

(odd number) in biennial sessions. When the bill goes in front of the committee, the public has yet another opportunity to provide input.


The MDIFW thresholds for listing Maine species rely mostly on combinations of risks. These listing guidelines (see www.maine.gov/ifw/docs/listingHandbook.pdf) have successfully guided MDIFW and the Legislature's state-listing decisions since 1996.

To designate fauna as E/T, MDIFW biologists review the best available science on populations' and habitats' conditions and use objective listing criteria to judge species vulnerability. These criteria include low population abundance, dramatic declines, limited distribution or loss of range, significant fragmentation of populations or habitat, endemism, E/T status under the U.S. Endangered Species Act, and regional (Northeast) conservation status. Threats are secondary considerations, and do not trigger listing unless they present additional hazards to already-vulnerable species.

The last time the state E/T list changed was 2015, and the next update is due by 2023. This scorecard (**Figure 1**) shows the status of 52 species listed by MDIFW since Maine ESA was enacted, and whether each species has experienced improvements, setbacks, or no significant change in the following three categories:

- Population (based on indices of abundance, number of occupied sites, or trends)
- Research and monitoring that contributes to species conservation
- Habitat security (from conservation status, land management, or stewardship programs)

FIGURE 1. A SCORECARD FOR SPECIES LISTED BY MDIFW UNDER MAINE ESA, 1975 - 2022

BIRDS (CLASS AVES) 

▲ SIGNIFICANT IMPROVEMENTS
 ■ NO SIGNIFICANT CHANGES
 ▼ SETBACKS OR NEW LIMITATIONS

SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
American Pipit (<i>Anthus rubescens</i>)	Endangered (since 1997)	■	■	■
Arctic Tern (<i>Sterna paradisaea</i>)	Threatened (since 1997)	▼	▲	■
Atlantic Puffin (<i>Fratercula arctica</i>)	Threatened (since 1997)	▲	▲	■
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Delisted (since 2009)	▲	▲	▲
Barrow's Goldeneye (<i>Bucephala islandica</i>)	Threatened (since 2007)	■	▲	■
Black-crowned Night Heron (<i>Nycticorax nycti-corax</i>)	Endangered (since 2015)	▼	▲	■
Black Tern (<i>Chlidonias niger</i>)	Endangered (since 1997)	▼	▲	■
Common Gallinule (<i>Gallinula galeata</i>)	Threatened (since 2007)	■	▲	■
Golden Eagle (<i>Aquila chrysaetos</i>)	Endangered (since 1987)	■	■	■
Grasshopper Sparrow (<i>Ammodramus savannar-um</i>)	Endangered (since 1987)	■	■	■
Great Cormorant (<i>Phalacrocorax carbo</i>)	Threatened (since 2007)	▼	▲	■
Harlequin Duck (<i>Histrionicus histrionicus</i>)	Threatened (since 1997)	▲	▲	■
Least Bittern (<i>Ixobrychus exilis</i>)	Endangered (since 2007)	■	▲	■
Least Tern (<i>Sternula antillarum</i>)	Endangered (since 1984)	■	▲	■
Peregrine Falcon (<i>Falco peregrinus</i>)	Endangered (since 1975)	▲	▲	▲
Piping Plover (<i>Charadrius melodus</i>)	Endangered (since 1987)	▲	▲	▲
Razorbill (<i>Alca torda</i>)	Threatened (since 1997)	▲	▲	■
Roseate Tern (<i>Sterna dougallii</i>)	Endangered (since 1997)	■	▲	■
Sedge Wren (<i>Cistothorus stellaris</i>)	Endangered (since 1987)	■	▲	■
Short-eared Owl (<i>Asio flameus</i>)	Threatened (since 2007)	■	■	■
Upland Sandpiper (<i>Bartramia longicauda</i>)	Threatened (since 1997)	▼	▲	■



- ▲ SIGNIFICANT IMPROVEMENTS
- NO SIGNIFICANT CHANGES
- ▼ SETBACKS OR NEW LIMITATIONS

FISH (CLASS ACTINOPTERYGII)

SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
Redfin Pickerel (<i>Esox americanus americanus</i>)	Endangered (since 2007)	■	■	■
Swamp Darter (<i>Etheostoma fusiforme</i>)	Threatened (since 1997)	■	■	■

INSECTS (CLASS INSECTA)










Arctic Fritillary (<i>Boloria chariclea grandis</i>)	Threatened (since 2007)	■	■	■
Boreal Snaketail (<i>Ophiogomphus colubrinus</i>)	Threatened (since 2007)	■	■	■
Clayton's Copper (<i>Tharsalea dorcas claytoni</i>)	Threatened (since 2015)	■	■	■
Cobblestone Tiger Beetle (<i>Cicindela marginipennis</i>)	Endangered (since 2015)	■	▲	■
Edwards' Hairstreak (<i>Satyrrium edwardsii</i>)	Endangered (since 1997)	▲	■	■
Frigga Fritillary (<i>Boloria frigga saga</i>)	Endangered (since 2015)	■	■	■
Hessel's Hairstreak (<i>Callophrys hesseli</i>)	Endangered (since 1997)	■	■	■
Juniper Hairstreak (<i>Callophrys gryneus</i>)	Endangered (since 2007)	■	■	▼
Katahdin Arctic (<i>Oeneis polixenes katahdin</i>)	Endangered (since 1997)	■	■	■
Pine Barrens Zanclognatha (<i>Zanclognatha martha</i>)	Threatened (since 1997)	■	■	■
Rapids Clubtail (<i>Gomphus quadricolor</i>)	Endangered (since 2007)	■	■	■
Ringed Boghaunter (<i>Williamsonia lintneri</i>)	Threatened (since 2007)	■	▲	■
Roaring Brook Mayfly (<i>Epeorus frisoni</i>)	Threatened (since 2015)	■	■	■
Sleepy Duskywing (<i>Erynnis brizo</i>)	Threatened (since 2007)	▲	■	■
Tomah Mayfly (<i>Lycia rachelae</i>)	Threatened (since 1997)	■	■	▲
Twilight Moth (<i>Erynnis brizo</i>)	Threatened (since 1997)	■	■	■

MAMMALS (CLASS MAMMALIA)

Eastern Small-footed Bat (<i>Myotis leibii</i>)	Threatened (since 2015)	■	▲	▲
Little Brown Bat (<i>Myotis lucifugus</i>)	Endangered (since 2015)	■	▲	▲
New England Cottontail (<i>Sylvilagus transitionalis</i>)	Endangered (since 2007)	▲	▲	■
Northern Bog Lemming (<i>Synaptomys borealis</i>)	Threatened (since 1987)	■	▲	■
Northern Long-eared Bat (<i>Myotis septentrionalis</i>)	Endangered (since 2015)	■	▲	▲

-  SIGNIFICANT IMPROVEMENTS
-  NO SIGNIFICANT CHANGES
-  SETBACKS OR NEW LIMITATIONS




MOLLUSCS (CLASS BIVALVIA)

SPECIES COMMON NAME (SCIENTIFIC NAME)	MAINE ESA LEGAL STATUS	RECENT POPULATION CHANGES	RESEARCH & MONITORING	HABITAT MANAGEMENT & CONSERVATION
Brook Floater (<i>Alasmidonta varicosa</i>)	Threatened (since 2007)			
Tidewater Mucket (<i>Atlanticoncha ochracea</i>)	Threatened (since 1997)			
Yellow Lampmussel (<i>Lampsilis cariosa</i>)	Threatened (since 1997)			

REPTILES (CLASS REPTILIA)

Black Racer (<i>Coluber constrictor</i>)	Endangered (since 1987)			
Blanding's Turtle (<i>Emydoidea blandingii</i>)	Endangered (since 1997)			
Box Turtle (<i>Terrapene carolina</i>)	Endangered (since 1987)			
Spotted Turtle (<i>Clemmys guttata</i>)	Threatened (since 1987)			

SNAILS (CLASS GASTROPODA)

Six-whorled Vertigo (<i>Vertigo morsei</i>)	Endangered (since 2015)			
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Wildlife Conservation Status Categories in Maine

Rare and declining species in Maine may receive different conservation status depending on their rate of population decline and their extinction risk. The various conservation statuses (shown below with examples of species) make specific funding opportunities available for monitoring and land conservation. Threatened or Endangered species and associated habitats are provided with additional legal protections.

	Species of Greatest Conservation Need	Species of Special Concern	Threatened Species	Endangered Species
JUSTIFICATION	Declining populations or limited distribution in Maine	Declining populations or limited distribution and potential to be listed as Threatened or Endangered in Maine	Moderate risk of extinction in Maine	High risk of extinction in Maine
CONSERVATION ACTION	Listed in Maine's Wildlife Action Plan which makes species eligible for certain federal grants and funds	Increased population monitoring and sharing of best management practices with landowners and land trusts	Protected under the Maine Endangered Species Act, thereby providing protections for both species and their habitat. Known populations are included in the Environmental Review process, and MDIFW makes expert recommendations to avoid or minimize impacts on Endangered and Threatened species.	
EXAMPLE SPECIES	Common Eider Lemon Cuckoo Bumble Bee Muskrat Northern Leopard Frog Bobolink	Evening Grosbeak Canada Lynx Northern Spring Salamander Monarch Lake Whitefish	Atlantic Puffin Spotted Turtle Brook Floater Upland Sandpiper Clayton's Copper	New England Cottontail Piping Plover Black Racer Northern Long-eared Bat Katahdin Arctic



Meet the Biologists Working with Endangered & Threatened Species



Alexander Fish, Ph.D.

Wildlife Biologist

Alex is MDIFW’s Endangered & Threatened Species Coordinator. He spends most of his time working with both state and federally listed Endangered and Threatened species, as well as Maine species of Special Concern, and also coordinates the Maine Wildlife Action Plan, which identifies Species of Greatest Conservation Need. Much of Alex’s Endangered and Threatened species work relies on collaboration with biologists in MDIFW’s Bird, Habitat, Inland Fisheries, Mammals, and Reptile, Amphibian and Invertebrates Groups, all of whom contributed to information contained within this section.

Wildlife Research Assessment Section Biologists

MDIFW staff in the Wildlife Research and Assessment Section (WRAS) are tasked with developing surveys, research, and conservation strategies. Regional wildlife biologists in the Management Section often assume prominent roles in implementing strategies and conducting environmental reviews. Unlike most state wildlife agencies, where a small staff assumes all these duties, nearly the entire Department participates in Maine’s endangered species programs.

Danielle D’Auria

Wildlife Biologist, Waterbird Specialist

Phillip deMaynadier, Ph.D.

Wildlife Biologist, Reptile, Amphibian, and Invertebrate Group Leader

Erynn Call, Ph.D.

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Adrienne Leppold, Ph.D.

Wildlife Biologist, Songbird Specialist

Cory Stearns

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Kelsey Sullivan

Wildlife Biologist, Game Bird Specialist

Beth Swartz

Wildlife Biologist, Invertebrate Specialist

Jennifer Vashon

Wildlife Biologist, Black Bear and Canada Lynx

Derek Yorks

Wildlife Biologist, Reptiles and Amphibians

Brad Zitske

Wildlife Biologist, Shorebird Specialist

Endangered Species Conservation Strategies

There are no easy fixes or shortcuts for species on the brink of extirpation (disappearing from Maine). Reversing the fate of a species (recovery) almost always requires decades of management, employing strategies that not only address the factor(s) that led to species rarity, but also new threats that arise once populations and/or habitats are compromised and vulnerable.

The Bald Eagle: A Success Story

In the mid-1940s, persistent byproducts of the insecticide DDT began to greatly depress the nesting success of raptors, especially fish-eating birds. By 1978, the bald eagle — our national symbol! — was endangered or threatened in all 48 contiguous states.

During that time, in addition to contaminant influences, Maine's bald eagles also faced increasing habitat threats and nest disturbances. In 1962, MDIFW began monitoring bald eagle populations; and in 1967, we initiated four decades of contaminants research. In 1972, we started intense habitat protection efforts. Our agency and others addressed habitat threats by forging cooperative agreements with landowners of key eagle habitats over the course of 18 years. Over the following 19 years, we enacted special regulations for the oversight of land use permitting decisions. MDIFW did not delist bald eagles until 2009, when enough conservation lands and easements had been established to create a safety net protecting traditional nesting habitat from future threats.

Maine's Cave Bats: A Work in Progress

In 2015, cave bats were newly listed as Endangered or Threatened in Maine. Over the span of just a few years, white-nose syndrome caused Maine's little brown bat and northern long-eared bat populations to decline by roughly 90%. First detected at a New York cave in 2006 and caused by a non-native fungus, white-nose syndrome has killed



The little brown bat was once a common species in Maine, but has experienced population declines due to white-nose syndrome

millions of bats across the U.S. For perspective, that level of decline would reverse all 40 years of bald eagle progress — at ten times the rate of change.

As we do with most newly listed species, Maine's biologists have started monitoring and researching bat populations to guide conservation strategies. While white-nose syndrome remains persistent, there is evidence that some bat populations are beginning to cope with it. Still, bats face a very slow population recovery dictated by their slow life history (raising only one pup each year). Ultimately, biologists will also need to address risks like recreational cave use, disruption of maternity colonies, and incidental mortality or injury from low-speed wind turbines operating at night.

Habitat Maintenance/Enhancement Strategies

Maintaining abundance - Some listed species are highly specialized to rare habitats; and in those cases, the key conservation focus is habitat maintenance or enhancement. One of the best examples of this in Maine is the six-whorled vertigo, a tiny land snail reliant on calcareous fens typically only found in areas of limestone bedrock, as opposed to the granite that underlies most of the state, resulting in primarily acidic soils and waters that are not suitable for the vertigo. Since this limitation is unlikely to change, conservation of specific sites is the only practical strategy for this species and others whose habitats are similarly limited. The primary mandate of Maine ESA is to avoid losses of Maine's biodiversity. With that in mind, while it is not always possible to fully recover listed species as self-sustaining populations or to delist species with naturally limited habitats, we do have the tools to minimize their extirpation risk.

Enhancing quality - For some species, habitat quality (rather than abundance) is the bottleneck. Take the brook floater: while Maine's extensive waterways seem to offer ample riverine habitat for this threatened freshwater mussel, water quality and connectivity barriers render some streams and rivers unsuitable. Maine is the U.S. brook floater stronghold, so "as Maine goes, so goes the nation": brook floaters were recently petitioned for range-wide listing under the federal ESA.

Working regionally - The brook floater is also an example of ongoing conservation efforts across state boundaries. Maine has contributed brook floaters for captive hatchery propagation and subsequent reintroduction to restored waters throughout the Northeast. It's likely that unsuitable stream habitat can be remediated by restoring riparian buffers and paying careful attention to watershed land use practices.

Staying youthful and connected - Some endangered wildlife rely on transient habitats, such as grasslands, old fields, shrublands, and young forests. A few such state-listed species include upland sandpipers, grasshopper sparrows, black racers, juniper hairstreak butterflies, and New England cottontails. Without active management, transient habitats naturally transition into forest, rendering a site unsuitable for these species. Connectivity can also be a challenge – without a large block, or mosaic, of early successional habitats, a setting can become too fragmented for these species. In such cases, thoughtful land management and incentives to create and enhance transient habitats are more beneficial than regulatory Maine ESA provisions.

Giving the barrens a hand - Another variation on this theme are habitats that once rejuvenated themselves naturally, but no longer do, such as the Northeast dry pine barrens. These habitats emerged in sandplains left by the retreat of glaciers, and persisted in part due to naturally occurring wildfires. A pattern of wildfires favors fire-resistant vegetation like the pitch pine and scrub oak, which also provide essential habitat to many vulnerable butterflies and moths including four state-listed species: Edward's hairstreak, sleepy duskywing, pine barrens Zanclognatha, and the twilight moth. By contrast, fire suppression allows other trees to establish and out-compete them. To maintain pine barren habitat on conservation lands, we use prescribed fire and silviculture.



Prescribed fire application (controlled burning) at Kennebunk Plains prevents trees encroachment and maintains early-successional habitat.

Cooperative Conservation

One of our most successful endangered species conservation efforts is an ongoing one. The piping plover is a resident shorebird that nests only on foredunes and uppermost reaches of sandy beaches. Not only is its habitat extremely limited in Maine, but its nesting sites are also subject to intense recreational use (including record levels of beach use since the beginning of the pandemic). Cooperative conservation efforts by MDIFW, Maine Audubon, state parks, USFWS, USDA Wildlife Services, and municipalities have led to a rebound in plover abundance over the past few decades; but long-term stewardship is crucial. Coastal beaches naturally erode, accrue and shift, presenting problems for nesting birds and their young. And climate-change-driven issues like rising sea levels and major storm events present additional threats. Fortunately, we can create suitable habitat through careful deposition of spoils from coastal dredging projects.

Keeping an Eye on Climate Change

Maine is a natural ecoregion transition zone, and as such hosts a blend of species that mostly reside further north or south. Species listed under Maine ESA that are at their northernmost range limit in Maine include Blanding's turtle, spotted turtle, northern black racer, grasshopper sparrow, and New England cottontail. Those at their southernmost range limit in Maine — whose future here is threatened by climate change — include Atlantic puffin, razorbill, Arctic tern, great cormorant, frigga fritillary butterfly, and northern bog lemming. Species with low mobility and exacting habitat requirements need extra attention — not only to secure existing habitat, but also to allow for potential shifts in geographic range associated with climate change.

Brief updates on species listed under Maine ESA

No extirpations: No Endangered or Threatened Species in Maine have disappeared from the state since listing.

“Up-listing”: Three species originally designated as Threatened in Maine have been reclassified as Endangered, owing to further setbacks in their status: Blanding's turtle, black-crowned night heron, and roseate tern.

“Down-listing”: Four species once designated as Endangered in Maine have been reclassified as Threatened, due to conservation success while listed: bald eagle, Clayton's copper, ringed boghaunter, and Roaring Brook mayfly.



Black-crowned night heron – The black-crowned night heron primarily forage nocturnally or in the evening, making it difficult to locate and observe.



Roseate tern – The US endangered roseate tern nests in colonies on off-shore islands managed to protect nesting seabirds.



Protected Under the U.S. Endangered Species Act in Maine

Twelve Maine species are listed under the U.S. Endangered Species Act (US ESA; Table 1); however, six of them are either marine animals or plants and thus under the purview of Maine Department of Marine Resources or Maine Natural Areas Program. Although three federally listed species (Northern Long-eared Bat [since 2015], Piping Plover [since 1985], and Roseate Tern [since 1987]) are also listed under Maine ESA, three additional species are not state listed. This is either because the population in Maine is secure (Canada Lynx [since 2000]), only migrates through Maine but does not breed or overwinter in the state (Red Knot [since 2015]), or is likely extirpated following range-wide population declines (Rusty Patched Bumble Bee [since 2017]; Maine’s last observation was in 2009). All three of these federally listed species are species of Special Concern and therefore remain on the forefront of MDIFW’s monitoring and conservation efforts. Regardless of state listing status, MDIFW staff often work closely with biologists and administrators from the U.S. Fish and Wildlife Service on issues related to US ESA species management and protection in Maine.

TABLE 1. SPECIES DIVERSITY IN MAINE BY TAXONOMIC GROUP AND THE NUMBER OF SPECIES IDENTIFIED AS SPECIES OF SPECIAL CONCERN, LISTED UNDER THE MAINE ENDANGERED SPECIES ACT (MAINE ESA), OR LISTED UNDER THE U.S. ENDANGERED SPECIES ACT (US ESA).

	SPECIES IN MAINE	SPECIAL CONCERN	MAINE ESA	US ESA
AMPHIBIANS	18	2	0	0
BIRDS	292	48	21	3
FISH ¹	56	5	2	0
INVERTEBRATES	>16,000	48	20	1
MAMMALS	58	7	5	2
REPTILES	16	2	4	0
TOTAL	>16,440	112	52	6 ²

¹Not including marine fish

²Six additional marine or plant species are listed; however, MDIFW does not manage these species.

BIRDS

- The cooperative management approach for **piping plovers** has resulted in five consecutive record-setting years on Maine’s southern beaches. In 2022, 140 nesting pairs fledged 252 fledgling plovers. Three beaches each fledged over 30 plovers: Wells Beach (40), Ogunquit Beach (35), and Seawall Beach (34). We thank the towns of Ogunquit, Old Orchard Beach, Scarborough, and Wells, the city of Saco, the Maine State Parks, and the Prouts Neck Association for their plover stewardship through beach management agreements with MDIFW.
- **Atlantic puffin** and **razorbill** on the Gulf of Maine’s seabird nesting islands had higher fledgling success in 2022 compared to their almost complete reproductive failure in 2021. The Gulf of Maine is warming faster than 99% of the world’s oceans, increasing the likelihood of high chick starvation events due to low forage fish availability. Warming summer waters cause forage fish to move deeper or further offshore, making it hard for adult waterbirds to catch enough to feed their chicks. A special thanks to the Gulf of Maine Seabird Working Group for their annual efforts to monitor Seabird Nesting Islands in the Gulf of Maine.
- Two high-elevation songbird species, the **Bicknell’s thrush** and **Blackpoll warbler**, are being proposed as Threatened under the Maine Endangered Species Act. Both birds rely on dense stands of spruce-fir or fir-dominated forests. In Maine, these forest types are found in high elevations with stunted growth (>1,100 m; think trying to crawl through a balsam fir fortress) or at lower elevations in commercial stands where forest regeneration mimics high-elevation stunted forests. Both species have experienced recent population declines in Maine.
- Aerial insectivore populations have been declining across Maine. Landscape-level changes (conversion of grasslands or agricultural lands to development or reforestation) have reduced habitat statewide. Additionally, increased use of potent pesticides has reduced insect availability and essentially limited food in many high-quality foraging areas. Two aerial insectivores, the **bank swallow** and **cliff swallow**, are being proposed for Threatened status under the Maine Endangered Species Act due to significant population declines. Other aerial insectivores experiencing population declines include the **purple martin**, **tree swallow**, **whip-poor-will**, and **common nighthawk**.
- MDIFW biologists have been studying the return rates and movement patterns of **black terns** that breed in Maine by color-banding adults and attaching small tracking devices called geolocators to them. This data will allow MDIFW to better understand if Maine’s breeding terns return to the same nesting sites annually, where they spend the non-breeding season, and what migratory routes they take in the autumn and spring.
- After **peregrine falcons** completely disappeared from the Eastern U.S. in the 1960s, MDIFW worked closely with a broad array of partners (e.g., biologists, falconers, private landowners, nonprofits, and citizen scientists) to return breeding peregrines to Maine. Breeding pairs can now be

found nesting on cliffs and on tall buildings in Maine’s urban cities; and in 2019, a three-year intensive effort to locate breeding pairs and estimate nesting success across Maine was initiated. Surveys in 2021 found 27 successful nesting pairs that raised a total of 50 fledglings!

- The Biodiversity Research Institute, in collaboration with MDIFW, has initiated a multi-year effort to monitor **upland sandpipers’** migratory movements and habitat use. Birds will be tracked in Maine during the summer to study local habitat use, and along their migratory routes to their South American overwintering regions. This project would not have been possible without financial support from The Nature Conservancy and the Maine Outdoor Heritage Fund.



Peregrine falcon – The peregrine falcon population in Maine continues to recover and benefits from protection provided by the Maine Endangered Species Act.



Upland Sandpiper – The upland sandpiper breeds in large treeless grasslands and blueberry fields primarily in southern and eastern Maine.



Tri-colored bat – The tri-colored bat is being proposed as threatened under the Maine ESA and endangered under the US ESA.

MAMMALS

- Since 2015, MDIFW has conducted annual surveys of our eight bat species during the summer maternity season. These surveys use ultrasonic acoustic recorders that record the high-pitched calls (beyond the range of the human ear) bats make while in flight and then use computer software to match calls to species. In 2022, we initiated a long-term monitoring plan in which we will survey the same sites on a two-year rotation. These surveys will allow us to track changes in bat populations and distribution over time.
- MDIFW has partnered with researchers from the University of Maine to study non-traditional bat hibernacula in Maine, with an emphasis on the three cave bats (**little brown, eastern small-footed, and northern long-eared**) listed under the Maine Endangered Species Act. This research confirmed that bats are using talus slopes (boulders and rock slab piles) during the hibernation period.
- One additional species of cave roosting bat, the **tricolored bat**, is being proposed as Threatened in Maine and Endangered on the US ESA. Tricolored bats have only been recorded overwintering in one Maine hibernacula but have been detected across the state in summer.
- In January 2023, the **northern long-eared bat** was uplisted on the US ESA from Threatened to Endangered. Northern long-eared bat populations continue to decline range-wide due to white-nose syndrome, and uplisting gives their populations additional protections.
- The number of Maine sites known to have **New England cottontails (NEC)** grew to 41 in 2022, up from a low of 17 in 2017. Central to the expanding NEC population has been a translocation effort (releasing NEC from captive breeding colonies or moving NEC from larger populations) that started in 2017. Four NEC were translocated in 2021, and 15 in 2022. Translocations help to establish new NEC populations, but also increase genetic diversity in isolated populations to prevent inbreeding. Translocation along with habitat restoration on private lands in southern Maine is central to maintaining a sustainable NEC population.
- Maine and New Hampshire are the only northeast states with **northern bog lemming** populations. The species was listed as Threatened under the Maine ESA in 1987 and is currently being considered for listing under the US ESA. To better understand northern bog lemming distribution in Western Maine, the University of New England (in coordination with the United States Fish and Wildlife Service and MDIFW) collected rodent feces from potentially suitable habitat and extracted DNA from it. The extracted DNA identified northern bog lemmings at four additional sites in Maine. This advanced DNA extraction technique showcases the incredible tools available to survey for and study secretive wildlife populations.

REPTILES, AMPHIBIANS, AND INVERTEBRATES

- A new population of **northern black racers**, Maine’s largest and rarest snake species, was documented in Brownfield (Oxford County) in spring 2021. A report of a roadkill specimen from the public led to the discovery. This is the northernmost confirmed population of this state Endangered snake.
- Maine’s first road crossing structure specifically designed for freshwater turtles was completed in the spring of 2021. The large concrete box culvert was installed at Route 236 in Eliot primarily for the benefit of state Endangered **Blanding’s turtles** after surveys there documented the highest level of turtle road mortality statewide. Subsequent monitoring has shown a substantial decrease in overall turtle mortality at the site since construction of the passage and adjoining turtle fence.
- In 2022, MDIFW partners, with USFWS funding, conducted a radio telemetry/GPS tag study of eight state threatened **spotted turtles** at a mid-coast site. The data will help answer questions about the biology and behavior of this rare turtle species at the northeastern edge of its global range, and will inform habitat protection efforts including landowner and land trust technical assistance.
- The **eastern box turtle** was first state listed as Endangered in 1986 based on documented reports from areas of apparently suitable habitat in southern Maine. At the time, it was hoped that targeted surveys would validate the reports and confirm native populations in the state. However, extensive field work over the past three decades in areas most likely to support box turtles has failed to locate any populations. In addition, continued reports of individual turtles have come from widely scattered areas, with no concentration that might suggest the existence of natural populations. Instead, these reports likely pertain to released captive animals, as box turtles are popular, long-lived pets. For these reasons, MDIFW is proposing to remove the eastern box turtle from Maine’s list of Endangered and Threatened Species. However, it will remain a Species of Greatest Conservation Need in the state’s Wildlife Action Plan in order to facilitate surveys and research should a potentially native population be discovered in the future.



Black racer – The black racer is a Maine endangered species found in southern portions of the state.



Boreal snaketail – This threatened species of clubtail dragonfly occurs further north than any other clubtail dragonfly, and is active from mid-June to the end of August. ©J. Abbott



Rusty-patched bumble bee – The US endangered rusty patched bumble bee has not been observed in the state since 2009.

- **The rusty patched bumble bee**, listed as federally endangered in 2017, is one of about 21 bumble bee species in the eastern U.S. Once one of Maine’s most common bumble bees, the species may now be extirpated following a range-wide collapse in the 1990s, likely caused by disease and pesticide use. Since 2019, MDIFW has been conducting targeted surveys every summer to look for any remaining populations; but unfortunately, the species has not been observed in Maine since 2009.
- **Ashton’s cuckoo bumble bee** was historically found statewide, but was not seen at all from 1996 to 2017. Currently known to exist in just one northern Aroostook County location, it has been proposed for Endangered status under the Maine ESA. If listed, it will receive special attention from MDIFW and our partners by way of increased population monitoring, research on limiting factors, and population recovery efforts such as habitat protection and landowner technical assistance.

- Surveys contracted by MDIFW in 2021-2022 resulted in new findings for one of Maine’s rarest freshwater mussel species. After previous failed attempts to redocument the state-Threatened **tidewater mucket** in Cold Stream Pond (Penobscot Co.), where it was last observed in 1946, it was finally rediscovered this past summer – 76 years later! And in 2022, live tidewater muckets were documented in the lower Androscoggin river for the first time, following up on a nearly 30-year-old record of empty shells found at the mouth of the river in Merrymeeting Bay. Finding remnant populations of rare species can be a painstaking exercise, requiring detailed knowledge of the species’ natural history and years of persistent detective work by dedicated biologists.
- With over 120 species and subspecies, butterflies are diverse and colorful components of Maine’s insect fauna. They also play important ecological roles, both as pollinators and as prey to larger species, from dragonflies to birds. Despite growing general concern for butterflies and other pollinating insects, Maine has, until recently, only had a rudimentary knowledge of the group. From 2007 to 2016, MDIFW sponsored a statewide citizen science butterfly atlas effort, culminating in a rich database of over 25,000 new records and a detailed natural history compilation. *Butterflies of Maine and the Maritime Provinces* will be published by Cornell University Press in 2023. One result of special conservation interest is the high proportion (20%) of Maine butterfly species considered Endangered, Threatened, Special Concern, or Species of Greatest Conservation Need. These include many species that are colorful in both name and form: **Hessel’s hairstreak** (Endangered), **Frigga fritillary** (Endangered), **Clayton’s copper** (Threatened), **sleepy duskywing** (Threatened), and **Katahdin Arctic** (Endangered).
- The **rapids clubtail dragonfly** was first listed as state Endangered in 2007 based on data indicating that the species may be limited to just one population on the upper Saco River. However, field work over the past 25 years in areas of southern Maine most likely to support Rapids Clubtail has neither located another population, nor reconfirmed its presence in the Saco River location. In fact, MDIFW biologists now question the original identification due to the difficulty of distinguishing species in this genus from larval morphology alone (the original observation was based on the shed skin [exuvia] of a larvae), especially using the rudimentary larval keys that were available in the mid-1990s, now much improved. For these reasons, and in order to keep the state’s endangered species list as accurate and credible as possible, MDIFW is proposing to remove the rapids clubtail from Maine’s list of Endangered and Threatened Species.

Program Funding Remains a Challenge

America's state wildlife agencies were initially established to manage game species and sport fisheries, and were supported as such by federal aid programs. In Maine, license fees generate matching state funds. The Pittman-Robertson Act (1937) and Dingell-Johnson Act (1950) each generate income for management of wildlife and fisheries, respectively.

Awareness of, and public interest in, endangered species conservation now requires traditional "fish and game" agencies to take on broader responsibilities for which there are no dedicated funding programs. And while Maine and other state wildlife agencies have developed Action Plans that identify all "Species of Greatest Conservation Need," program funds remain well below program needs.

In 2020, Recovering America's Wildlife Act (H.R. 3742) was passed in the House Committee on Natural Resources but failed to pass the Senate by the end of 2022 and is expected to be reintroduced to the House in 2023. If enacted, this legislation would stabilize and increase funding for at-risk species. If you value Maine's diverse wildlife heritage, consider voicing your support to our Congressional delegation.

In the interim, most states typically seek voluntary contributions in the absence of general fund support. The three major options that generate revenue for Maine's Endangered and Nongame Wildlife Fund are:

- **The Chickadee Checkoff** is an option on individual state income tax returns filed in Maine; see Schedule CP. Total revenue since 1984 has exceeded \$2,340,000. These funds are often used to leverage other grants. If only half of our taxpayers contributed the \$5 minimum on the Chickadee checkoff, annual revenue would increase 500%.

- **The Loon Plate** is a vehicle license plate that has been available in Maine since 1994. Forty percent of the extra registration fee is deposited into the Endangered and Nongame Wildlife Fund, and the remainder supports state parks. The Loon Plate program has generated more than \$11,370,000 for the Fund, representing 80% of all the state income for this program. Other specialty plates that fund special programs have steadily reduced loon plate purchases.

- **The Sportsman Plate** was first issued in 2008. The entire extra registration fee goes to MDIFW programs, but only 10% of the \$18/plate renewal cost is earmarked for the Endangered and Nongame Wildlife Fund. Revenue to date has totaled more than \$561,000.

We are grateful for these contributions, which have enabled the startup of the Department's endangered species programs; but they have naturally declined over time as competing state interests have also begun to utilize checkoffs and license plates as funding strategies.

Until we have a stable funding source, staff must triage efforts for our most vulnerable species, even when we know it would be best to address at-risk species before they are highly jeopardized and in need of E/T listing.

Recent public surveys confirm that most members of the public strongly support MDIFW's E/T conservation efforts, but only a small subset of residents financially contribute to the Endangered and Nongame Wildlife Fund. Please consider joining this impactful group of citizens by donating through the chickadee checkoff, purchasing or renewing a loon plate, or making an independent donation.