

STATE *Of The* Birds

2011

Documenting Changes in
Massachusetts' Birdlife



Mass Audubon
BIRD CONSERVATION PROGRAMS
State of the Birds

Project Team

Gary Clayton, Vice President,
Conservation Programs

James DeNormandie, Conservation Planner/
Project Coordinator

John Galluzzo, Education Coordinator,
South Shore Sanctuaries

Matthew Kamm, Research Assistant,
Bird Monitoring

David Larson, Education Coordinator,
Joppa Flats Education Center

Chris Leahy, Gerard A. Bertrand Chair of
Natural History and Field Ornithology/
Project Lead Writer

Wayne Petersen, Director, Important Bird
Areas Program

Joan Walsh, Director of Bird Monitoring/
Breeding Bird Atlas 2 Coordinator

Cover photo: American Kestrel



The Black-capped
Chickadee is the
Massachusetts
State Bird.

Funding provided in part by



Table of Contents

- 2 Executive Summary**
- 4 CHAPTER 1. Renewing our commitment to bird conservation**
- 5 CHAPTER 2. Evidence of change in Massachusetts' bird populations**
- 10 CHAPTER 3. Which birds are increasing, decreasing, or stable?**
- 10 BY THE NUMBERS**
- 18 BY HABITAT**
- Grassland, Agricultural, and Open Field Habitats
 - Shrublands
 - Forests and Woodlands
 - Urban and Suburban Habitats
 - Open Water: Lakes, Ponds, and Rivers
 - Freshwater Open Wetlands
 - Freshwater Forested Wetlands
 - Salt Marshes
 - Other Coastal and Offshore Habitats
- 38 OTHER PERSPECTIVES**
- Wintering Birds in Massachusetts
 - Game Birds of Massachusetts
 - Ground-Nesting Birds
 - Aerial Insectivores
 - Passage Migrants
 - Regional Status of Raptors
- 48 CHAPTER 4. What's causing current changes in bird populations?**
- 52 CLIMATE CHANGE AND MASSACHUSETTS BIRDS**
- 54 CHAPTER 5. Why should we care about declines in bird populations?**
- 56 CHAPTER 6. Recommendations**
- 60 References**
- 61 Acknowledgments and Photo Credits**

MUSEUM OF COMPARATIVE ZOOLOGY

The Agassiz Museum

Edward O. Wilson University Professor Emeritus and Honorary Curator in Entomology
Harvard University MCZ 408 26 Oxford Street Cambridge, Massachusetts 02138-2902 USA

Dear Friends:

It is with tremendous enthusiasm that I mark the release of Mass Audubon's seminal report on Massachusetts avifauna, *State of the Birds 2011*. Though our Commonwealth is one of the smallest, most populous states in the union, it is blessed with spectacular landscapes filled with an astonishing biodiversity. The Berkshire Hills in their autumn splendor, Bald Eagles soaring over the Quabbin wilderness, the majesty of the sea at any season from Cape Ann to Cape Cod—these and many other treasures inspire our imagination and lift our spirits. These landscapes are home to birds—birds that can show us, when we watch and listen, how our environment is faring and how it is changing.

Mass Audubon's method is to report what the birds are telling us without preconceived biases either positive or negative, relying on simple yet systematically gathered data that was tested for its accuracy using science-based analysis as well as the exceptionally well-chronicled history of Massachusetts birdlife. This report on the state of Massachusetts birds provides considerable detail and makes specific recommendations in areas that problems are apparent and solutions seem possible.

State of the Birds also celebrates the successes of many bird species. Peregrine Falcons are nesting in downtown Boston, many of our forest birds are thriving, and birdwatchers arrive from around the world in every season to marvel at the relative abundance and variety of our coastal birdlife. But as a longtime observer of the natural world, I am alarmed by the challenges facing many Bay State bird species. Grassland and early-successional habitats are declining sharply, signaling the loss of biodiversity particular to those ecosystems. Many marshland birds are also decreasing, raising questions about the functionality of our wetlands. Even many "common" birds, such as swallows and blue jays, are gradually losing ground. My concern is not simply for the loss of birdlife, but that birds as nature's heralds are signaling broader ecological deterioration. Finally, this report captures the changes in bird distribution that seem to be unmistakable markers of climate change since many historically southern species are now permanent residents.

Birds inhabit our myths, appear in our poetry, and inspire our music. Since ancient times, birds have been used in auguries to make critical decisions or predict the future. Now science rather than superstition is interpreting what the birds are telling us. We need to listen carefully.

Sincerely,



Edward O. Wilson

Executive Summary



The birdlife of Massachusetts is exceptionally rich, containing both a great diversity of species and several populations of global significance. Thanks to a long history of bird and habitat conservation and some of the earliest and strongest environmental protection laws in the country, the citizens of the Commonwealth continue to enjoy the reassuring sounds of warblers and thrushes in our forests, masses of waterbirds along our shores, and eagles soaring overhead.

The goal of this report is to create a comprehensive overview of the status of all of our breeding and wintering bird species, thereby laying the foundation for a reevaluation of the Commonwealth's bird conservation strategy. If successful, we will continue to protect and preserve healthy bird populations and the habitats in which they reside across our state.

We use several science-based methodologies to look closely at bird populations. The data reveal positive trends: distributions of about 60% of our breeding bird species are increasing according to recent Breeding Bird Atlas results, and the birdlife of our cities/suburbs and forests is becoming richer.

However, it also becomes clear that in recent decades many Massachusetts bird populations have decreased and continue to decline. These declines are occurring not just among our rarest species but affect a broad spectrum of bird families in many habitats and include some of the most familiar and beloved birds of our backyards and countryside—birds that we tend to think of as common. These findings are disturbing and raise questions not only about the health of our bird populations but also about the state of our environment and the quality of people's lives.

Here are some of our key findings.

- **While the majority of our nesting species are increasing, many nesting birds are disappearing from large areas of the Commonwealth.** According to the Massachusetts Breeding Bird Atlas (Atlas), which measures changes in breeding distribution, 24% of our breeding bird species have smaller distributions than they did in 1979 and 18% of species have lost 20% or more of their former distribution.
- **Thirty-nine percent of our breeding birds have decreasing populations.** The United States Geological Survey Breeding Bird Survey (BBS), which measures changes in bird abundance, shows that, since 1966, 39% of BBS birds are significantly declining. Furthermore, the number of species that are increasing in abundance has fallen almost by half since 1980, according to BBS data. While declines in some species are to be expected as Massachusetts completes a prolonged transition from the agricultural landscape that prevailed in the 19th and early 20th centuries to the combination of recovering forestlands and urban/suburban development we see today, many of the declines are not sustainable and indicate a real risk that we could lose some of our native birdlife in the future.

a. Eastern Phoebe b. Purple Finch c. American Kestrel d. American Bittern e. Brown Thrasher f. Mixed flock of migratory shorebirds

- **Twenty-six percent of our wintering birds are in decline.** The Christmas Bird Count (CBC), which has tracked the populations of 183 winter bird species since 1964, records declines in almost 26% of the species that winter in Massachusetts.
- **Many rare species remain imperiled.** While a number of species, such as the Common Loon, Bald Eagle, Peregrine Falcon, and Piping Plover, have been brought back from near extirpation in Massachusetts by targeted management programs, 71% of the 28 birds listed under the Massachusetts Endangered Species Act (MESA) remain vulnerable.
 - The Massachusetts State Wildlife Action Plan (SWAP), produced in 2005, identifies all MESA-listed species *plus an additional* 34 bird species of conservation concern. This group of birds (MESA-listed plus the additional 34) were analyzed in our statistical analysis as SWAP species. The SWAP species were selected well, and repeatedly show significantly sharper declines in comparison with all birds not on the SWAP list.
- **Climate change is affecting our bird populations.** There is a notable increase in both the distributions and abundance of species that have expanded their breeding range northward in the last 50 years. At the same time, northern species are declining in abundance as breeders in the state. Resident species are increasing in abundance at a faster rate than species that are either long- or short-distance migrants, possibly another signal from a changing climate.
- **Breeding birds restricted to certain habitats are especially at risk.**
 - **Grassland birds have declined significantly more in numbers and distribution** during the last 35 years than species that use other habitats. Out of 23 grassland birds, 10 need urgent conservation action. Although some are on the state endangered species list, others with steep declines are not. For example, the breeding distribution of the Eastern Meadowlark has shrunk by 76% since 1979, yet it is not on the Massachusetts endangered species list.
 - **Shrubland birds have declined significantly.** For several species—Northern Bobwhite, Brown Thrasher, Nashville Warbler, and White-throated Sparrow—the decline is steep and some of these shrubland birds may merit endangered species protection.
 - **Many freshwater marsh obligates (see glossary on page 6) are also threatened.** Of 16 such species, 7 have shrinking distributions, 7 are increasing, and 2 have remained unchanged since 1979, according to the most recent Breeding Bird Atlas. The distribution of the American Bittern, described as a common summer resident as recently as the mid-1950s, has shrunk by a third (from 96 blocks in Atlas 1 to 64 blocks in Atlas 2) since 1979.

- **Breeding birds in other habitats are thriving.**
 - **Forest birds overall are expanding in distribution**, and increasing in abundance, compared with species in other habitats.
 - **Urban and suburban birds are also increasing**, especially among species that have expanded their ranges from the South.
 - **Birds using coastal habitats in winter have increased**, such as alcids and sea ducks.
- **Certain behaviors are associated with the decline of some species.**
 - **Ground- or low-nesting birds are declining in distribution and abundance** compared with other breeding species. This is especially evident within shrublands, where ground-nesting birds show significantly lower trends than other birds that breed in this habitat.
 - **Aerial insectivores**, i.e., birds that feed primarily on flying insects, are declining in distribution and abundance.
 - Some of our rarest birds nest on only a few coastal islands and are therefore exceptionally vulnerable to natural or human-caused catastrophes. For example, two small islands contain 45% of the North American breeding population of the federally endangered Roseate Tern (Mostello 2007).
- **The decline of “common” birds.** One of the most worrisome trends revealed by a close examination of the long-term data sets is a decline of many “common” birds: Northern Flicker, Eastern Phoebe, Blue Jay, Song Sparrow, Common Grackle, and Baltimore Oriole. These familiar birds continue to occupy their past ranges, so that the Atlas indicates that they are stable and they still seem quite common. Yet the BBS clearly traces a gradual but steady decline over the last 45 years, a downward trend that has steepened in many cases since 1989.

This *State of the Birds* report is also accompanied by a website that provides species-specific accounts, an ability to create custom tables, a project glossary, and other useful information. For more information visit www.massaudubon.org/StateoftheBirds.

The state endangered Upland Sandpiper breeds in Massachusetts airfields—and almost nowhere else in the state.



CHAPTER 1. Renewing our commitment to bird conservation



The Bald Eagle has made an inspiring recovery, now breeding across the state in favorable locations.



Massachusetts' mudflats and tidal marshes provide critical stopover points for countless migratory shorebirds.



Hundreds of thousands of Long-tailed Ducks winter in Massachusetts' coastal waters, feeding on abundant amphipods.

The birdlife of Massachusetts is exceptionally well studied, starting with Thomas Nuttall and John James Audubon in the early 19th century through to the present. The wholesale destruction of birds impelled the founding of the Massachusetts Audubon Society, the passage of state and federal legislation protecting birds and other wildlife, and a new appreciation of birds.

The desire to understand and conserve the birds of the Commonwealth has never been greater than at the present time. Since 1978, the Massachusetts Natural Heritage & Endangered Species Program, within the Massachusetts Division of Fisheries and Wildlife (MassWildlife), has built a database containing tens of thousands of records of the state's rarest bird (and other) species; operates monitoring and protection programs for species of conservation concern; and tracks species listed under the Massachusetts Endangered Species Act. The Wildlife Section within MassWildlife monitors populations of game birds and protects and manages habitat for both upland and wetland species. Mass Audubon has developed model programs for the conservation of coastal waterbirds and grassland birds, monitors breeding bird populations on its wildlife sanctuaries totaling 34,000 acres, and offers bird-related educational outreach to people of all ages. From 1974-1979, Mass Audubon conducted North America's first Breeding Bird Atlas (Atlas 1) and, as this report goes to press, has completed the fieldwork of a second five-year atlas (Atlas 2).

Many other private organizations—from research institutions such as the Manomet Center for Conservation Sciences to the state's many bird clubs—are dedicated to bird protection in the Commonwealth. And never before have so many “citizen conservationists” been engaged in projects to study, protect, and enjoy our native birdlife.

We now have the ability to bring together all that we know about the birds of Massachusetts, detect trends in bird populations, and devise effective conservation strategies for those species in clear decline. We hope that this report and its website will serve as a vital resource on the status of all the birds of the Commonwealth, a living project for future contributions on bird conservation, and the foundation for the urgent task of building a new bird conservation action plan for Massachusetts.

The purpose of this report is to document and analyze the current state of Massachusetts birdlife using the best scientific evidence available. This will include:

- Highlighting those *species and groups of species* that appear to be most vulnerable as well as those whose populations seem to be stable or increasing;
- Characterizing those *habitats* in which birds are declining most dramatically;
- Describing the possible *causes* for changes in our bird populations;
- Detailing the *value* of birds to the health and well-being of the people and nature of Massachusetts; and
- Recommending *corrective strategies* to arrest current declines and ensure that our common wealth of birdlife remains a legacy for future generations.

CHAPTER 2. Evidence of change in Massachusetts' bird populations

The facts and analysis offered in this report derive primarily from three extensive, long-term data sets—the USGS' Breeding Bird Survey (BBS), Mass Audubon's Breeding Bird Atlas 1 & 2 (Atlas), and National Audubon's Christmas Bird Count (CBC). Each of these data sets documents different aspects of our birdlife, but taken together they allow complementary perspectives on the *State of the Birds*. Other data sources were also used throughout the report to enrich the long-term data and fill information gaps.

MASSACHUSETTS BREEDING BIRD ATLASES 1 & 2 (ATLAS)

From 1974 to 1979, hundreds of volunteers undertook the first statewide Breeding Bird Atlas (Atlas 1) in North America. A breeding bird atlas is an internationally adopted system for mapping the *distribution* of the breeding bird species of a given geographical area. An atlas does not attempt to assess the abundance of a species but collects evidence of a species' presence or absence during the breeding season. When two atlases from different time periods are compared, the changes in the status of a species are revealed by expansions or contractions of the *distribution* of species within the atlas area.

In a typical breeding bird atlas, the region is divided into *blocks* containing about 9 square miles, and volunteers collect evidence of breeding for as many species as possible within their assigned blocks. When an atlas is repeated years later, the number of blocks a species occupies may increase, decrease, remain stable, or shift geographically. An atlas' greatest strength is that it collects data on many species of birds—from common to rare, from secretive to gregarious, and from inhabitants of localized habitats to widespread landscapes—and that this information reveals changes in a species' distribution on a fairly small scale.

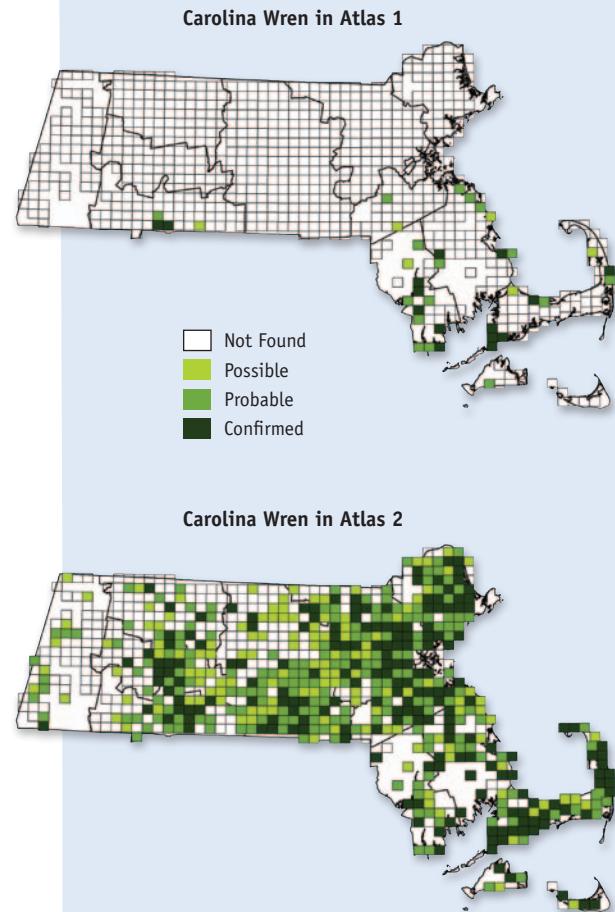


The Breeding Bird Survey data highlight the slow but steady decline of the striking Rose-breasted Grosbeak, among others.

Atlas 1 mapped the distribution of breeding birds in Massachusetts with an eye to the future when the project could be repeated and changes in distribution over time could be revealed. Mass Audubon initiated Atlas 2 in 2007 and the project will be completed during 2011. The data used for this report were collected from 2007 through 2010. To be sure we were comparing matching samples from Atlas 1 and Atlas 2, we only used survey blocks that had a sufficient effort (at least 15 hours) in Atlas 2.

In the map shown (Figure 1), it is clear that the *distribution* of the Carolina Wren in Massachusetts expanded greatly during the Atlas 1 and Atlas 2 interval. From this fact we can infer that its numbers may also have increased. There is documentation that changes in block occupancy rates over time do mirror changes in abundance—and tests of the New York Breeding Bird Atlas showed a high correlation between BBS abundance estimates and BBA block occupancy rates.

FIGURE 1. Range of Carolina Wren from Breeding Bird Atlas 1 and 2.



GLOSSARY

Distribution: The specific areas in which a particular species can be found comprise its distribution. Distribution, range, and population are related but not identical concepts. For example, the breeding range of Common Terns extends from Essex to Nantucket County. Their actual breeding distribution includes only certain beaches within that range. Though they are found in relatively few Atlas blocks, their colonies are large enough that the population of breeding Common Terns is in the tens of thousands.

MESA: The Massachusetts Endangered Species Act, which provides state protection to certain species deemed to be Threatened (T) or Endangered (E) by extinction at the state level, or to those deemed to be of Special Concern (SC).

Obligate species: An obligate species depends entirely or almost entirely on one specific type of habitat. It cannot survive unless that habitat is available; thus, it is obligated to seek out and use such habitat.

Population: The number of individuals of a particular species that can be found in the state comprise its population; also sometimes referred to as **abundance**.

Range: The geographic area that encompasses all places where a species might be found is its range. Range differs from distribution in that it includes both areas where the species is known to breed and areas where it is not known to breed that lie between known breeding locations.

SWAP: Massachusetts State Wildlife Action Plan, a document produced in 2005 that identifies a number of species judged to be in need of additional conservation attention, over and above the Massachusetts Endangered Species Act.

For a more complete glossary, see www.massaudubon.org/StateoftheBirds.

It is critical to note that when a species “winks out” from an Atlas block, its numbers have likely gone close to zero. This makes an Atlas decline a measure of serious loss. For some very rare species, it is possible to miss them even though they may be present, but the time spent in an Atlas block (15 or more hours) is sufficient to encounter most species in the area.

In the case of the many species whose distributions have not changed notably in the last 30 years, an Atlas becomes a blunt tool for estimating changes in abundance. Luckily, we also have a system for assessing changes in abundance—the Breeding Bird Survey. For example, the distribution of the Northern Flicker is relatively stable throughout most of Massachusetts between the two Atlases. Were it not for information from another survey, the Breeding Bird Survey, we would not be aware of a 4.4% decline in this species. These two complementary surveys work together to give us a more thorough picture of the trends of our breeding bird populations.

NORTH AMERICAN BREEDING BIRD SURVEY (BBS)

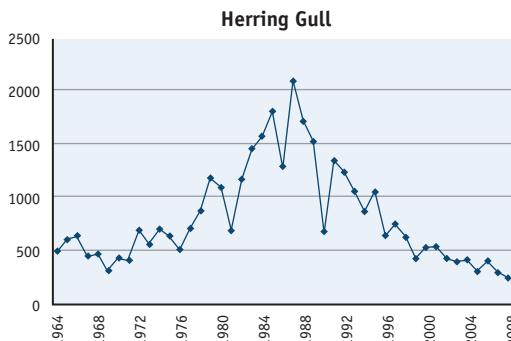
The U.S. Geological Survey’s Patuxent Wildlife Research Center and the Canadian Wildlife Service coordinate the largest and most comprehensive source of information on breeding bird population trends across North America: the Breeding Bird Survey (BBS). Started in 1966 in response to a perceived threat to birdlife from the indiscriminate use of DDT and other pesticides, this continent-wide survey sought to monitor the status of breeding bird *populations* throughout North America. There are now over 4,100 BBS routes in North America including 24 in Massachusetts, many of which have been monitored annually for decades.

The BBS uses a *point count* methodology for estimating the abundance of birds along a series of road routes. Each summer volunteers stop 50 times along fixed 24.5-mile routes at half-mile intervals, and count every bird that can be seen or heard in three minutes at that point. The BBS records *numbers of individual birds*, and does this year after year in the same locations, so it provides an estimate of changes of *abundance over time*. Because it is a continent-

wide survey, the BBS not only shows trends in Massachusetts bird populations but also makes possible comparisons with the national or regional trends of the same species. No survey method is perfect, and some of the limitations of the BBS are that it underrepresents rare species, those occupying specialized habitats, and nocturnal species because the survey routes and timing typically do not include sufficient samples of these situations.

While both the BBS and Atlas provide information on breeding birds, each has its strengths and weaknesses. The Atlas measures the distributions of more species, and covers more specialized habitats, but the BBS allows us to detect trends *before* they have resulted in noticeable changes in distribution. Together they create a strong foundation for assessing the status and trends of breeding birds in the Commonwealth.

FIGURE 2. Estimated number of Herring Gulls per Christmas Bird Count circle since 1964.



CHRISTMAS BIRD COUNT (CBC)

The National Audubon Society launched the first CBC in 1900. The CBC was an attempt to draw popular attention and sympathy to the plight of the nation's birdlife in an era before wildlife protection laws when a day's "birding" was likely to mean a day's shooting. It was not designed to be a rigorous scientific census.

Times have changed, and the Christmas Bird Count has changed too. Now, teams of birders spend one day, between December 14 and January 5 each year, counting birds wherever they can find them within a prescribed 7.5-mile radius circle. Totals are tallied for each species within the circle at the end of the day (see Figure 2 for example of results). There are now more than 1,800 CBCs nationwide involving over 50,000 volunteer birders. Massachusetts birders survey 33 circles every year. (Note: Mass Audubon is an independent state Audubon organization and is not formally affiliated with the National Audubon Society.)

Though less rigorous than either the Atlases or the BBS, the CBC can be used to estimate *trends in abundance* of winter bird populations. Most importantly, the CBC focuses on wintering birds, a major component of our state's avifauna not covered by either the Atlas or the BBS.

SPECIES-SPECIFIC TRENDS

It can be confusing to discuss changes in 200+ breeding species and 145+ winter species during 35+ years using three data sets. Throughout the report, we discuss species-specific trends that are derived directly from the Atlas, BBS, or CBC data. For instance, during Atlas 2 the Eastern Meadowlark was found in only 24% of the blocks it occupied in Atlas 1. The BBS reports that meadowlarks had a 10.4% average annual decrease from 1966-2008, and the CBC shows an 8.8% average annual decrease from 1964-2008. As an illustration, consider that a hypothetical population of 100,000 birds, decreasing at a rate of 10% per year, would have only 4,240 birds remaining after 30 years.

We use five categories for each of the long-term data sets in an effort to simplify their interpretation (Table 1). With the BBS and CBC data sets, a trend value can be calculated, and this value is accompanied by a test of the trend's significance. In the case of the BBS data, a trend is statistically significant if the P-value associated with the trend is less than 0.05. In the case of the CBC data, significance is indicated if the trend is significantly different than zero. In Table 2 we summarize data using *all* of the trend values, and indicate the subsets that are significant.

TABLE 1. Thresholds used for each data set to identify increasing, stable, and decreasing species.

Statistic used for Ranking	Atlas	BBS	CBC
	Percent change in block occupancy between Atlas 1 and Atlas 2	Average annual trend	Average annual trend
Strong Increase	> 100%	> 5%	> 5%
Likely Increase	10% to 100%	1% to 5%	1% to 5%
Likely Stable	0% to 10%	-1% to 1%	-1% to 1%
Likely Decrease	-20% to 0%	-5% to -1%	-5% to -1%
Strong Decrease	< -20%	< -5%	< -5%

ANALYSIS GROUPINGS

HABITAT

- Grassland
- Shrubland
- Urban and Suburban
- Forest
- Forested Wetland
- Open Freshwater Marsh
- Salt Marsh
- Coastal

BEHAVIOR

- Ground/Low Nesting
- Cavity Nesting
- Human Structure Nesters (including boxes and platforms)
- Colonial Nesters
- Common Feeder Birds
- Aerial Insectivores
- Game Birds
- Habitat Obligate Species

RANGE

- Southern edge of breeding range
- Northern edge of breeding range
- Wide-range

MIGRATION STRATEGY

- Long-distance
- Short-distance
- Permanent Resident

Other factors

- SWAP-listed Species

CITIZEN CONSERVATION

The vibrant community of bird clubs active throughout Massachusetts as well as many other citizen conservationists deserve thanks for countless hours of volunteer effort.

It is unlikely that species such as Osprey, Wood Duck, and Eastern Bluebird would have made the strong recoveries they have without the labor of these devoted citizens.

There is also no doubt that this report would not have been possible without their efforts, in summer and winter, one outing at a time, to document the *State of the Birds*.



Athol Bird and
Nature Club



Essex County Ornithological Club



Brookline
Bird Club



Eastern
Massachusetts
Hawk Watch



Thanks as well to the South Shore and Allen Bird Clubs, and other bird clubs of this state not shown here!



GROUP TRENDS

In addition to species-specific analysis, we used statistical tests to identify trends among groups of birds. Birds were grouped by the habitats they frequent, their behavior, their migration strategy, and their geographic range (see Analysis Groupings sidebar on page 7). The average of the trends for the species in each group was compared with the average of the trends for all species not in that group. The behavior, range, and migration strategy groups were also cross-checked within each habitat to see if any patterns such as nest-placement strategy or feeding strategy contribute to an increase or decrease in a group in a particular habitat.

Throughout the report, we indicate results that were derived from the “group trend analysis” with italicized, purple text like the text in this sentence.

When we look at the habitats that species are associated with and the influence of habitat association to changes in bird abundance or distribution, we can identify habitats where the associated species are increasing or decreasing, and this can help us to identify appropriate conservation strategies. For instance, the average BBS trend (1966-2008) for the 39 species that are known to use shrublands was a 1.8% annual decrease, in comparison to a 0.8% increase for the 95 birds that are not associated with shrublands. The difference between the means of these two groups is statistically significant with a P-value of 0.03.

This finding, coupled with species-specific knowledge of shrubland birds in trouble, such as Golden-winged Warbler, Brown Thrasher, and White-throated Sparrow, makes a very strong case for the need for management or conservation action in particular habitats or for particular groups of birds.

Throughout the group-trend analysis, we report results when we are 95% certain that the findings were real (the test had a P-value of <0.05). There were three instances when we felt it was relevant to mention results that were significant at a slightly relaxed P-value of <0.1. The P-value is indicated in these instances.

The P-value is a probability, with a value ranging from zero to one. If the means of two groups of birds are so different that they have a P-value that is less than 0.05, the difference in the means is, traditionally, considered “statistically significant,” or real. A value of 0.05 indicates a 5% chance that, although the means of the two groups vary, the difference cannot be attributable to a “real” phenomenon.

Snowy Owls are among our most recognizable winter visitors, and cannot be seen at any other time of the year.



Coastal Waterbird Surveys keep a close eye on vulnerable shorebirds like the Piping Plover.

Least Terns have benefited from programs to protect their nesting areas on popular beaches.

ADDITIONAL INFORMATION SOURCES

A variety of additional data sources were incorporated into the report to enrich the long-term data sets as well as to fill important gaps in species or seasons not covered by Atlas, BBS, and CBC data sets. They include the following.

- A brief summary of bird banding records compiled since 1969 by the Manomet Center for Conservation Sciences (MCCS), formerly Manomet Bird Observatory. Manomet was one of the first bird observatories in North America, and has made a commitment to the long-term study of birds, emphasizing their role as environmental indicators. MCCS has studied and monitored migrant songbirds for over 40 years, banding and recording data on more than 350,000 songbirds during that period. MCCS has one of the most consistent, long-term databases on migrant songbirds in the Western Hemisphere, fueling a number of important avian conservation programs. Several published articles based on this invaluable data source were used to derive our summary of the status of nonresident migratory birds (passage migrants) in Massachusetts (Miller-Rushing et al. 2008; Lloyd Evans and Atwood 2004).
- A variety of surveys conducted by the Massachusetts Division of Fisheries and Wildlife were used in this report.
 - Recent inventories of terns, Black Skimmers, and Laughing Gulls nesting in Massachusetts summarized results of annual surveys of these species.
 - Recent surveys of colonial waterbirds compared results from a 2006-2008 survey with those found in 1994-1995, providing valuable information on nesting colonies of cormorants, night-herons, egrets, ibises, and gulls in Massachusetts.
 - Waterfowl counts surveying nesting species of freshwater ducks, geese and swans, and wintering waterfowl.
 - Surveys conducted on upland game species such as the Ruffed Grouse Drumming Survey.
- Coastal Waterbird Surveys conducted annually by Mass Audubon's Coastal Waterbird Program, the Massachusetts Natural Heritage & Endangered Species Program, and others.
- Information collected at the Stellwagen Bank National Marine Sanctuary as well as data obtained by other National Oceanic and Atmospheric Administration agencies were used to describe factors that impact population trends of pelagic bird species present off the coast of Massachusetts.
- The Hawk Migration Association of North America (HMANA) collects data from almost two hundred affiliated raptor monitoring sites throughout the United States, Canada, and Mexico and is a driving force behind the Raptor Population Index (RPI). The summary of the status of Massachusetts diurnal raptors in this report was based on surveys and analyses produced by HMANA and RPI (Bildstein et al. 2008; RPI website).

Each of the surveys and studies cited above shows a different and complementary aspect of the state of Massachusetts birds. Brought together like a jigsaw puzzle, they reveal a convincing portrait of our birdlife.



Tracking and banding of migratory songbirds can offer a wealth of data about trends in larger populations. An immature Mourning Warbler is shown here.



With American Kestrels experiencing an alarming decline, raptor migration data is more important than ever.

CHAPTER 3. Which birds are increasing, decreasing, or stable?



The Red-bellied Woodpecker population has grown astoundingly in recent years.



Eastern Meadowlarks are vanishing along with the grasslands they inhabit.



The American Robin is stable as a breeding species, and becoming more common as a winter resident, underscoring the complexity of bird populations.

Having analyzed the data sources outlined above, we describe the state of Massachusetts bird populations in the following three sections.

- 1. By the Numbers**, essentially an avian scorecard, showing numbers and percentage of our bird species that are increasing, decreasing, or holding their own.
- 2. By Habitat**, an analysis of habitats whose characteristic birds are becoming notably scarcer, as well as those that are supporting healthy bird populations.
- 3. Other Perspectives**. If we examine birdlife seasonally or with regard to groups of closely related species or species that share feeding strategies or other behavior patterns, we find that birds in some of these categories are declining disproportionately, while others are doing well.

BY THE NUMBERS

Comparison of Atlas 1 and 2 reveals that 60% of our breeding birds are increasing, 15% are stable, and 25% are decreasing. The pattern revealed by BBS data is reversed, with 31% increasing, 21% stable, and 48% of the birds surveyed showing declines. When looking at wintering birds, 59% are increasing, 15% are stable, and 26% are decreasing.

TABLE 2. Number of species identified using thresholds from Table 1. The numbers in parentheses in the BBS and CBC columns are those species with trends that are statistically significant.

	Atlas	BBS	CBC
Strong Increase	52	21 (12)	52 (51)
Likely Increase	61	21 (5)	57 (46)
Likely Stable	29	28 (2)	27 (3)
Likely Decrease	12	44 (21)	24 (15)
Strong Decrease	34	20 (11)	23 (21)
Present in too few blocks to indicate a trend	31		

BREEDING BIRD ATLAS 1 AND 2

Breeding Bird Atlas 2 volunteers found 218 species from 2007-2010, compared to 197 species recorded during the Atlas 1 period from 1974-1979—a notable increase in the number of species recorded. Some of the newcomers are not “new” at all, like two reintroduced species—Peregrine Falcon and Bald Eagle—which have become well established, with growing populations in the state. Still other new species, like the Sandhill Crane, were found in very few blocks during the project, indicating pioneering species.

Looking at Atlas trends, we find 52 (28%) species with strong increases in distribution, 61 (32%) with likely increases, 29 (15%) with stable populations, 12 (6%) with likely decreases, and 34 (18%) showing strong decreases (Figure 3). Tools used by Atlas volunteers in the field have certainly improved since 1979, so it is possible that some species are being found in blocks that they occupied during 1979 but were simply overlooked. This would boost the “increasing” species in the Atlas to some degree. However, it is also fair to say that more than 50% of the breeding species in the state have expanded their distribution since 1979, an impressive measure of the success of our breeding species in the Commonwealth.

If it is slightly easier to find species during Atlas 2 than in Atlas 1, then the declining species, especially those 34 species with strong declines, should be viewed as a call to action. Atlas declines indicate that not even a single individual was found in some blocks where the species had been breeding during Atlas 1. For many species this shift from present to absent is indicative of a change in abundance.

The Atlas Winners

During the last 35 years, we have had many new species either colonize the state, or rise from rare to common status. Some of these changes have been dramatic, as with the Red-bellied Woodpecker, which colonized more than half of the state since 1979. The absolute increase in blocks occupied between Atlases of many species, such as the Wild Turkey and Great Blue Heron, are so dramatic that knowledge of their success is commonplace. These represent significant changes in distribution over a short period of time—changes that signal the speed at which these birds can expand their distribution (Table 3).

There are a variety of characteristics that explain the success of these species. Some of the common characters of the big expanders are that they nest in forests, river/lakes/ponds, or urban-suburban environments. They are often generalists in their breeding habitat choices, and many are expanding from the south, or are permanent residents that do not migrate.

Another window into increasing species is to identify those species with the largest percent increase in blocks since 1979. Many of these birds were and still are exceedingly rare, such as Hooded and Cerulean warblers (Table 4).

FIGURE 3. Trends identified by the Breeding Bird Atlas.

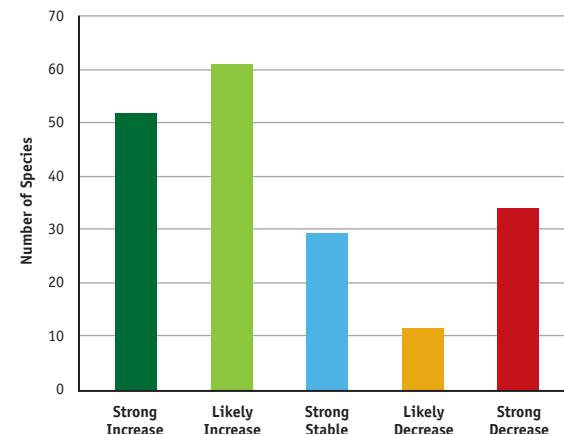


TABLE 3. The 20 bird species with the largest *absolute* increase in the number of Atlas blocks in which they occurred between Atlas 1 and Atlas 2. Species in **bold** are present in both Table 3 and Table 4.

Common Name	Absolute change in blocks occupied	Atlas 1 Blocks	Atlas 2 Blocks
Wild Turkey	658	16	674
Red-bellied Woodpecker	636	4	640
Carolina Wren	551	43	594
Pine Warbler	532	139	671
Canada Goose	466	281	747
Cooper's Hawk	417	13	430
Eastern Bluebird	378	227	605
Warbling Vireo	367	253	620
Ruby-throated Hummingbird	357	298	655
Great Blue Heron	352	61	413
House Finch	351	319	670
Tufted Titmouse	309	484	793
Pileated Woodpecker	305	166	471
Red-tailed Hawk	284	418	702
Mallard	279	450	729
Common Raven	274	4	278
Wood Duck	263	339	602
Willow Flycatcher	249	114	363
Turkey Vulture	238	116	354
Hermit Thrush	238	302	540

TABLE 4. The 20 bird species with the largest percent increase in the number of blocks in which they occur between Atlas 1 and Atlas 2. Species in **bold** are present in both Table 3 and Table 4.

Common Name	Percent change in blocks occupied	Atlas 1 Blocks	Atlas 2 Blocks
Red-bellied Woodpecker	+15,900	4	640
Common Raven	+6,850	4	278
Evening Grosbeak	+4,900	1	50
Wild Turkey	+4,113	16	674
Cooper's Hawk	+3,208	13	430
Common Merganser	+2,275	4	95
Willet	+1,833	3	58
Osprey	+1,710	10	181
Carolina Wren	+1,281	43	594
Double-crested Cormorant	+1,125	4	49
Acadian Flycatcher	+1,000	3	33
Common Eider	+1,000	1	11
Common Loon	+900	3	30
Cerulean Warbler	+900	1	10
Hooded Warbler	+900	1	10
Sharp-shinned Hawk	+782	17	150
Mute Swan	+621	33	238
Worm-eating Warbler	+583	6	41
Great Blue Heron	+577	61	413
Fish Crow	+524	21	131

Reintroduction of the Wild Turkey to Massachusetts has been wildly successful.



The Willet was once hunted to extirpation in Massachusetts, but has recently become a fairly common sight in many coastal areas.



Breeding declines in the American Black Duck are a concern to birders and sportsmen alike.

The Atlas Losers

There are 9 species posting losses from 100 or more blocks since Atlas 1 was completed in 1979 (Table 5). None of these species are listed on the Massachusetts endangered species list, although several are listed in the State Wildlife Action Plan (SWAP) as species of conservation concern.

The declining species present in Table 5 drive many of the statements that follow—they are icons for the vanishing species of Massachusetts. Eastern Meadowlark, American Kestrel, American Black Duck, Brown Thrasher, Northern Bobwhite, Purple Finch, White-throated Sparrow, and Canada Warbler are the species that have withdrawn from the greatest number of breeding blocks.

What are the common characteristics of these large-scale declining species? Many nest in grasslands or early successional habitats, many are specialists and nest in only one habitat, many nest on the ground, and most are not permanent residents, instead undertaking long- and short-distance migrations.

The Perennially Rare

There are 51 species found in fewer than 10 blocks during Atlas 2. Many of these species were also rare in Atlas 1, and persist in the state in small, but somewhat stable, numbers. Nineteen of these species were not recorded in Atlas 1 and are new to the state as possible breeding birds.

Many of these perennially rare species are MESA-listed species, rare breeding waterfowl or marshbirds, or regional rarities. Some colonial species, which nest in fairly high numbers but in very few places, such as Roseate Tern, are also on this list of the perennially rare.

Rare and Still Falling

If we exclude the perennially rare, and look at the species that occurred in more than 10 blocks in Atlas 1, and now occur in fewer than 10, we find the Golden-winged Warbler (E), Barn Owl (SC), Red Crossbill, Upland Sandpiper (E), Olive-sided Flycatcher, and Common Moorhen (SC). Of note in this group is the decline of several listed species, especially the loss of the Golden-winged Warbler.

WHAT'S HAPPENING TO THE AMERICAN KESTREL?

Once a common and familiar resident of fields and farms, the American Kestrel has become markedly scarce over the past few decades. The Breeding Bird Atlas and Breeding Bird Survey agree: American Kestrels have been declining sharply in Massachusetts in recent years. Many theories exist to explain this startling drop in the kestrel population.

Toxic pollutants have been the culprit of many raptor declines in the past century. The pesticide DDT nearly wiped out many of our native birds of prey, including Ospreys, Peregrine Falcons, and Bald Eagles. DDT has been banned for many years, but new chemicals continue to emerge as potential threats to our avian wildlife. Brominated flame retardants, once used in

a vast array of consumer goods, have been experimentally linked to smaller eggs and thinner eggshells in captive kestrel populations, and these chemicals are pervasive in the modern environment. It's certainly possible that these and other chemicals could be affecting our kestrels, but if so, why are most of our other raptor species doing so well? American Kestrels appear to be the only diurnal raptor whose numbers are significantly declining according to both the BBS and the Atlas. A pervasive pesticide problem should be affecting many species, not just one.

Another factor that has unquestionably had negative impacts on the American Kestrel is disease. West Nile virus (WNV) in particular is a

known bird killer. Transmitted by mosquitoes, which ingest the blood of an infected animal and then go on to infect others through subsequent bites, West Nile virus was responsible for the deaths of large numbers of raptors, crows, and other birds during the last major outbreak about ten years ago. In a study performed on nesting populations of kestrels at Hawk Mountain, Pennsylvania, in 2004, 95% of the birds tested positive for WNV antibodies. This indicates widespread exposure to the disease. However, the successful breeding and subsequent departure of these exposed birds suggests that "herd immunity" may have developed among the kestrel population at large.

As American Kestrels have decreased, other bird species have increased. Cooper's Hawks especially have become much more numerous and widespread within the Commonwealth over the last 40 years. These powerful and agile hawks specialize in feeding on other birds, and an adult Cooper's Hawk is certainly capable of taking a kestrel. The increase in Cooper's Hawks with the accompanying decrease in kestrels could certainly lead one to believe that predation by Cooper's Hawks is responsible for this decline, but correlation does not prove causation. There is no scientific evidence that Cooper's Hawks are preying extensively on kestrels, and, furthermore, kestrels are also declining in areas of the country, such as the American Southeast, where they have coexisted alongside Cooper's Hawks for many years.

The most significant threat facing American Kestrels may be the same one facing many grassland species: loss of suitable breeding habitat. Not only do American Kestrels require large areas of short grass in which to hunt, but they must also nest in tree cavities, which they cannot excavate themselves. Rather, they must find a hole created by a Northern Flicker or other woodpecker in which to lay their eggs. Competition for these cavities with introduced birds such as European Starlings, along with dwindling numbers of suitable fields for foraging, is probably the most serious problem that kestrels have

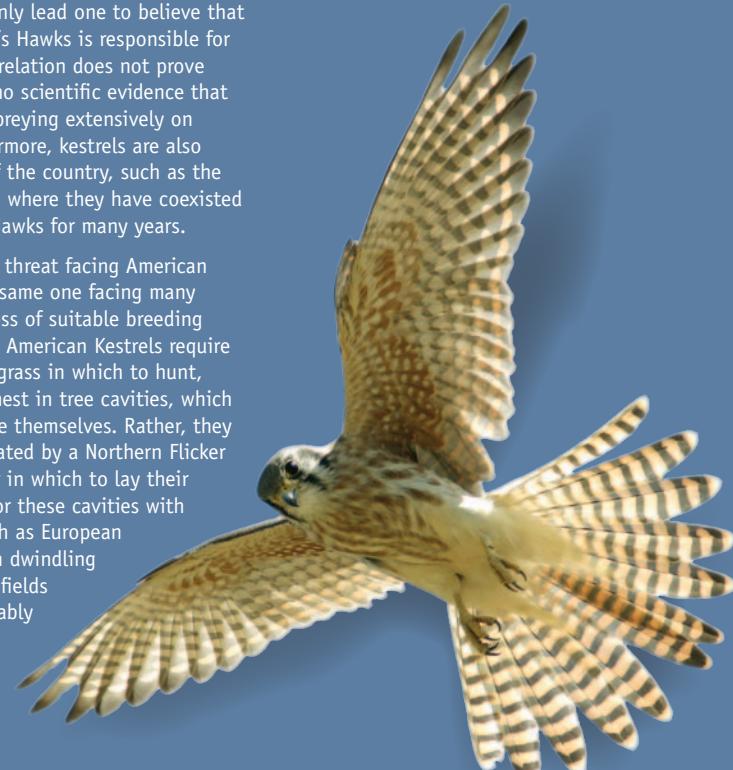
to contend with. Some kestrels have proven adaptable enough to breed in urban areas, building their nests in broken cornices and feeding on House Sparrows. In the traditional strongholds of this species, however, fewer and fewer kestrels are breeding in Massachusetts each year.

Adding to the complexity of the problem is the fact that we know almost nothing about what happens to those kestrels that spend the winter outside the United States, as many do. Changes in the habitat quality of migratory stopovers as kestrels disperse from and return to Massachusetts might also be contributing to declines.

It is reasonable to suppose that all of the aforementioned factors are having some negative effects on American Kestrels. For the present, however, preserving grassland habitats and ensuring the availability of suitable cavities through nest box programs may be the best ways to help this beleaguered falcon while further research is done into the ultimate causes of this worrisome decline.

TABLE 5. The 20 bird species with the largest decrease in the number of blocks in which they occur between Atlas 1 and Atlas 2.

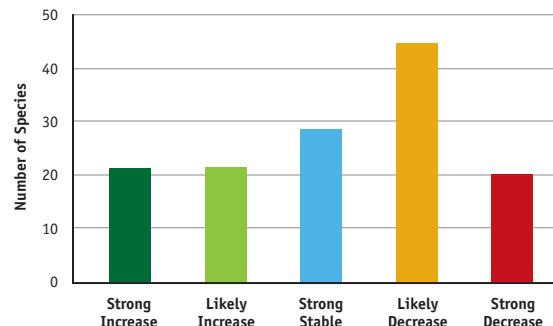
Common Name	Absolute change in blocks occupied	Atlas 1 Blocks	Atlas 2 Blocks
Eastern Meadowlark	-282	371	89
Ring-necked Pheasant	-264	341	77
American Kestrel	-249	425	176
American Black Duck	-240	425	185
Brown Thrasher	-222	582	360
Northern Bobwhite	-178	238	60
Purple Finch	-171	540	369
White-throated Sparrow	-161	309	148
Canada Warbler	-101	259	158
Eastern Whip-poor-will	-83	180	97
Bank Swallow	-69	274	205
Cliff Swallow	-69	128	59
Nashville Warbler	-62	154	92
Golden-winged Warbler	-61	64	3
Field Sparrow	-44	488	444
Black-billed Cuckoo	-41	271	230
Common Nighthawk	-35	47	12
Vesper Sparrow	-34	50	16
American Bittern	-28	106	78
European Starling	-27	792	765



BREEDING BIRD SURVEY

We looked at overall trends, from 1966-2008, and classified birds as increasing, stable, or decreasing by the direction and strength of their annual trend. BBS data also includes confidence levels for the trend estimates, but for this exercise of overall categorization we show all trends regardless of their statistical significance.

FIGURE 4. Trends identified by the Breeding Bird Survey.



Our analysis of Breeding Bird Survey data includes 134 species in Massachusetts, a smaller number of species than the Atlas. After we categorized species by their overall trends we found 21 (16%) of the BBS species have strong increases, 21 (16%) are likely increasing, 28 (21%) are stable, 44 (33%) are likely decreasing, and 20 (15%) show strong decreases (Figure 4). For many species the direction of their trend between the Atlas and the BBS is the same. However, BBS identifies a higher percentage of species with strong or likely declines.



The Pileated Woodpecker is becoming more common as forests mature and spread throughout the state.



The Eastern Towhee is disappearing from Massachusetts at an average rate of more than 8% per year.

BBS Winners and Losers

Table 6 identifies the top 10 increasing and decreasing BBS species. There is much agreement between Atlas and BBS findings. However, it is important to note the appearance of species on this list that do not show up as strong decliners in the Atlas, such as Broad-winged Hawk and Eastern Towhee.

The Whisperers

Broad-winged Hawk is a stable Atlas bird, with no change in Atlas blocks. However, the BBS captures a 10% decline in this species between 1966 and 2008. We refer to these species that are stable in the Atlas, yet demonstrate robust declines in the BBS, as “whispering” birds. Though most of these species are now widespread, their declines, if “quietly” continued, will cause them to be reclassified as rare. Table 7 lists all of the birds that the Atlas classifies as “stable” and “likely increasing,” are present in more than 300 Atlas 2 blocks, and have significant declines of at least 1% in the BBS.

TABLE 6. The twenty species with the largest increases and decreases since 1966 according to the BBS. *Italicized species were not identified as strong decliners by the Atlas.*

Common Name	Trend (1966-2008) Percent change per year	Common Name	Trend (1966-2008) Percent change per year
<i>Common Tern</i>	+24.5	Golden-winged Warbler	-18.0
Red-bellied Woodpecker	+22.5	Eastern Meadowlark	-10.4
Common Raven	+20.2	Northern Bobwhite	-10.2
<i>Wild Turkey</i>	+18.1	<i>Broad-winged Hawk</i>	-10.0
Carolina Wren	+12.6	Brown Thrasher	-9.7
Sharp-shinned Hawk	+12.3	American Kestrel	-9.3
<i>Orchard Oriole</i>	+11.9	<i>Eastern Towhee</i>	-8.4
<i>Spotted Sandpiper</i>	+10.2	Ring-necked Pheasant	-7.3
Pileated Woodpecker	+8.4	<i>Savannah Sparrow</i>	-7.3
<i>Northern Cardinal</i>	+6.8	White-throated Sparrow	-7.2

CHRISTMAS BIRD COUNT

The Christmas Bird Count includes results from 183 species from circles within Massachusetts during the years 1964-2008. We classified birds in the same categories as we did for the BBS. Of the species recorded on the CBCs, 52 (28%) show strong increases, 57 (31%) are likely increasing, 27 (15%) are stable, 24 (13%) are likely decreasing, and 23 (13%) are declining. It is surprising, and welcome, that so many species that winter here are doing well. While some of the same “intangible” caveats that apply to the increases in Atlas trend data apply also to the CBC data (field identification techniques have improved over the years), we did control for some known differences in sample effort, such as field hours and observer numbers. Even with these factors controlled, CBC data do indicate that many species present during the winter count period are increasing.

TABLE 7. Some of the “whispering” birds that have shown declines in abundance.

Common Name	Atlas 1 Blocks	Atlas 2 Blocks	Percent change in blocks occupied	BBS Trend (1966- 2008) Percent change per year
Broad-winged Hawk	438	438	0.0	-10.0
Savannah Sparrow	198	355	79.3	-7.3
Green Heron	346	436	26.0	-6.9
Northern Flicker	750	778	3.7	-4.4
Least Flycatcher	349	351	0.6	-4.4
Eastern Kingbird	746	792	6.2	-3.7
Wood Thrush	690	690	0.0	-3.5
Blue Jay	799	811	1.5	-2.9
Killdeer	486	574	18.1	-2.9
Common Grackle	773	810	4.8	-2.7
Indigo Bunting	530	664	25.3	-2.6
Song Sparrow	805	819	1.7	-2.4
Chimney Swift	630	650	3.2	-2.3
Baltimore Oriole	700	806	15.1	-2.0
Common Yellowthroat	768	803	4.6	-1.7
Eastern Phoebe	670	787	17.5	-1.7
Red-winged Blackbird	785	817	4.1	-1.6
Great Crested Flycatcher	519	743	43.2	-1.5
Scarlet Tanager	654	707	8.1	-1.4
Brown-headed Cowbird	645	793	22.9	-1.3
Rose-breasted Grosbeak	562	651	15.8	-1.1

Winter birding is enjoyed by both the casual and experienced birder.



The Broad-winged Hawk is still widespread, but soars overhead in smaller numbers each year.



The slow but significant decline of the vibrant Scarlet Tanager may signal trouble for our common birds.

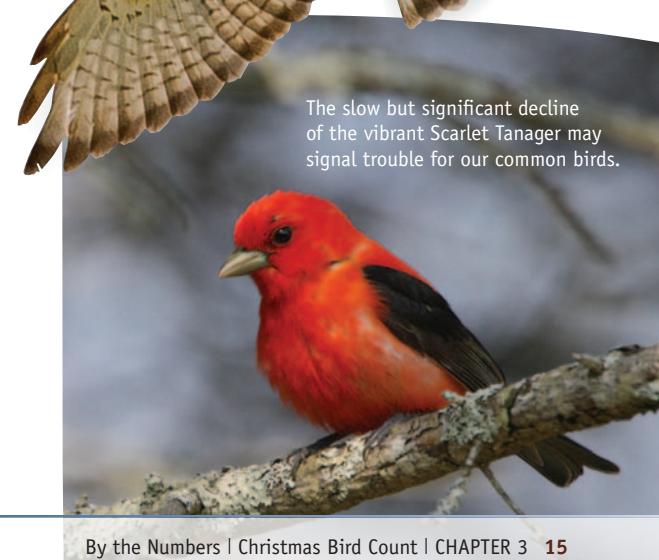
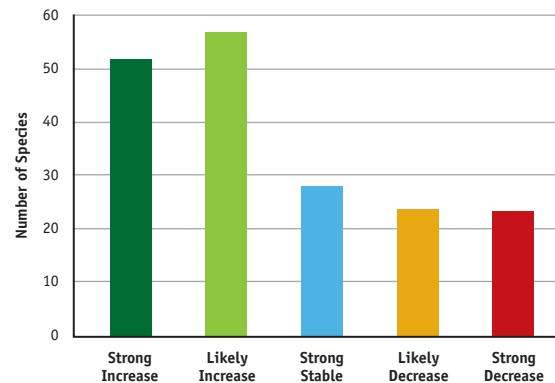


FIGURE 5. Birds present within the Christmas Bird Count data.



The Ruffed Grouse seems to be shifting its distribution to the heavily forested western part of the state, and drops in winter numbers warn of possible decline.



CBC Winners and Losers

Table 8 shows the top 10 increasing and decreasing wintering birds identified by the CBC.

TABLE 8. The twenty species with the largest increases and decreases according to the CBC.

Common Name	Trend (1964-2008) Percent change per year	Common Name	Trend (1964-2008) Percent change per year
Turkey Vulture	26.26%	Evening Grosbeak	-22.68%
Wild Turkey	25.20%	Northern Bobwhite	-15.94%
Red-bellied Woodpecker	20.85%	Ring-necked Pheasant	-9.86%
Common Raven	16.25%	Brown-headed Cowbird	-8.97%
Carolina Wren	14.56%	Eastern Meadowlark	-8.86%
Eastern Bluebird	13.91%	Purple Finch	-8.47%
House Finch	10.87%	American Kestrel	-7.59%
Tree Swallow	9.88%	Common Grackle	-5.83%
Cedar Waxwing	9.59%	Black-crowned Night-Heron	-5.45%
Cooper's Hawk	9.46%	Ruffed Grouse	-5.34%



The Cooper's Hawk has moved into Massachusetts from the south in great numbers.

IDENTIFYING CONSERVATION STATUS FOR THE BREEDING BIRDS OF MASSACHUSETTS

The final step in this exercise is to convert the trend assignments into a **Conservation Status** rank that suggests the level of attention and action that is needed by each species. To do this, we began with the increasing, stable, and decreasing trends from the Atlas and BBS (Figures 3 and 4). We then incorporated information from a variety of other sources that provide the best current information. The additional data sources that we considered include, but are not limited to, the current MESA-listing status, *regional* BBS trends, information gathered in *intensive survey* efforts such as that gathered by the Natural Heritage & Endangered Species Program (NHESP) on colonial waterbirds, single-species surveys such as the American Woodcock Population survey collected by the Division of Fisheries and Wildlife and collated regionally by the U.S. Fish & Wildlife Service, and historic information. In short, although the Atlas and BBS findings are the foundation of trend assignments and conservation status, the process of identifying overall conservation status must be *dynamic* and constantly use the best available information.

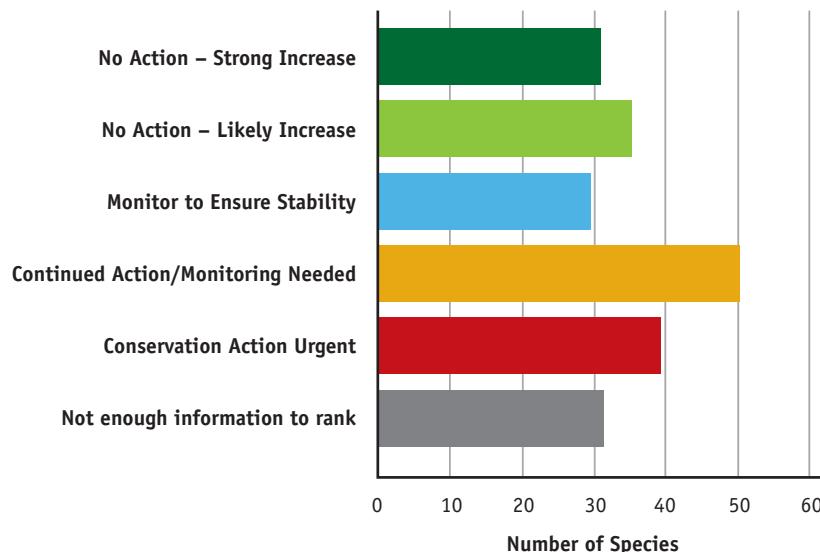
The populations of birds with strong and likely increases, by multiple

measures, are likely doing fine and should be simply monitored (dark green and light green). All of the stable species should be monitored using inexpensive, long-term surveys such as the BBS and eventually Atlas 3 to ensure that population levels remain stable (blue). A variety of birds reside in the “Continued Action/Monitoring Needed” category (orange). Piping Plovers and terns, whose populations are stable or increasing, must continue to benefit from the active management provided by the Coastal Waterbird Program of Mass Audubon and the NHESP,

or they will likely suffer declines. Many common species exhibiting declines—the whisperers—are also placed into this category. If trends persist, these birds will no longer be common throughout the state. Finally, the 39 species present in the “Conservation Action Urgent” category are a combination of currently listed species and species that have seen drastic declines in their numbers for reasons such as loss of grassland and shrubland habitat. Together, the red and orange categories include 41% of the breeding species of the Commonwealth. The 32 species with not enough information to rank are rare species that were present in too few blocks to indicate a trend.

Although this exercise did not extend a conservation status to the wintering species of Massachusetts, the CBC analysis identifies trends in wintering species, and serves as an excellent foundation upon which to extend this status exercise to all of the birds of Massachusetts.

FIGURE 6. Overall Conservation Status of the Breeding Birds of Massachusetts.



BY HABITAT

In order to try to understand possible causes for declines in various bird species, we have grouped Massachusetts birds into their preferred habitat types and then assessed the status of the species within each habitat group. While some species are restricted to a single habitat (“obligates”), others use two or more habitats and therefore arguably have a greater degree of flexibility in maintaining their populations when one habitat type decreases or is otherwise rendered unusable. Therefore, we have analyzed trends of all of the bird species that use each habitat as well as the status of the obligate species alone, using the data sources and methodologies described above. Each of the accounts begins with a general description of the habitat in question. One advantage of looking at our birdlife through this lens is that it may reveal habitat-related causes of species declines that could be addressed by active ecological management or land protection initiatives. Where such issues are apparent, we have drawn attention to them, and suggested possible remedies on page 57.

Each bird was assigned to one or more of the above habitats based on its breeding and wintering behaviors. In a separate exercise, birds that were “obligate” breeders in only one habitat were also assigned to the appropriate habitat type.

TABLE 9. Habitat types to which birds were assigned.

Grassland, Agricultural, and Open Field Habitats
Shrublands
Forests and Woodlands
Urban and Suburban Habitats
Open Water: Rivers, Lakes, and Ponds
Freshwater Open Wetlands
Freshwater Forested Wetlands
Salt Marshes
Coastal Habitats

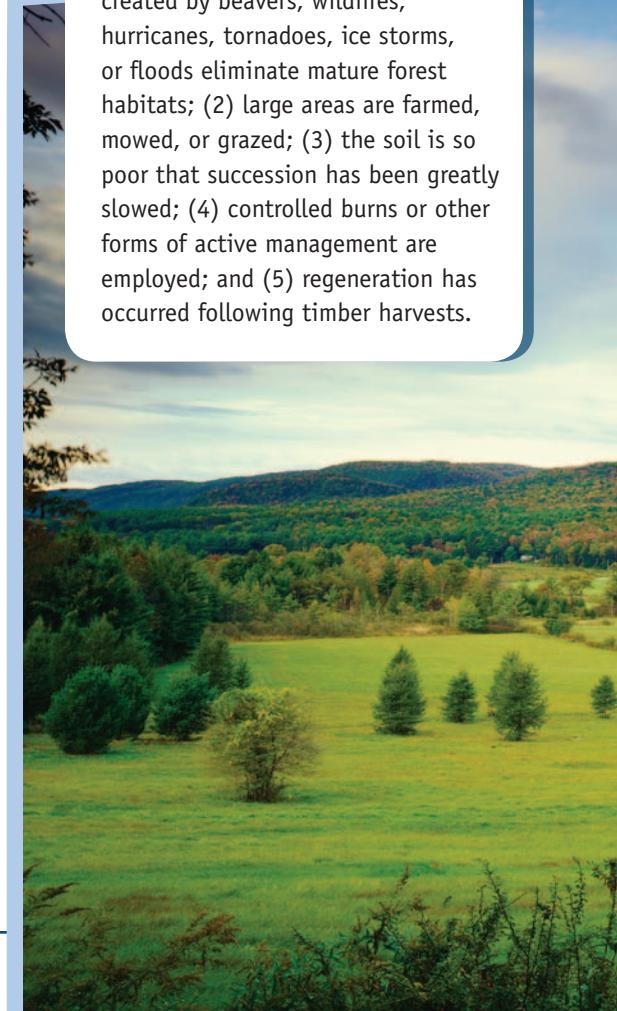
TABLE 10. Key to the conservation status assignments.

No Action – Strong Increase
No Action – Likely Increase
Monitor to Ensure Stability
Continued Action/Monitoring Needed
Conservation Action Urgent
Not enough information to rank

Within each section that follows is a list of all of the breeding birds of that habitat. We applied the same color scheme and status description as shown in Figure 6 to each bird within these lists. Obligate species are denoted in *italics*, and the listing status of each species is indicated as Endangered (E), Threatened (T), or Special Concern (SC) for MESA-listed species; or with (SWAP) for birds that are not MESA-listed but are of conservation concern in the State Wildlife Action Plan.

EARLY-SUCCESSIONAL GRASSLANDS AND SHRUBLANDS

Both grasslands, discussed in this section, and shrublands, discussed in the next section, can be described as “early-successional” habitats. They are characterized by plant communities in various states of transition created by disturbances, both natural and those caused by humans. Biologically viable examples of grasslands and shrublands can occur where (1) natural disturbances created by beavers, wildfires, hurricanes, tornadoes, ice storms, or floods eliminate mature forest habitats; (2) large areas are farmed, mowed, or grazed; (3) the soil is so poor that succession has been greatly slowed; (4) controlled burns or other forms of active management are employed; and (5) regeneration has occurred following timber harvests.





Savannah Sparrows are grassland birds on the cusp—continued action and monitoring are necessary.



The significantly increasing Bobolink can breed in fields of only a few acres.



Open grasslands and many of the birds that call them home are becoming harder to find in the Bay State.

GRASSLAND, AGRICULTURAL, AND OPEN FIELD HABITATS

Broadly speaking there are two types of grassland in the Commonwealth: (1) sandplain grassland, an increasingly rare and localized habitat dominated by native grasses and forbs growing on the well-drained sandy soils of the coastal plain, Cape Cod, and especially the Islands (Nantucket, Martha's Vineyard, Tuckernuck, and the Elizabeth Islands); and (2) cultural grassland, dominated by non-native pasture grasses and forbs. Cultural grasslands include the hay and grain fields created by the European colonists, a small percentage of which remain in active production today, as well as large commercial and military airfields, which are now the nearly exclusive home to species such as the Upland Sandpiper. Most of our rare and declining grassland birds use both types of grassland.

Grassland birds are declining in Massachusetts—and throughout the region. Data from Atlas 2 show that the distributions of grassland-nesting species are contracting significantly more than the ranges of species nesting in other habitats. BBS data also shows an overall decline for these birds (P-value = 0.07).

Which birds need the most help? We have identified 23 species as grassland breeders, and 9 of these are grassland obligates. There are few grassland species that are not declining, and most of them remain an imperiled component of the Massachusetts avifauna.

Additional details to note regarding grassland birds include the following.

- Eastern Meadowlark populations in Massachusetts, and in our neighboring states, show marked decline. Atlas data show their distribution has shrunk by 76%. This species also shows a steep 10.4% average rate of annual decline in the BBS. Until recently one of the most familiar songbirds of the Massachusetts agricultural and salt marsh landscapes, this striking icon now ranks as a species in urgent need of conservation action. The loss of agricultural land limits nesting opportunities for this species since it typically requires fields at least 15 acres in size to breed. Hay harvesting practices that encourage two crops of hay annually, and include a month of June cut, have likely caused considerable losses to incubating adults and pre-fledged young. This species is not MESA-listed, although it is listed in the State Wildlife Action Plan, and should be considered as a candidate for expanded protection.

TABLE 11. Conservation status of grassland breeding species. Refer to page 18 for the key to this species list.

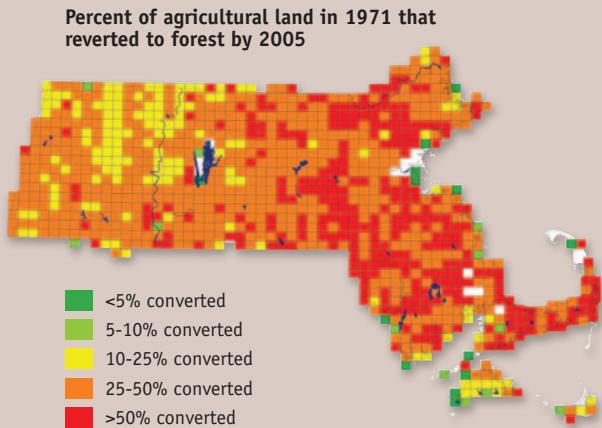
Wild Turkey
Eastern Bluebird
Bobolink
Barn Swallow
Tree Swallow
Red-winged Blackbird
Savannah Sparrow
American Woodcock (SWAP)
Killdeer
Brown-headed Cowbird
Barn Owl (SC)
Vesper Sparrow (T)
Grasshopper Sparrow (T)
Short-eared Owl (E)
Horned Lark
American Kestrel (SWAP)
Eastern Meadowlark (SWAP)
Northern Bobwhite (SWAP)
Sedge Wren (E)
Upland Sandpiper (E)
Ring-necked Pheasant
Henslow's Sparrow (E)
Dickcissel

AGRICULTURAL DECLINE IN MASSACHUSETTS

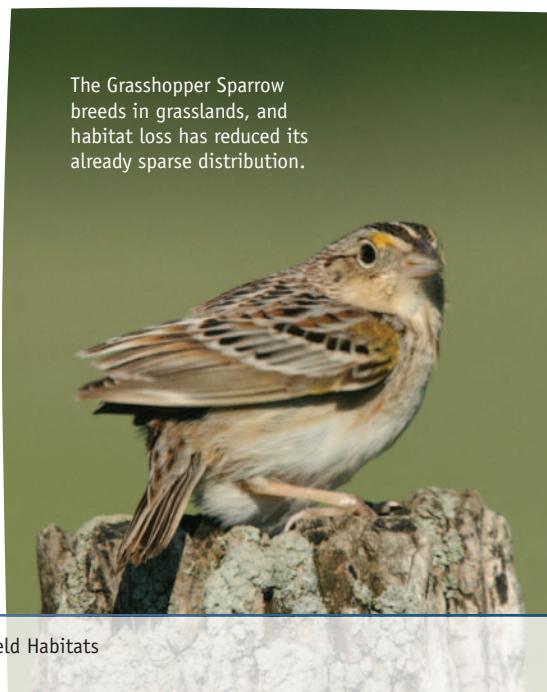
Agricultural land uses have been in decline in Massachusetts ever since the advent of the railroad made the fertile grasslands of the midwestern U.S. more appealing than the rocky landscapes of New England. Despite this long history of decline, at the time of the first Atlas, there were still many grassland species that were relatively more common than today, such as the Eastern Meadowlark. A more recent look at changes in land use between 1971 and 2005 is useful as a potential explanation for the decrease in so many of our grassland

bird species. Of the roughly 400,000 acres of cropland and pasture present in 1971, nearly 150,000 of these acres have been converted to other land uses. While most are aware of the 75,000 acres that were converted to developed land uses over this period, it is important to realize that an equivalent amount of land (71,400 acres) has naturally reverted to a forested condition. The combination of conversion to development and reversion to forest results in a 25% decrease in cropland and pasture in most Atlas blocks. In the “Sprawl Frontier” identified in the 4th edition of Mass Audubon’s *Losing Ground*, more than 50% of the agricultural land had been lost in most blocks.

Creative partnerships between the agriculture and bird conservation communities could go a long way toward maintaining some of our declining grassland bird species. If we are able to develop and implement management practices that are compatible with grassland birds’ diverse breeding requirements *and* the needs of agricultural communities, we may be able to maintain these species as part of the natural heritage of our working landscapes. Attention must also be paid to the size and distribution of the grassland “patches” that remain. Those species that need fields larger than 15 acres such as Eastern Meadowlark and Vesper Sparrow are the very species that have shown some of the steepest declines.



The Vesper Sparrow requires large fields of mixed grasses to breed successfully.



The Grasshopper Sparrow breeds in grasslands, and habitat loss has reduced its already sparse distribution.

- Vesper Sparrow numbers are also continuing to decline in the state, despite its listing as a threatened species, and are sliding fast with a 66% decline in distribution, and a 19.9% decrease on BBS routes. Planted agricultural fields, including hay fields, do not provide the vegetation diversity and structure that these birds require. Vespers use dry fields with little litter, patchy vegetation, including some small shrubs, and they prefer large fields—more than 35 acres. It is unlikely that this species will benefit from management strategies that simply call for delayed mowing—their specific habitat requirements and long breeding season suggest they need dedicated sites tailored to their specific needs.
- Several birds that depend on grasslands for a significant part of their livelihood are also listed species or are decreasing sharply. These include Northern Bobwhite, American Kestrel (see box on page 13), Killdeer, Barn Owl, Horned Lark (a grassland obligate species), American Woodcock, and Northern Harrier.

Are any grassland obligates doing well? Both the Bobolink and Savannah Sparrow show increases in distribution in the Atlas data, although both show declining trends from the BBS. The Bobolink is able to use planted hay fields, and Savannah Sparrows will use an unusually wide variety of grassland habitat types for breeding. These traits may have helped them to adapt to the current grassland and agricultural landscapes that we find in Massachusetts today.

SHRUBLANDS

Shrublands represent a stage of succession between grasslands and forest, though, like grasslands, they can persist on poor and thin soils. As we have defined the category, shrublands comprise several plant communities that often intergrade and include: barrens of low shrubs, typically dominated by blueberries and huckleberry (e.g., coastal “moorlands”); tangles of taller second growth including shrubs and small trees that often occur on abandoned agricultural lands; forest edges where young forest trees are resprouting at the edge of a burn or a mowing associated with a utility (electricity, natural gas, or water) corridor, as well as the regeneration that occurs following timber harvest.

Many shrubland species are declining significantly as breeding birds in Massachusetts, with both the Atlas and BBS showing significant declines for these species. Among the 47 shrubland birds, the BBS reveals that the 15 ground-nesting species are declining significantly faster than the rest of this group. In Massachusetts, no obligate species in this habitat show an increase in both Atlas and BBS status.

Which birds need the most help?

- In the entire BBS eastern region, there is no shrubland nesting species with a statistically significant positive trend, while there are 13 that are declining.
- Golden-winged Warbler, on the state endangered species list, is probably extirpated as a breeding bird in the Commonwealth, and has been proposed for listing on the federal list of endangered species. In 1979, the Golden-winged Warbler was known to breed in 64 blocks in the state—currently it has only been recorded in three, and not one has been confirmed breeding.
- The White-throated Sparrow, while still one of the most numerous breeding birds in the boreal forests to our north, is present in only 48% of its 1979 breeding blocks in Massachusetts. This species (1) is a specialist of recently disturbed shrubland or edge habitats in Massachusetts; (2) is near the southern edge of its breeding range in Massachusetts; and (3) nests on or close to the ground. Each of these elements is identified as characteristic of a declining species. Declines of common birds are often missed because, as they move from abundant and widespread to less abundant, they often remain widespread, just less numerous. It is only after years of decline and gradual withdrawal that they are identified as species in need of conservation action. Even though the long-term surveys of the BBS show strong and consistently significant negative trends for this species across all time periods (at least 7% decrease) in Massachusetts as well as in New York, Maine, New Brunswick, New Hampshire, and Nova Scotia, the White-throated Sparrow’s plight has gone largely unrecognized to date. White-throats are still common during spring and fall migration and at feeders in winter.

The Prairie Warbler has found a niche in utility rights-of-way.



The “Old Sam Peabody” song of the White-throated Sparrow is now heard in less than half of its 1979 range.

Shrublands are diminishing as the state reverts to forest and as open lands are developed.

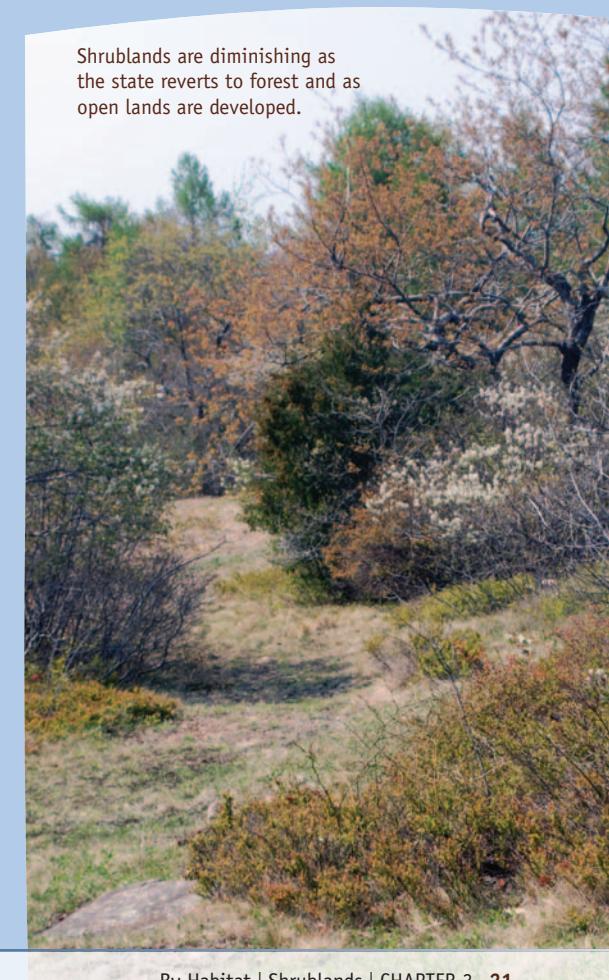


TABLE 12. Conservation status of shrubland breeding species. Refer to page 18 for the key to this species list.

Carolina Wren	Cedar Waxwing	Nashville Warbler
Wild Turkey	Northern Harrier (T)	Yellow-breasted Chat
Warbling Vireo	Song Sparrow	White-throated Sparrow (SWAP)
Eastern Bluebird	Common Yellowthroat	Field Sparrow (SWAP)
Alder Flycatcher	Blue Jay	Brown Thrasher (SWAP)
Mourning Warbler (SC)	Eastern Towhee (SWAP)	Northern Bobwhite (SWAP)
Ruby-throated Hummingbird	Ruffed Grouse (SWAP)	White-eyed Vireo
Blue-winged Warbler (SWAP)	Great Crested Flycatcher	Eastern Whip-poor-will (SWAP)
Yellow-billed Cuckoo	Prairie Warbler (SWAP)	Common Nighthawk
American Robin	Indigo Bunting	Golden-winged Warbler (E)
Gray Catbird	Eastern Kingbird	Ring-necked Pheasant
Northern Mockingbird	Least Flycatcher	Clay-colored Sparrow
American Goldfinch	Chestnut-sided Warbler	Lincoln's Sparrow
Yellow Warbler	Black-billed Cuckoo	Blue Grosbeak
American Redstart	American Woodcock (SWAP)	Chuck-will's-widow
House Wren	Brown-headed Cowbird	

- The Nashville Warbler is following a trend similar to that of the White-throated Sparrow, although as a neotropical migrant it is also subject to the rigors of a long-distance migration and habitat loss on the wintering grounds. The Nashville Warbler is restricted to early-successional habitats—second-growth forests, clear-cuts that have matured to a point that they have a well-developed shrub layer, and forest edges. This restrictive habitat requirement means they were never a common breeding warbler in the state, but they currently are found in only 60% of the blocks occupied in 1979. BBS data from both Connecticut and Massachusetts evidence steep declines for the Nashville Warbler. As with White-throated Sparrows, Nashville Warblers are persisting or even thriving to our north where there is sufficient logging to create thousands of acres of maturing early-successional habitat.
- The Brown Thrasher has declined notably to only 62% of its distribution since Atlas 1 was completed in 1979, and this decline is echoed in the BBS in Massachusetts with a 9.7% annual decrease between 1966 and 2008, as well as throughout the Northeast. The Brown Thrasher is a breeder in thickets, tangles, and richly vegetated shrublands, all habitats that are declining. This affinity for thickly vegetated sites makes them vulnerable to any changes in agricultural or landscape management practices that reduce vegetation structure. They are not as numerous as some of the other shrubland obligates, such as the Eastern Towhee, so are more susceptible to extirpation than some other species. Like many of the other shrubland obligates, thrashers are also low-nesting birds. This makes them more vulnerable to predation, especially when vegetative cover and/or habitat patch size is reduced. Along with the other declining shrubland obligates, thrashers will require focused habitat management if they are to retain or expand their current breeding distribution.

THE STRANGE CASE OF THE “WINGED WARBLERS”

Golden-winged and Blue-winged warblers are “sibling species.” Though they are strikingly different in appearance, they are so closely related genetically that they hybridize freely where their ranges overlap, producing fertile hybrids that are themselves so distinctive that they have their own names (Brewster’s and Lawrence’s warblers). Apart from their appearance, the two species remain similar in many respects such as nesting behavior and habitat preference. However, as is typical in the evolution of one species into two, the siblings develop distinctive tendencies that reinforce their differences. For example, while both Blue-winged and Golden-winged warblers prefer forest edge, second growth, or shrubby fields as breeding habitat, Golden-wings tend to be more tolerant of (and thrive better in) wetland versions of such communities. In the historical period, Blue-wings have had a more southerly distribution and dominated at lower elevations, while Golden-wings have ranged farther northward and higher into the mountains.

Early in the 20th century, the Blue-winged Warbler was considered a rare “southern” species in Massachusetts, while the Golden-winged Warbler was locally common and widespread; their ranges did not overlap here. But by mid-century, Blue-wings were nesting regularly in southeastern Massachusetts, though still in small numbers. And by the 1970s and ‘80s the Blue-wings had invaded Golden-wing territory. For a decade or so, it was possible to visit historic Golden-winged Warbler habitat and find Golden-wings, Blue-wings, and all manner of hybrids nesting together in the same patch of habitat. Before long, however, the newcomers overwhelmed their northern counterpart. Today Blue-winged Warblers are common throughout most of the state where suitable habitat is available, while Golden-wings have all but



disappeared—reversing their respective status of a hundred years ago. Blue-wings are reputedly the more aggressive of the two “sisters,” and simple competition may have played a role in their battle for dominance. But most authorities believe that a genetic competition has also been in play, and that where the two gene pools have met the dominant Blue-winged genes have prevailed.

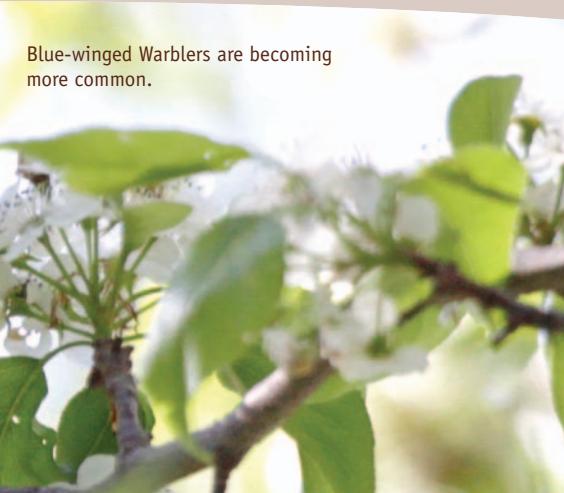
Other factors have also contributed to the sad decline of one of our most beautiful wood-warblers—now a candidate for the federal endangered species list. A major one, affecting both species, is loss of habitat as the forest edges and shrublands that both birds require is rapidly lost to succession. Though Blue-wings are faring far better than Golden-wings, they too appear to be decreasing as this habitat dwindles. Parasitism by Brown-headed Cowbirds and habitat destruction on the wintering grounds may also be affecting the populations of both species, but perhaps have a disproportionate impact on Golden-wings given the already weakened state of their populations. In sum, the decline—whether rapid or gradual—of the “winged warblers” may be attributable not to one or two factors, but a whole suite of conditions (all human induced), working in unwholesome combination against survival. It is the “multi-whammy” that may be driving the gradual decline of many of our birds.

Finally, a question: Why did the Blue-winged Warbler start moving steadily northward around the middle of the 20th century like so many other “southern” birds? Could it be that ultimately the Golden-winged Warbler will prove to be a victim of climate change?

Blue-winged Warblers are becoming more common.



Golden-winged Warblers have vanished as breeders in the state.



- Shrublands make up a critical part of the habitat requirements of a number of bird species that also depend on other habitat types. Some of these species are also decreasing, e.g., Whip-poor-will (10.1% decline 1980-2008) and Least Flycatcher (abundant in the agricultural era, now only locally common and decreasing by 6% in the BBS between 1980 and 2008).

- *Among shrubland birds, the ground nesters have been declining by at least 5%, on average, annually in BBS between 1966 and 2008 as well as more recently between 1980 and 2008.*

Some good news:

- One obligate shrubland nesting species on the state list, Mourning Warbler, is actually increasing, according to the Atlas.
- While the plights of some endangered species do not lend themselves to effective conservation action, there are active management strategies that can aid recovery for many shrubland species.
- Indigo Bunting, Prairie Warbler, and Blue-winged Warbler show increasing trends in the Atlas.

Recognizing the Value of Shrubland Habitat

Prior to European colonization, most shrublands were created by fire (primarily in coastal areas and major river valleys), blowdowns in the forest, beaver activity along low gradient streams, ice scouring along rivers and high gradient streams during the spring thaw, and/or agricultural practices of native people. These historic landscapes were ephemeral, but were consistently created throughout the landscape, and they supported a diversity of plant, insect, and bird communities as they matured. Without maintenance or continual creation, shrubland sites become unsuitable for shrubland-nesting birds. Shrubland communities are often not recognized as distinct habitat, especially when they occur as forest edges. But their small trees, thick ground cover, and tangled thickets are critical for ground- and low-nesting species. We suppress fires and now constrain other natural disturbance processes that create shrublands. We must develop a public understanding of the wildlife value of this habitat and we need to increase shrubland acreages through active management—management that is often expensive.



Formerly a familiar backyard bird, the Brown Thrasher is now an uncommon breeder in the Commonwealth.



The vocal White-eyed Vireo, once common in the southeast, is fading away.



Quabbin Reservation, New Salem

FORESTS AND WOODLANDS

Due to adequate precipitation throughout the seasons, Massachusetts tends to be a forested landscape, unless the growth of trees is inhibited by natural disturbance or eliminated by human activity. Early European settlers encountered a wilderness dominated by mature forest, which they cleared with astonishing rapidity, both for the valuable timber they could sell abroad and for agricultural use at home. By the turn of the 18th century, only about 20% of Massachusetts forests remained. As agriculture declined and much of the population moved into the towns and cities during the industrial revolution, the forests began to return. This trend has continued to the present, and non-urban residents of the Commonwealth once again find themselves living surrounded by relatively mature forest.

There are many different types of forest in Massachusetts, including the dominant mixed oak-conifer forest that occupies most of the state, as well as more localized forest communities such as the northern hardwood forest of the western hills, the pitch pine woods of the coastal plain, and the spruce-fir forests of our highest elevations.

We have identified 79 bird species that nest in forests, 35 of which are forest obligates. For the sake of clarity, we have omitted from the obligate category some very common birds such as Red-tailed Hawk and Black-capped Chickadee—which have accommodated so well to urban and suburban habitats, with their park-like landscapes of scattered trees and patchy copses—that they can no longer be considered truly forest dependent. We have also excluded from our statistical analysis the rarest forest birds (e.g., Yellow-bellied Flycatcher) and so-called “irruptive” species whose breeding status is erratic.

TABLE 13. Conservation status of forest and woodland breeding species.
Refer to page 18 for the key to this species list.

- Turkey Vulture
- Red-bellied Woodpecker
- Common Raven
- Cooper's Hawk
- Tufted Titmouse
- Pine Warbler
- Northern Saw-whet Owl
- Fish Crow
- Sharp-shinned Hawk (SC)
- Pileated Woodpecker
- Wild Turkey
- Warbling Vireo
- Barred Owl
- Acadian Flycatcher
- Orchard Oriole

- Yellow-bellied Sapsucker
- Winter Wren
- Golden-crowned Kinglet
- Great Horned Owl
- Ruby-crowned Kinglet
- White-breasted Nuthatch
- Chipping Sparrow
- Red-breasted Nuthatch
- Yellow-rumped Warbler
- Brown Creeper
- Pine Siskin
- Cerulean Warbler
- Blue-gray Gnatcatcher
- Yellow-throated Vireo
- Blue-headed Vireo
- Black Vulture

- Hermit Thrush
- Eastern Screech-Owl
- Red-tailed Hawk
- American Redstart
- American Crow
- Downy Woodpecker
- Black-capped Chickadee
- Dark-eyed Junco
- Hairy Woodpecker
- Magnolia Warbler
- Black-throated Green Warbler
- Eastern Wood-Pewee
- Ovenbird
- Blackburnian Warbler
- Veery
- Red-eyed Vireo

- Northern Flicker
- Northern Goshawk
- Baltimore Oriole
- Evening Grosbeak
- Worm-eating Warbler
- Black-throated Blue Warbler
- Green Heron (SWAP)
- Rose-breasted Grosbeak
- Scarlet Tanager
- Blue Jay
- Swainson's Thrush
- Broad-winged Hawk (SWAP)
- Wood Thrush (SWAP)
- Ruffed Grouse (SWAP)
- Black-and-white Warbler
- Great Crested Flycatcher

- Least Flycatcher
- American Woodcock (SWAP)
- Brown-headed Cowbird
- Long-eared Owl (SC)
- Purple Finch
- Red Crossbill
- Eastern Whip-poor-will (SWAP)
- Olive-sided Flycatcher
- Chuck-will's-widow
- Merlin
- White-winged Crossbill
- Blackpoll Warbler (SC)
- Bicknell's Thrush
- Summer Tanager

The breeding distribution of forest birds has expanded significantly—almost certainly resulting in a corresponding increase in abundance in many cases—compared with species nesting in all other habitats.

Most of our forest birds are currently common and widespread and have remained so for decades. Specific good news includes the following.

- Of the 35 forest obligates, all but 3 (Red Crossbill, Long-eared Owl, and Purple Finch) have remained stable or expanded their distribution per Atlas results.
- 19 species have increased in distribution by at least 20% or more since Atlas 1.
- These gains seem to hold across the seasons, with many forest-nesting species even showing higher winter numbers—indicating that the general increase in forest birds is a regional phenomenon.
- *The forest species that are resident in Massachusetts—those that do not migrate—are increasing in abundance according to the BBS.*

Climate signals: Forest birds that have recently expanded their ranges northward, such as the Red-bellied Woodpecker, show a significant increase in distribution (Atlas) and abundance (BBS), when compared with species at the southern edge or in the center of their range in Massachusetts. This large-scale phenomenon is a plausible signal of climate change.

- The 10 southern expanders had an average 560% increase in blocks occupied between Atlases, compared with the maximum 74% increase for a center/southern edge species.

Which forest birds need help?

- *The abundance of forest aerial insectivores (Eastern Whip-poor-will, Eastern Wood-Pewee, Least and Great Crested flycatchers) is declining at a rate significantly faster (-2.8%) than other forest-nesting species (1.49%) according to BBS.*
- Wood Thrush, Black-and-white Warbler, Scarlet Tanager, Rose-breasted Grosbeak, Eastern Wood-Pewee, and Ovenbird all show declining trends according to the BBS since 1980. These are the archetypal neotropical migrant songbirds of eastern forests. While we accurately associate these birds with mature forest, the reality is that, after the nesting period is completed and the young birds have fledged, some of these forest-nesting birds (e.g., the Wood Thrush) seek out shrubland and young forest habitats for a combination of protective cover and food (insects and berries) that help the birds prepare for an arduous fall migration flight (Marshall et al. 2003).
- The Eastern Whip-poor-will now occupies only 54% of its Atlas 1 distribution. While it nests in forest and feeds around forest clearings, it is also dependent on nocturnal flying insects and, like other decreasing forest birds, is also a long-distance migrant, indicating that the presence of forest habitat alone is not sufficient to ensure the well-being of some species (see page 43).
- Perhaps the most striking (and puzzling) “forest decliner” is the Purple Finch, which has both lost 39% of its 1979 breeding distribution, and also suffered a 3.9% decline in abundance (between 1980 and 2008 according to the BBS).

Populations of many forest residents, such as the American Redstart, are stable or increasing.



The Purple Finch is undergoing a mysterious and alarming drop in population.



Intelligent and adaptable, the Common Raven has expanded its range across the state.



The bark-crawling Black-and-white Warbler is showing signs of decline.

Hacking programs and pesticide control have brought the Peregrine Falcon back from the brink.



URBAN AND SUBURBAN HABITATS

Human influence on natural landscapes is—with considerable justification—often viewed as destructive. But for birds, the value of human-made habitats is based simply on their utility for successful nesting, feeding, or roosting. Birds see a typical cityscape as an aggregation of rocky canyons, interspersed with small areas of open woodlands, often with a traversing river system or coastline. Of the 22 pairs of Peregrine Falcons now nesting in Massachusetts, 14 are nesting on urban infrastructure, 6 are nesting in quarries, and only 2 are nesting on natural cliff ledges that were historic nest sites. In cities, this endangered species finds ideal cliff-nesting habitat with minimal disturbance and an abundance of birds and rodents on which to prey. Similarly, the habitat that suburbanites have created based on their own needs and tastes—a parklike landscape with numerous well-spaced trees and copses, an abundance of fruiting shrubbery, and patches of lawn—perfectly suits many bird species such as woodpeckers, titmice, nuthatches, wrens, some thrushes, waxwings, and various finches that, predevelopment, would have inhabited woodland edges and natural shrublands.

The urban/suburban avifauna has become notably richer in species during the last half century, apparently due to a combination of factors. The conjunction of a warming climate and the creation of a nearly continuous urban/suburban corridor from Washington to Boston have encouraged a northward range expansion by many “southern” birds such as Red-bellied Woodpecker, Tufted Titmouse, Northern Mockingbird, and Northern Cardinal. These are now among the commonest year-round residents in Massachusetts towns and cities. In addition, several raptor species, including Sharp-shinned, Cooper’s, and Red-tailed hawks and Great Horned and Barred owls—also species once self-restricted to rural habitats—have discovered the wealth of feeding opportunities and nesting sites that are available in urban and suburban areas and have taken up residence as never before.

For the purpose of analyzing this evolving habitat, we have identified 54 resident bird species (plus 3 that winter), which, while by no means restricted to urban and suburban landscapes, show a strong affinity for its “amenities” and can confidently be described as characteristic of our cities and the residential developments beyond.

Urban/suburban nesting species are increasing in abundance compared with all other species. They are also increasing in abundance in the winter (P-value = 0.06). Analysis of these birds reveals some interesting facts and trends.

- *Urban/suburban species that are expanding from the South are averaging 10% annual gains in abundance, far greater than species of other habitats. Atlas data shows the same trend, with urban nesting species that have southern roots posting average gains of nearly 400% since 1979.*
- *Both the Atlas and BBS show that resident urban species are expanding their distributions and increasing in abundance at rates higher than species that migrate.*
- Twenty-four of the 54 resident species (or 44%) nest in or on human-made structures at least occasionally, a far higher percentage than among Massachusetts birds as a whole.
- About 26% of our urban/suburban birds are cavity nesters, again a much higher fraction than other bird species as a whole.

- The urban/suburban avifauna has become richer, adding at least 10 species that would have been absent from these landscapes 60 years ago, and has, as yet, lost no species. This is due mainly to northward range expansions of a number of “southern suburban” species and what might be called the “urbanization” of species that formerly kept to more rural environments.
- The populations of many urban/suburban birds have also increased, due partly to the heightened reproductive rates and rapid range expansion that is typical of species arriving at new frontiers and finding unexploited ecological niches to occupy.
- Urban/suburban birds that remain year-round are increasing at a higher average annual rate than short-distance migrants that favor the same habitat.***

Despite the many success stories, there are also some sharp declines and worrisome trends among urban/suburban birds.

- Perhaps most worrisome is the striking decline in common species—the “whisperers.”** This list includes some of our most familiar songbirds, still holding their full distributions, so that the Atlas indicates that they are stable, and still common enough that it is scarcely credible that they could be in trouble. Yet, the BBS clearly traces a gradual but steady decline over the last 45 years, a downward trend that has steepened in many cases since 1980. The names of these whispering species may surprise you: Northern Flicker, Eastern Phoebe, Blue Jay, Common Grackle, European Starling, Song Sparrow, Brown-headed Cowbird, House Sparrow, and Baltimore Oriole.
- Common Nighthawks, once common ground nesters of Massachusetts pine barrens and sterile plains, were drawn to the flat, gravel-paved roofs that became popular in urban architecture around the turn of the 19th century and became common in many cities and towns. With urban renewal and changing architectural styles, however, this artificial habitat has all but disappeared, and with it the urban nighthawks.
- Chimney Swifts, which have abandoned the hollow trees in which they once nested for the sturdier and more reliable venting structures for which they were eventually named, have become notably less frequent along BBS routes. This may be due in part to the growing practice of capping chimneys or may be due to inadequate food supplies, as seen by the decline of many aerial insectivores.
- European Starling and House Sparrow are among the whisperers. These are introduced “pest” species but the House Sparrow is now on the “red list” in the United Kingdom, where they are native. The message their decline is sending may be worth heeding despite what we think of the messengers.
- Within the urban species, the colonial (P-value = 0.001) and aerial insectivore (P-value = 0.002) groups are significantly decreasing in distribution in contrast with the increasing average trends for urban species.*** These birds include the Cliff Swallow, Bank Swallow, Barn Swallow, and Purple Martin. This pattern is evident in the BBS for colonial nesting species during the most recent period.

TABLE 14. Conservation status of urban and suburban breeding species. Refer to page 18 for the key to this species list.

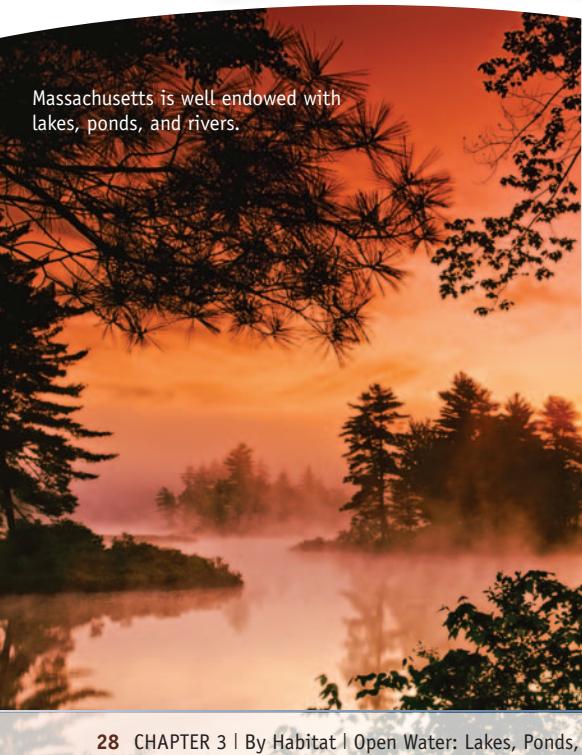
House Finch	American Crow
Mute Swan	Downy Woodpecker
Peregrine Falcon (E)	Black-capped Chickadee
Carolina Wren	Hairy Woodpecker
Red-bellied Woodpecker	Northern Mockingbird
Common Raven	Barn Swallow
Cooper’s Hawk	American Goldfinch
Tufted Titmouse	House Wren
Fish Crow	Mourning Dove
Wild Turkey	Rock Pigeon
Warbling Vireo	Eastern Phoebe
Orchard Oriole	House Sparrow
Canada Goose	European Starling
Mallard	Common Grackle
Northern Cardinal	Cedar Waxwing
Red-shouldered Hawk	Northern Flicker
Eastern Bluebird	Song Sparrow
Ruby-throated Hummingbird	Baltimore Oriole
Great Horned Owl	Chimney Swift
White-breasted Nuthatch	Blue Jay
Chipping Sparrow	Killdeer
Northern Rough-winged Swallow	Brown-headed Cowbird
American Robin	American Kestrel (SWAP)
Gray Catbird	Common Nighthawk
Eastern Screech-Owl	Bank Swallow
Red-tailed Hawk	Purple Martin
	Cliff Swallow
	Monk Parakeet



Many marsh ducks, such as Blue-winged Teal, are declining in range and population.



Common Loons are returning in numbers to the lakes and ponds of Massachusetts.



Massachusetts is well endowed with lakes, ponds, and rivers.

OPEN WATER: LAKES, PONDS, AND RIVERS

Massachusetts is rich in open water habitats for many reasons including: (1) glaciers left behind deep depressions and troughs on the surface of the Commonwealth, many of which eventually filled with water; (2) European settlers created additional ponds for various agricultural uses; (3) beavers turned many streams into shallow ponds (see box on page 31); and (4) rainfall amounts typical in this region allow these water bodies to persist. Each of these types of water bodies has its own distinctive set of characteristics and attracts different species of birds, but, for the purpose of this analysis, we have combined them into a single category. When we speak of breeding birds identified with these habitats, we are, of course, referring to species that nest on shorelines, islands, banks, and other features directly associated with the open water. But all are dependent on lakes, ponds, or rivers to a significant degree for their survival. We have identified 3 obligate species, 21 breeding species, and 33 species that winter in these open freshwater habitats.

Our analysis reveals the following.

- *Overall, species that nest in open water habitats are increasing in distribution.*
- *The Atlas shows that the obligate species in this category (Common Loon, Common Merganser, and Bald Eagle) have experienced great expansions in the number of Atlas blocks occupied in the last 35 years, compared with other species that nest in this habitat.*
- Of 8 species that use human-made structures for nesting (e.g., nest boxes, platforms, or bridges), all but one are expanding their distributions, most of them dramatically. Much of this progress in the recovery efforts for species such as the Wood Duck, Common Loon, Osprey, and Bald Eagle is due to the efforts of federal and state agencies, private land trusts, the sporting community, and citizen conservationists.
- Common and Hooded mergansers, also fish eaters, have colonized many new areas of the state. Increases in the former are unexplained, but could result from clean rivers programs and the subsequent recovery of fish populations. Hooded Mergansers are undoubtedly unintended beneficiaries of nest box programs targeting Wood Ducks.

TABLE 15. Conservation status of open water breeding species.
Refer to page 18 for the key to this species list.

Mute Swan
Hooded Merganser
Bald Eagle (E)
Osprey
Common Merganser
Common Loon (SC)
Canada Goose
Mallard
Red-shouldered Hawk
Belted Kingfisher
Wood Duck

Northern Rough-winged Swallow
Spotted Sandpiper
Gadwall
Double-crested Cormorant
American Black Duck (SWAP)
Blue-winged Teal
Bank Swallow
Purple Martin
Ring-billed Gull
American Wigeon

- Several declining species (e.g., Blue-winged Teal, Bank Swallow) have yet to be identified as in need of attention in the State Wildlife Action Plan.
- Two of the declining species in this habitat category, Purple Martin and Bank Swallow, are aerial insectivores, a category of birds that itself is in decline overall. By contrast, the Belted Kingfisher, a species with nesting habits similar to the declining Bank Swallow, feeds on fish, not insects, and is increasing robustly statewide.

FRESHWATER OPEN WETLANDS

Marshes are open wetlands shallow enough to support a dense cover of emergent plants such as cattails, but deep enough to impede the growth of woody plants; they have a mixture of organic and mineral soils that are saturated year-round. They may be flooded to a depth of up to six feet in the wet seasons but can show exposed soil during the driest weeks of late summer and early fall. Typically drained by slow outflow streams, they may cover large areas where source waters spill into a broad basin. Marshes may also represent a stage in the life cycle of a pond; as the pond gradually fills with dead vegetation and sediment, enough soil accumulates to support emergent vegetation, which eventually begins to form a fringe of marsh around the pond's shore. Because of their dense vegetation, freshwater marshes provide excellent cover for birds that nest on or near ground level, and they harbor some our most secretive birds such as rails and bitterns.

Marshes harbor a unique—and uniquely threatened—group of birds, of which 36 nesting species and 14 obligate or strongly associated species have been identified. *Statistical analysis of all 36 marsh nesting species did not find clear population trend differences between these and species in other habitat types.* However, when only the obligate species are considered, Atlas data gives a different picture. Of the 14 species, 6 have shrinking distributions, 7 are increasing, and 1 has remained unchanged since 1979. Table 16 emphasizes the many rare birds present within this habitat type that deserve additional attention.

Furthermore, when the analysis is extended back to the mid-20th century, the picture darkens.

- The modest recent gains in population that appear in the Atlas data for the Pied-billed Grebe, Least Bittern, and Sora turn into pronounced declines, and the presence of the first two species on the state endangered species list remains wholly justified.
- The continuing decline of the American Bittern is especially notable. Described as a common summer resident as recently as the mid-1950s, the American Bittern has declined in number of occurrences recorded by the Atlas by a third (from 106 to 78) since 1979.
- Also striking is the plight of the American Black Duck. Its decline in the last 35 years is one of the steepest in the Atlas data.
- Though always a local resident in Massachusetts, the Common Moorhen has also lost significant ground between the two Atlases from 17 occurrences to 8, a nearly 60% loss. With a warming climate, one might expect moorhens to be on the increase like so many other “southern” species. That the opposite is true suggests the possibility of countervailing conditions related to habitat.
- The Mute Swan, Canada Goose, and Mallard nest extensively in freshwater marsh habitat and have undergone population explosions in recent decades as a result of human assistance.

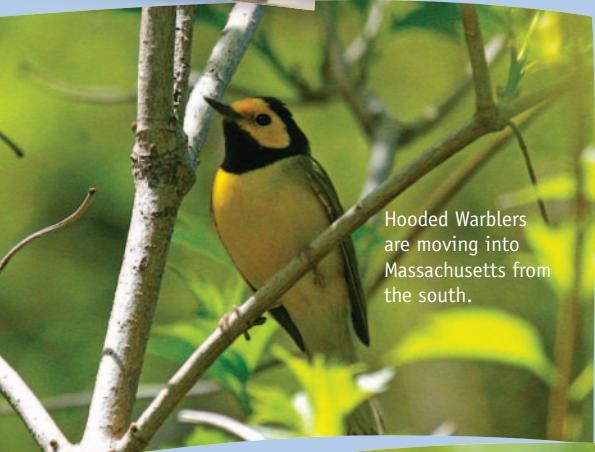
On the bright side, a spectacular marsh nester, the Sandhill Crane, was added to the Commonwealth's list of breeding species starting in 2007. Sandhill Cranes may have nested here until the beginning of the colonial period, but were rapidly extirpated and were regarded as “accidental” for most of the intervening three and a half centuries.

TABLE 16. Conservation status of freshwater open wetlands breeding species. Refer to page 18 for the key to this species list.

█	Mute Swan
█	Hooded Merganser
█	Virginia Rail
█	Canada Goose
█	Marsh Wren
█	Mallard
█	Red-shouldered Hawk
█	Wood Duck
█	Spotted Sandpiper
█	Gadwall
█	Swamp Sparrow
█	Green-winged Teal
█	Great Egret
█	Wilson's Snipe
█	Tree Swallow
█	Sora (SWAP)
█	Red-winged Blackbird
█	Northern Harrier (T)
█	Common Yellowthroat
█	Green Heron (SWAP)
█	Brown-headed Cowbird
█	American Black Duck (SWAP)
█	Blue-winged Teal
█	American Bittern (E)
█	Pied-billed Grebe (E)
█	Common Moorhen
█	Sedge Wren (E)
█	Least Bittern (E)
█	King Rail (T)
█	Ring-necked Duck
█	Ruddy Duck
█	Northern Shoveler
█	American Wigeon
█	Northern Pintail
█	American Coot
█	Sandhill Crane



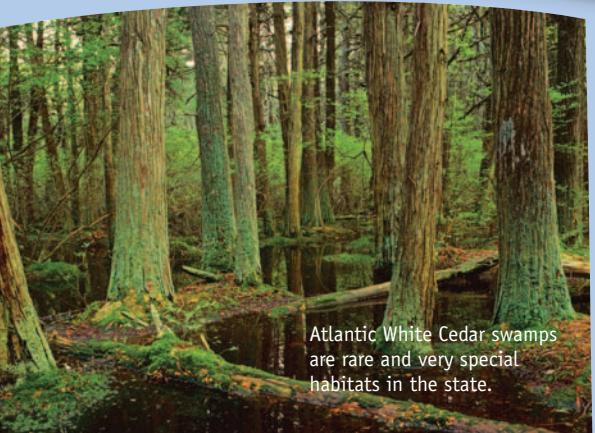
The spectacular Hooded Merganser has benefited from nest boxes put up for Wood Ducks.



Hooded Warblers are moving into Massachusetts from the south.



The forest-dwelling Black-throated Green Warbler is a fairly common denizen of mixed forests.



Atlantic White Cedar swamps are rare and very special habitats in the state.

FRESHWATER FORESTED WETLANDS

Though they are quite localized from a global perspective, forested wetlands are a common and important natural community, covering roughly 280,000 acres, or almost 6% of Massachusetts. Deciduous wetlands make up 68% of this habitat type, and are more commonly known as red maple swamps. They occur in a wide variety of situations from depressions in coastal sand dunes to broad former glacial lake basins. Structurally, they may contain as many as five distinct layers of vegetation, and they are highly diverse biologically with at least 50 species of trees, over 300 species of nonwoody plants, and over 200 species of vertebrate animals. As their various names imply, these forests are flooded or at least saturated for part of the year, but may be dry enough to walk in during the dry seasons. Forested wetlands support over 100 bird species, many of them forest generalists, but with few true obligates.

In general, we did not find clear differences in the population trends of the species that breed in wooded swamps when compared with other habitat types, and, as with the birds of other forest types, species that prefer this habitat seem to be doing well overall. Twenty-two of the 37 species that nest in wooded swamps have increased their distribution by more than 25% during the Atlas period. However, a few details—both positive and negative—are worth attention; first the good news.

- *According to Atlas data, species at the northern edge of their ranges (i.e., “southern” species) are significantly outperforming all other species that breed in this habitat.*
- The two species of cavity-nesting ducks show strong increases in distribution, doubtless resulting from an expansion of available habitat due to beaver flooding (see box on page 31) and an aggressive Wood Duck nest box program sponsored by MassWildlife.
- Red-shouldered Hawks and Barred Owls are also prospering, possibly reflecting a continuing recovery of many raptor species following the ban on DDT and other pesticides, which for many years depressed the reproduction rates of these birds.
- Of the passerines, Northern Waterthrushes, Brown Creepers, and Acadian Flycatchers are both expanding in distribution and increasing in abundance, the last due to its recent arrival from the South.
- Also on the “up” side are four species of rare warblers (Prothonotary, Hooded, Kentucky, and Northern Parula), all but the last at the northern extremity of their ranges. These species have recently been added to the list of state breeders or increased their populations since Atlas 1. All prefer wooded swamps as breeding sites.

Findings of concern include the following.

- Two species associated with this habitat, American Black Duck and Canada Warbler, are clearly declining, not only in Massachusetts but throughout the Northeast.
- The Veery is still widespread but suffered a sharp decline (per the BBS) between 1966 and 1979 and has continued to drop off, though more gradually. Veeries nest in understory shrubbery near the ground.

- The Canada Warbler is the most worrisome case among forested wetland birds. Atlas records declined from 259 to 158 (nearly 40%) between 1979 and 2010, and the downward slope of the BBS trend is similarly alarming. This and the previous species are both inhabitants of the shrubby understory, and some suggest the cause of their slide is that a burgeoning deer population is eliminating the low understory across the state. The deer browse issue is well documented, but no proof yet exists as to the connection to these two imperiled swamp birds.

TABLE 17. Conservation status of forested wetland breeding species. Refer to page 18 for the key to this species list.

Hooded Merganser	Eastern Phoebe
Great Blue Heron	Common Grackle
Northern Saw-whet Owl	Northern Parula (T)
Barred Owl	Red-winged Blackbird
Acadian Flycatcher	Common Yellowthroat
Mallard	Green Heron (SWAP)
Red-shouldered Hawk	Eastern Kingbird
Wood Duck	Great Crested Flycatcher
Alder Flycatcher	Brown-headed Cowbird
Winter Wren	American Black Duck (SWAP)
Hooded Warbler	Red-headed Woodpecker
Brown Creeper	Olive-sided Flycatcher
Willow Flycatcher (SWAP)	Canada Warbler (SWAP)
Northern Waterthrush	Lincoln's Sparrow
Louisiana Waterthrush (SWAP)	Ring-necked Duck
Blue-gray Gnatcatcher	Rusty Blackbird
Yellow-throated Vireo	Prothonotary Warbler
Yellow Warbler	Kentucky Warbler
Veery	

Great Blue Herons have increased along with the population of beavers.

BIRDS AND BEAVERS

Few animals have the capacity to significantly alter entire ecosystems and landscapes. We are one. Elephants are another. And a third is the unprepossessing beaver. Due to the value of its fur on the European market, the beaver was extirpated by colonial hunters and trappers in Massachusetts by 1750. And extensive deforestation during this period made much of New England inhospitable to beavers for decades. But as farming declined and the forests began to return, so did the beavers. Their return to Massachusetts was first recorded in West Stockbridge in 1928, and a few New York animals were released in Lenox in 1932. By 1946 there were 45 beaver colonies in the Commonwealth, all west of the Connecticut River. With protection and careful management, this industrious mammal is once again common throughout most of the state and has regained its former role as a major ecological influence on our landscape.

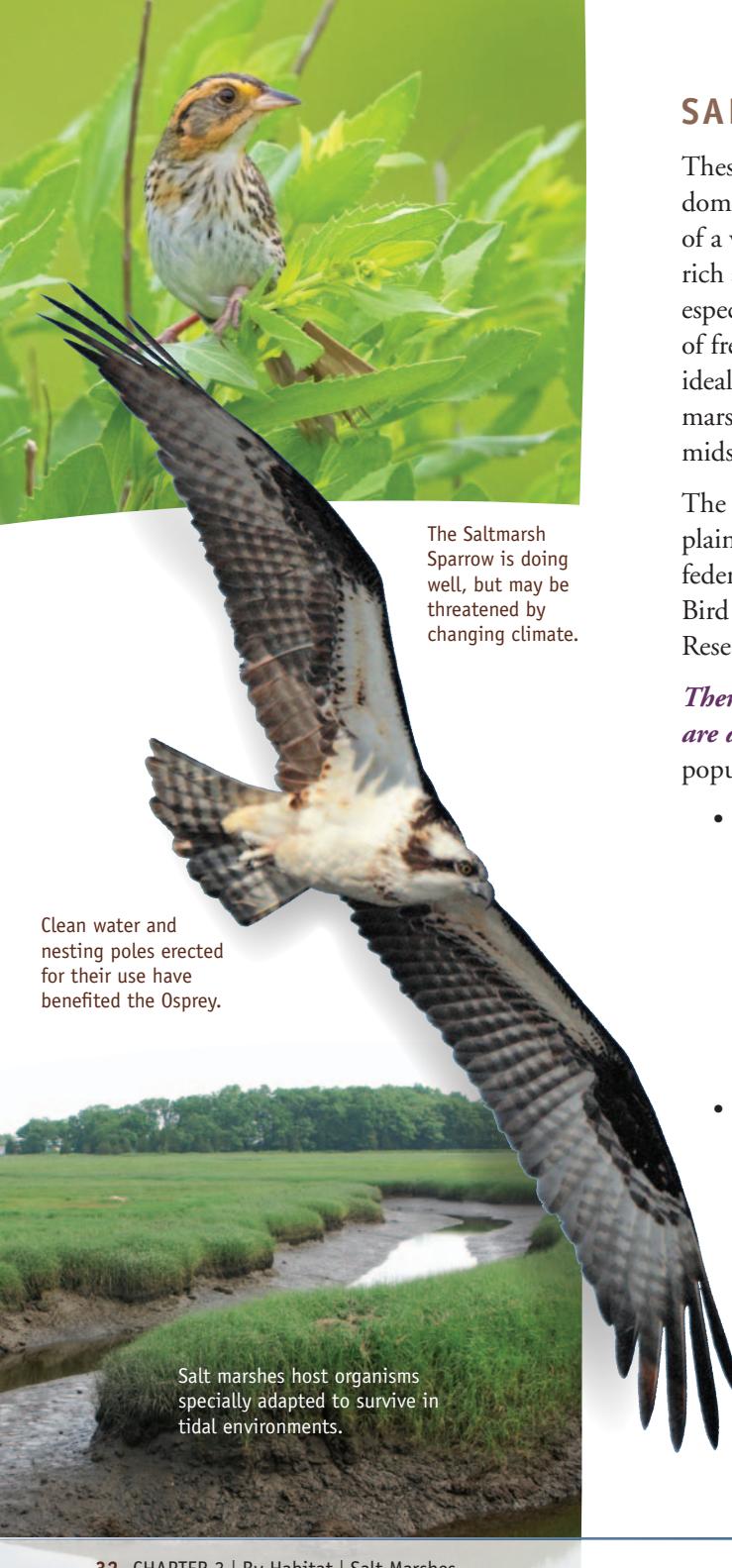
While the beaver's dam-making and flood-creating abilities are well known, its influence on bird populations may not at first be obvious. But its return has contributed significantly to increases in a number of bird species due to habitat alteration.

When beavers dam streams, they often flood areas of forest, killing stands of trees. The resulting skeletal clusters of dead trunks create an ideal framework for a high-rise colony of Great Blue Herons to nest in. As a result, we have seen the population of our largest heron expand significantly as beavers have created favorable conditions for the establishment of new colonies. Eventually, heron nests may be taken over by Great Horned Owls or other raptors. As the trees decay, cavities in the trunks provide secure nest sites for two of our most spectacular waterfowl species, Wood Duck and Hooded Merganser, both of which are also increasing due at least in part to the beavers' activity. In addition, fisheries studies have shown that beaver ponds usually increase fish populations, a further attraction for fish-eating birds such as kingfishers and wading birds.

Beaver flooding also tends to create areas of stunted trees and shrubland at the edges of the forests surrounding their wetlands. As we point out elsewhere in this report, we are rapidly losing this type of habitat in Massachusetts and with it birds such as the White-throated Sparrow that depend on it for nesting. Another group of birds that benefits from the forest clearings and open wetlands made by beavers are the so-called "aerial insectivores" such as swallows, swifts, and flycatchers. These birds, which appear to be declining overall, require extensive open areas and an abundance of insect life in order to thrive, both of which are characteristic of beaver "renovations."

The successional habitats they create are critical components of the Commonwealth's biodiversity, supporting many bird species.





SALT MARSHES

These coastal grasslands are among the most biologically productive ecosystems on the planet, with a single acre of the dominant cordgrass producing up to 10 tons of plant material each year. The decomposing grasses are the foundation of a vast food web that begins with bacteria and fungi that break down plant detritus. This in turn is consumed by a rich and dense invertebrate fauna, which ultimately comprises much of the diet of many species of vertebrate predators, especially fish and birds. In addition to regular tidal flooding and draining, salt marshes typically receive large amounts of freshwater from rivers, streams, and groundwater along their inland border. The resulting brackish mixtures provide ideal breeding conditions for a wide variety of aquatic invertebrates that attract a great diversity of bird species. Salt marshes are important bird habitat in all seasons—wading birds and rare residents in summer, shorebirds in spring and midsummer through fall, and species of hawks and owls in winter.

The 20,000-acre North Shore Great Marsh is the largest salt marsh in New England, stretching in a nearly continuous plain from north of the New Hampshire border to Cape Ann. Much of it is now owned and managed by state and federal agencies as well as private conservation organizations. In 2001, it was designated as one of our largest Important Bird Areas (IBAs) as well as being dedicated as a site of regional importance by the Western Hemisphere Shorebird Reserve Network (WHSRN).

There are no general trends from statistical analyses of the Atlas, BBS, or CBC to suggest that tidal marsh breeders are doing either better or worse than birds breeding in other habitats. Nonetheless, a number of recent trends in populations of salt marsh birds are worthy of notice.

- Salt marshes are home to several notable avian success stories. The Osprey, which favors estuarine habitats as nesting areas because of the ready availability of the fish on which it depends, declined drastically in the 1960s and '70s due to the effects of DDT and DDE on its reproductive system. With the banning of DDT and DDE in the 1970s, and a concerted conservation effort by concerned citizens, the Osprey has surpassed historic population levels and continues to expand. The Willet, a vociferous shorebird that nests in salt marsh, was once common along the Atlantic coast from Nova Scotia to Florida, but by the turn of the 19th century it had been extirpated north of New Jersey by market gunners. The first pair to nest again in Massachusetts was found in 1976; the species is now established and locally common in all of our large salt marshes.
- Massachusetts contains a significant percentage of the world's population of Saltmarsh Sparrows, a species that nests exclusively in this habitat and whose range is limited to the northeast coast from Maine to Virginia. It is a federally watch-listed species of conservation concern. Recent studies have revealed significant amounts of mercury in the tissues of this sparrow and in sediments and invertebrates of marshes in five national wildlife refuges in the Northeast (Lane and Evers 2008). Mercury levels in sparrows tested from the Parker River National Wildlife Refuge in Massachusetts were significantly higher than those from the other four refuges. Despite this threat, the Saltmarsh Sparrow has expanded to 168% of its 1979 distribution according to Atlas 2 data.

- The Seaside Sparrow, another salt marsh endemic, reaches the northern extremity of its range in Massachusetts and occurs in just a few localities. Nesting areas for the Seaside Sparrow appear to have shrunk by 14% since 1979, according to the Atlas, however, there are so few records that this may not be a reliable indication of a trend.
- The Clapper Rail is a rare and secretive marsh bird known in Massachusetts from only a handful of nesting records, all in salt marsh; it also occurs as a rare migrant and winter resident. It reaches the northern limit of its range here, and could be expanding due to climate change, but the species is too little known to detect population trends. It may be a candidate for increased legal protection.
- Salt marshes attract large numbers of waterfowl in fall and winter and therefore are of great importance to duck and goose hunters. The CBC shows that game species that occur in salt marshes are experiencing higher population growth (with annual gains of 7-10% in some species) than other species in this habitat.
- The exception to the good news about wintering waterfowl is the American Black Duck, an especially important game species, which decreased in the number of Atlas blocks occupied by 57% since 1979, from 425 to 185.

Major threats to salt marsh are: (1) accelerated sea-level rise due to climate change; (2) invasion by non-native plants, especially common reed and perennial pepperweed, both of which can supplant native vegetation, making the habitat unusable by marsh birds; and (3) pollution by petroleum, PCBs, mercury, and other toxic chemicals.

OTHER COASTAL AND OFFSHORE HABITATS

The Commonwealth's 1,500 miles of shoreline and adjacent ocean encompass many of our most important nesting, feeding, and roosting areas for birds. These habitats include the pelagic zone, offshore islands, inshore waters, rocky intertidal zone, barrier beaches and dunes, and salt marshes. While all of these habitats are intimately connected by the influence of the sea, different groups of birds use them in different seasons, and the majority of species that nest, winter, and migrate along our coast depend on two or more of them. We have identified 89 bird species that use these habitats in any season, 32 species that breed in the coastal zone, and 19 species that are obligate coastal breeders.

Overall, the BBS and Atlas results do not show either increasing or decreasing trends in coastal birds compared with all other species, while CBC data shows increasing trends for species that winter along the coast. However, the BBS often fails to record many coastal species because there are few routes through these habitats, and the Atlas has reduced sensitivity for species with few breeding pairs or those that have a small distribution.

Given these limitations, we have analyzed the status of colonial waterbirds, winter waterbirds, shorebirds, land birds of the coastal zone, and pelagic birds using species-specific information. There are a few points worth highlighting about coastal birds in general.

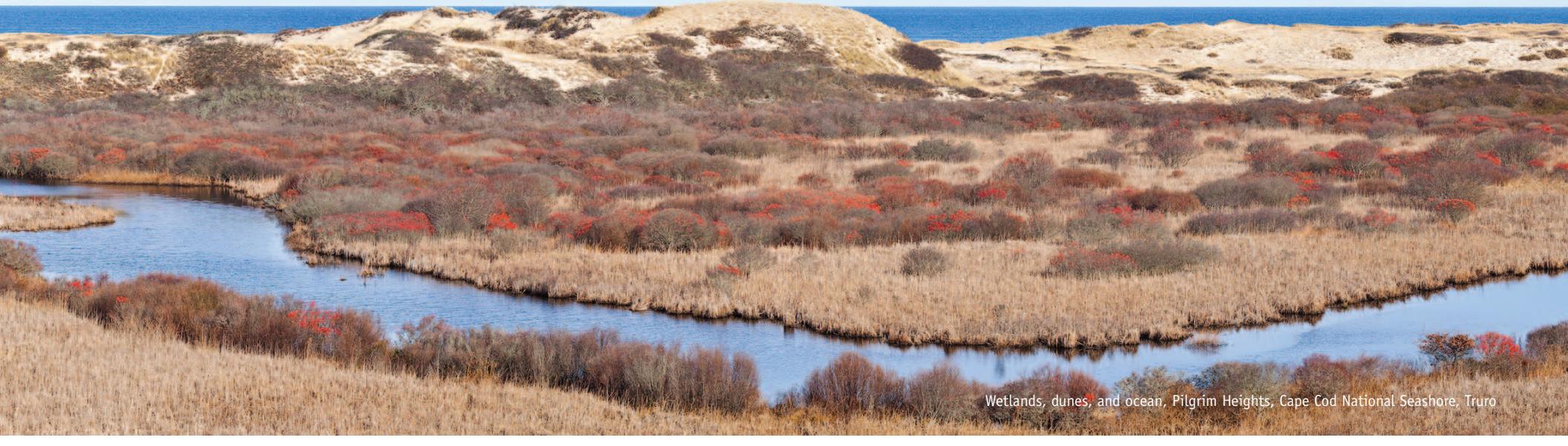
- Birds of coastal habitats are among the species most vulnerable to decline, or even extinction, from accelerated sea-level rise resulting from climate change.
- Of the 19 obligate species in this habitat, 15 are colonial species, indicating vulnerability due to high concentrations of nests in small areas.

TABLE 18. Conservation status of salt marsh breeding species. Refer to page 18 for the key to this species list.

Mute Swan
Osprey
Virginia Rail
Willet
Canada Goose
Marsh Wren
Gadwall
Clapper Rail
Seaside Sparrow (SWAP)
Tree Swallow
Saltmarsh Sparrow (SWAP)
Common Tern (SC)
Red-winged Blackbird
American Black Duck (SWAP)
American Wigeon
Wilson's Phalarope
Forster's Tern
Least Sandpiper



Double-crested Cormorants are a common sight along the coast, where they nest on rocky islands.



Wetlands, dunes, and ocean, Pilgrim Heights, Cape Cod National Seashore, Truro

- Twelve species nest on the ground, or in burrows or crevices in rocks, thus putting them especially at risk from ground predators; 8 of these species are already MESA-listed; and 11 additional species are of conservation concern (per SWAP). Population trends among these wintering waterbirds may be more influenced by factors on their northern breeding grounds. For example, the wintering population of Great Cormorant has plummeted recently due at least in part to persecution of the species as a pest at Canadian fish farms (Milton et al. 1995).
- Federal and state law, and programs by private conservation organizations and coastal towns have been instrumental in protecting many species.

Colonial Waterbirds

Historically, both the rocky “skerries” of the North Shore and the sandy isles south of Boston were the primary nesting grounds for hundreds of thousands of colonial waterbirds (especially tern species). These islands served as natural refuges from native mammalian predators of the mainland such as foxes and raccoons and introduced predators that arrived with European immigrants. However, from the mid-19th to the early 20th century, whole populations of terns (along with many other species) were slaughtered for the millinery trade, a devastating toll from which the birds never fully recovered. Beginning in the early 20th century, the expansion of commercial fishing and the increasing use of open refuse dumps on land induced a southward expansion of the breeding range of Herring and Great Black-backed gulls. These large, aggressive

TABLE 19. Conservation status of coastal breeding species. Refer to page 18 for the key to this species list.

Osprey	Horned Lark
Common Eider (SWAP)	Black-crowned Night-Heron (SWAP)
<i>Red-breasted Merganser</i>	Snowy Egret (SWAP)
Willet	Bank Swallow
American Oystercatcher (SWAP)	Roseate Tern (E)
<i>Glossy Ibis</i>	Arctic Tern (SC)
Spotted Sandpiper	Great Cormorant
Rock Pigeon	Laughing Gull (SWAP)
Double-crested Cormorant	Wilson's Phalarope
Great Egret	Tricolored Heron
Great Black-backed Gull	Yellow-crowned Night-Heron
Herring Gull	Cattle Egret
Least Tern (SC)	Little Blue Heron
Common Tern (SC)	Black Skimmer
Piping Plover (T)	Leach's Storm-Petrel (E)
Killdeer	Manx Shearwater

gulls, which remained as year-round residents, soon preempted the secure island tern nurseries, forcing most of the terns to shift to more vulnerable sites on barrier beaches connected to the mainland.

During the 1970s, historically southern-breeding waders like Great, Snowy, and Cattle egrets; Little Blue and Tricolored herons; and Glossy Ibises established, or markedly expanded, breeding colonies on islands off the North Shore, South Shore, Cape Cod, and Martha's Vineyard. Because these islands concentrate large numbers of relatively uncommon and rare birds on very limited real estate, their conservation value and their vulnerability are unusually high. A single oil spill could wipe out whole populations of some of our rarest birds.

In December 2010, the Massachusetts Natural Heritage & Endangered Species Program published a final report of a comprehensive survey of colonial waterbirds nesting along the Massachusetts coast (Melvin 2010). This survey, together with the NHESP Inventory of terns, Laughing Gulls, and Black Skimmers nesting in Massachusetts in 2009, serve as the main sources for the population data cited below (Mostello 2010).

Some significant aspects of the Commonwealth's colonial waterbird populations are as follows.

- Double-crested Cormorants, which in Massachusetts nest exclusively on offshore islands, have declined in population by 19.5% (from 6,375 pairs in 1994-1995 to 5,134 pairs in 2006-2008) in 12 years. While such a sharp decline in just over a decade is of concern, it needs to be balanced by the recognition that the 1994-95 survey was a peak after the species' extirpation from Massachusetts in the early 19th century.
- Declines in Herring Gulls (42%) and Great Black-backed Gulls (45%) are even steeper than those of Double-crested Cormorants, and these apparently abundant birds are now among the most rapidly decreasing species in the Commonwealth. But again it bears remembering that these species did not breed in Massachusetts until the late 19th and early 20th centuries and that their populations were at historic highs in the 1970s and '80s. It is possible that the reduction in gull populations resulting from the declining fishery and the capping of landfills may free up some coastal real estate for use by the more vulnerable terns—a goal of gull-control programs.

- In the 1920s, over 2,500 pairs of Black-crowned Night-Herons nested in a single colony at Sandy Neck in Barnstable, and other large colonies existed in Ipswich and on Plum Island. Since then the species has declined gradually, with the largest colonies supporting only a few hundred pairs by the 1980s. The continuing decline of 45% from 1994-1995 to a mere 781 pairs in 2006-2008 bodes ill for this species.

- In 2009, the population count of the federally endangered Roseate Tern decreased by 5% to 1,339 pairs, the lowest population reported since accurate record keeping began in 1985. Negative trends for this species are of particular concern because 45% of the total North American population of this species nest on Bird Island and Ram Island in Buzzards Bay, which are only 1 acre and 3 acres in extent, respectively.



Black-crowned Night-Heron counts at coastal colonies have been dropping, even as the birds appear at new colonies.



Breeding numbers of the majestic Great Egret have remained stable.

- Some colonial waterbirds are increasing. For example: Great Egret (230%), Glossy Ibis (193%), and Laughing Gull (83%) all increased between the 1994-1995 and 2006-2008 surveys. In the 2009 survey, nesting Least and Common terns were recorded at or near peak populations since 1985.

Winter Waterbirds

Our inshore waters are important feeding grounds for over 20 species of regularly occurring waterbirds. These include loons, grebes, and sea ducks that nest on tundra and taiga lakes and rivers in the Arctic and Subarctic, then migrate to coastal areas after freeze-up, along with alcids that nest on coastal islands to our north, and follow their food sources south in winter. Our huge wintering sea duck populations are among the Commonwealth's most important avian phenomena and are of global significance for at least one species, the Long-tailed Duck.

Overall, the waterbirds that winter along our coast are doing well, with no alarming declines apparent. Details on some individual species follow.

- Possibly the world's largest wintering congregation of Long-tailed Ducks, numbering as many as 525,000 birds, winters in the food-rich waters surrounding the island of Nantucket.
- Major wintering populations of Common Eiders and White-winged and Black scoters also range in the tens of thousands in and around Nantucket Sound, with lesser (though still impressive) wintering rafts of scoters and eiders occurring off the North Shore and in Boston Harbor.
- The wintering population of Harlequin Ducks in Rockport on Cape Ann is one of the three largest on the East Coast of the United States, although overall the eastern North American population of this species continues a gradual decline and has been considered for endangered species status.

Shorebirds

The term "shorebird" is used in North America to refer to sandpipers and plovers. Many species of shorebirds nest in the Arctic and winter at the opposite end of the globe, undertaking migratory flights of as much as 10,000 miles each way. Of the more than 30 species of shorebirds that are found in Massachusetts every year, fewer than a third nest here regularly. But during their brief spring and more protracted fall migration, many thousands of these birds gather to rest and feed in salt marshes and tidal flats in favorable locations such as Newburyport/Plum Island and South Beach and Monomoy National Wildlife Refuge on Cape Cod, the latter a Wetland of Regional Importance in the Western Hemisphere Shorebird Reserve Network (WHSRN).



Harlequin Ducks frequent our rocky coasts during the winter.

Until the middle of the 19th century, shorebirds occurred in Massachusetts in almost inconceivable numbers, only to crash under the pressure of market gunners. Following a ban on shorebird shooting in the early 20th century, populations of these birds began to recover, but few if any have approached restoration of their historical numbers, and the Eskimo Curlew is almost certainly extinct. Today shorebirds are threatened once again by a host of new perils from habitat loss to industrial pollution. Some facts relating to the conservation of Massachusetts shorebirds are as follows.

- The WHSRN, which tracks shorebird populations at key sites across the Americas, has described the conservation status of 17 species of shorebirds that occur regularly in Massachusetts as either "Highly Imperiled" or of "High Concern."
- Two of the four coastal-nesting shorebirds, American Oystercatcher and Willet, are re-inhabiting their historical ranges and have increased dramatically here in recent decades. Nonetheless, the oystercatcher remains uncommon throughout its North American range and is listed as a Species of High Concern in the United States Shorebird Conservation Plan (Brown et al. 2001).
- The Piping Plover is a conservation success story in Massachusetts, but remains a federally threatened species, and its ultimate survival depends on strict management of its beach habitat each year.
- Our fourth coastal shorebird, the Wilson's Phalarope, is a recent arrival from the West known from only a handful of salt marsh nest sites in Massachusetts.
- Of the 8 species of colonial waterbirds and shorebirds that depend to some extent on Massachusetts barrier beaches as breeding habitat—Piping Plover (T), American Oystercatcher, Common Tern (SC), Arctic Tern (SC), Roseate Tern (E), Least Tern (SC), Laughing Gull, and Black Skimmer—5 are on the state endangered species list.
- Like other birds dependent on coastal habitats, shorebirds may be severely impacted by accelerated sea-level rise resulting from a warming climate.

Land Birds of the Coastal Zone

While sparsely vegetated in general due to their extremely porous soils and exposure to the sea, beaches and dunes offer some important habitats for birdlife. Maritime forests sheltered within depressions in the dunes attract numbers of migratory songbirds in spring and fall. Copses of hardy shrubs such as Beach Plum, bayberry, and shadblush provide ideal nesting conditions for increasingly rare shrubland species such as Brown Thrasher* and Eastern Towhee*. The open sandy areas are ideal hunting grounds for migratory and wintering raptors such as Snowy and Short-eared owls*, Rough-legged Hawk*, Northern Harrier, and American Kestrel*. The declining Horned Lark* is one of the few songbirds to nest in these harsh sands, but in winter American Tree Sparrows, Lapland Longspurs* and Snow Buntings forage for windblown seeds here along with the larks.

It is notable that all of the birds marked with asterisks have gradually declined in numbers since 1964, according to Christmas Bird Count records.

Pelagic Birds

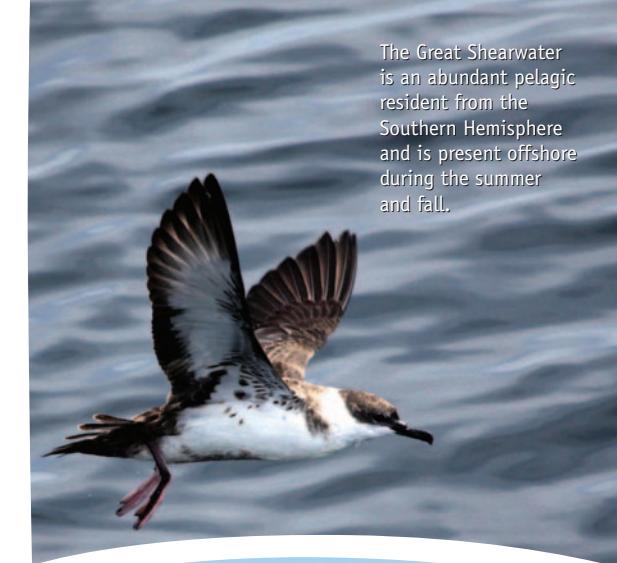
Pelagic birds spend most of their lives on the open sea, often beyond the shoreline horizon, coming to land only to nest, usually on offshore islands. The birds most characteristic of the pelagic zone are the shearwaters, fulmars, storm-petrels, gannets, phalaropes, kittiwakes, jaegers, and alcids, though many typical coastal species (e.g., loons and terns) often occur far offshore as well. Of the 16 species of pelagic birds that occur regularly in Massachusetts, only two are known to nest and those very rarely or locally. The others breed as far away as Antarctica.

Determining long-term trends of seabirds presents a number of challenges due to the difficulty of surveys, the nomadic nature of many of the bird species, and the variability of bird distributions due to changes in food resources. A few methodical studies have been done in local waters in recent decades, notably Powers' distributional study of 1983 and the effort of scientists at the Stellwagen Bank National Marine Sanctuary (SBNMS) during the period July 1994 to August 1995. There are also numerous accounts from birding and whale watch cruises.

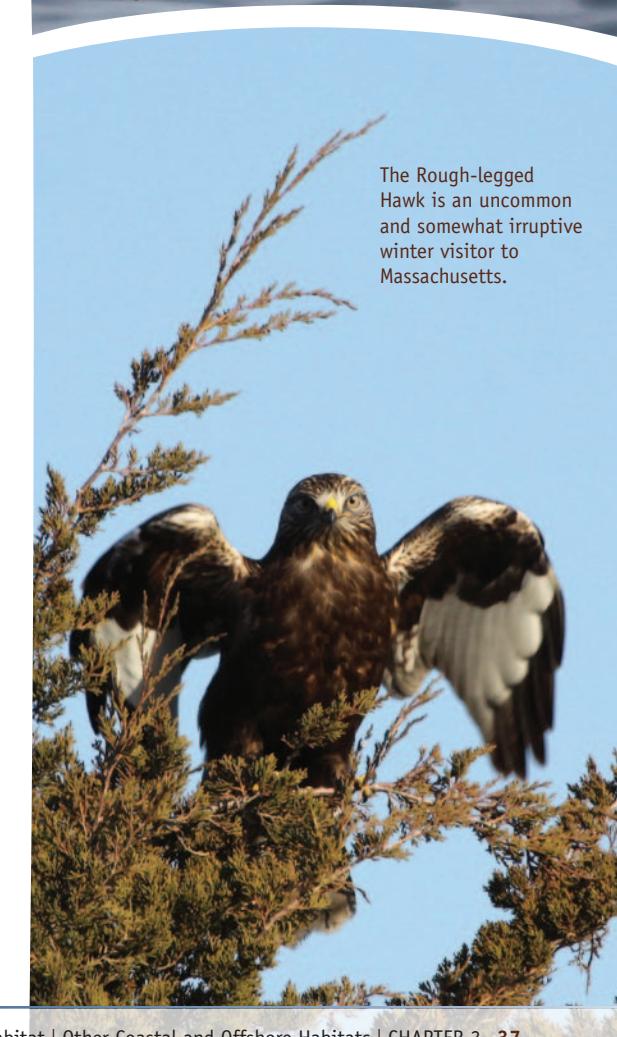
Taken together these studies and accounts have given us a reasonably accurate picture of seabird distribution, seasonality, and relative abundance in a few hot spots such as Stellwagen Bank and Nantucket Shoals. But such records tell us almost nothing about overall population trends among this group of birds. From a global perspective, seabirds are suffering steep declines from factors such as oil spills, entanglements with fishing gear, overfishing, egg and meat hunting, and predation by rats, feral cats, and other introduced pest species.

Instituting systematic surveys of pelagic birds in key offshore habitats would provide important information to inform conservation actions.

The Great Shearwater is an abundant pelagic resident from the Southern Hemisphere and is present offshore during the summer and fall.

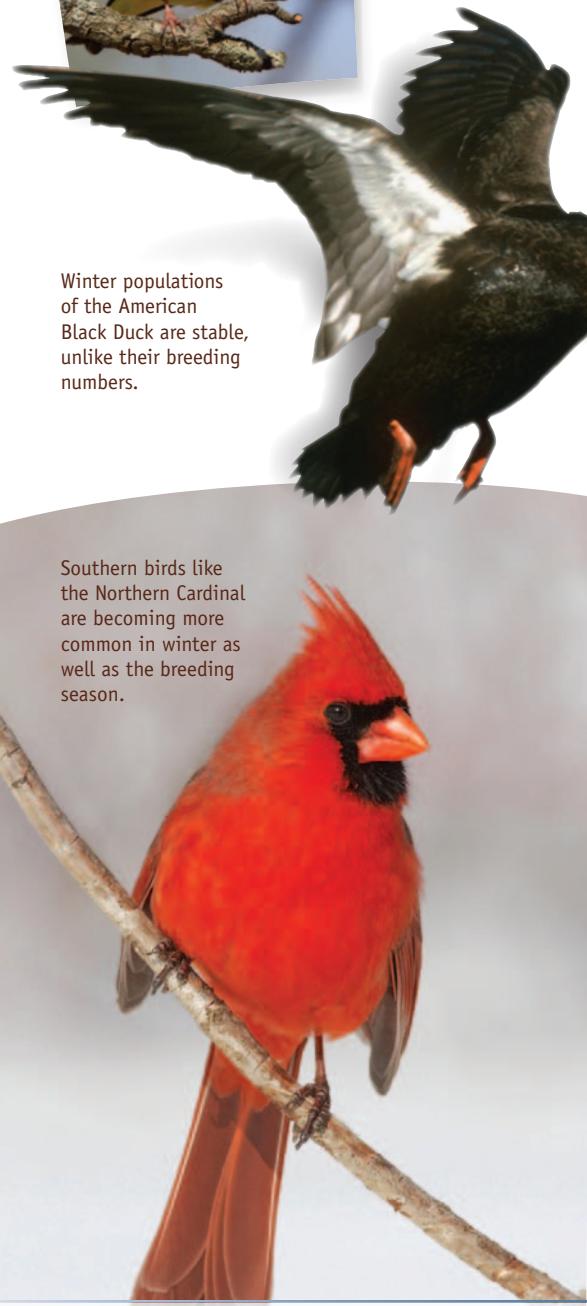


The Rough-legged Hawk is an uncommon and somewhat irruptive winter visitor to Massachusetts.





The Evening Grosbeak is journeying south to Massachusetts for the winter in decreasing numbers of late.



Winter populations of the American Black Duck are stable, unlike their breeding numbers.

Southern birds like the Northern Cardinal are becoming more common in winter as well as the breeding season.

OTHER PERSPECTIVES

In order to form a more comprehensive understanding of the changes occurring among Massachusetts birds and, where necessary, to devise conservation strategies, it is useful to analyze the Commonwealth's birdlife through different lenses. In the preceding section, we placed special emphasis on how birds in particular habitats are faring, since in some cases it is possible to manage landscapes to maintain or restore populations of declining species. In this chapter, we examine selected groupings of birds from several different perspectives: by season (wintering birds), by taxonomic grouping (raptors), by user category (game birds), and by behavior (passage migrants, ground nesters, and aerial insectivores) to determine whether any of these groups of birds are experiencing high degrees of change for better or worse. Each of the sections in this chapter could, and may, be the focus of an entire future edition of *State of the Birds*. These sections should serve as brief introductions to the state of the birds that are present within each of these various groupings.

WINTERING BIRDS IN MASSACHUSETTS

Approximately 183 species of birds spend the winter in Massachusetts. These birds find their way here through many strategies, and the changes in the abundance of each species are as varied as the birds themselves.

For example, birds wintering in the Commonwealth may be permanent residents that remain in nearly the same place year-round (e.g., gallinaceous birds); permanent species, with some individuals that may remain year-round, while others may move in from breeding grounds from our north (e.g., Black-capped Chickadee); winter-only species (e.g., many sea ducks); lingering winter species, with most individuals migrating south of Massachusetts, but a few overwintering every year (e.g., American Woodcock); and irruptive species whose winter range and numbers vary dramatically (e.g., Snowy Owl).

Given these different paths to winter residency, changes in the numbers of birds wintering in Massachusetts may be due to factors from as far away as breeding grounds in the Arctic, or as local as breeding habitat changes in Massachusetts. Also, given these flexible paths to becoming a wintering species in the state, and the unpredictability of a changing climate, it is complex to assess the status and trends of many of these species.

For example, Christmas Bird Count (CBC) records indicate a gradual but statistically significant *increase* in the *winter* population of White-throated Sparrow, while Atlas and Breeding Bird Survey results show a precipitous *decline* in the *breeding* population of this species in the state. These conflicting results stem from the fact that, while the species is present in the state year-round, the winter birds represent a different population from the breeding birds. This presents complex management challenges.

Although the CBC had humble beginnings more than 100 years ago, this program has become one of the most important bird monitoring efforts in this hemisphere. Changes in the numbers of participants, the effort with which they scour their count circles, and the increasing understanding of bird finding and identification have no doubt helped to increase counts over the years. While we can control for known influences, like observer hours in the field, we cannot control for increased enthusiasm leading to higher counts.

Despite these limitations, the CBC does provide us with the best information on changes in Massachusetts' wintering birds. *Since 1964, wintering birds along the coast have increased more than species in other habitats, pelagic species have also increased more than other species, and year-round residents are increasing more than those species that migrate. Species identified as those in need of conservation by SWAP are decreasing as wintering birds.*

We will continue to evaluate the results of our analysis of the CBC numbers, but some notable patterns have emerged.

- **Coastal birds are increasing:** Many waterbirds have shown marked increases, especially since 1980 (e.g., loons and many sea ducks). The cause of this trend is unclear, although similar trends have been observed in Europe and Great Britain (Eaton et al. 2010). Some of these increases may be attributable to "short-stopping" (see online glossary) rather than actual population increases.
- **Pelagic birds are increasing:** Common Murre (19%), Razorbill (18%), Northern Gannet (15%), and others show remarkable increases since 1980.
- **Year-round residents are increasing:** Common Raven and Cooper's Hawks, both increasing sharply during the breeding season, are also increasing as wintering species by about 13%. Both of these species are likely augmented during the winter by migrants from the north.
- **SWAP species are declining:** Many of the species that have shown the most striking recent declines as breeding birds are also decreasing as wintering birds. For example, the CBC shows the Northern Bobwhite declining at 19%. In addition, the Ruffed Grouse, which is also a permanent resident, has also been declining for decades in winter counts (-5% before 1980 and -9% thereafter).
- **Range shifts:** Southern species, many of which have increased sharply as breeding birds, also show large increases in their winter populations. The following trends reflect increases just since 1980: Turkey Vulture (26%), Red-bellied Woodpecker (21%), Carolina Wren (15%).
 - Many southern species that underwent sharp increases before 1980 are still increasing but at a slower rate or are decreasing slightly. Tufted Titmouse shows a pre-1980 trend of 22% but slows to 4% after 1980. Northern Cardinal increased by 13% pre-1980 but drops off to 3% thereafter. Northern Mockingbird shows a decrease of 2% after 1980 versus a 20% increase before 1980.

- Some species are wintering farther north than previously. Yellow-bellied Sapsucker, Eastern Phoebe, Gray Catbird, and Yellow-breasted Chat, for example, once wintered here only rarely but are now routinely encountered in CBCs in Massachusetts.
- American Robin posts a 14% increase since 1980, and is still increasing as a wintering species.
- **Common species are declining:** The Purple Finch, a declining breeder in the state, also has declining counts during the winter (-8%). Blue Jays are decreasing as winter residents and are found at only about 50% of their effort-controlled 1964 counts. House Sparrow and European Starling, two non-native species, also show large declines. House Sparrow numbers, when corrected for effort, are about 50% of their 1964 CBC counts.
- **Conservation actions are having positive effects:** Species aided by concerted conservation programs, including building of nesting platforms and boxes, are also doing well in winter. The following trends are post-1980: Wild Turkey (24%), Bald Eagle (7%), Eastern Bluebird (26%).
- **Waterfowl:** Canvasback (-15%) and Redhead (-8%) both show significant declines in their winter numbers according to the CBC. USFWS population estimates for these species show high variability but report that current numbers for both are above their long-term averages.
 - The Massachusetts breeding population of American Black Duck has undergone a catastrophic decline since 1979, yet the CBC data shows the wintering population to be fairly stable. This discrepancy is due to the fact that our nesting black ducks, many of which migrate south after the breeding season, are replaced in late fall and winter by birds that nest in eastern Canada. Our breeding black ducks are hunted on their wintering grounds where they assemble in the vast flocks of dabbling ducks in the Mid-Atlantic states.
- **Irruptives:** Several winter finches whose occurrence in winter is highly inconsistent are far less numerous in Christmas Counts since 1980. Pine Siskin (-10%), Pine Grosbeak (-20%), and Evening Grosbeak (-36%) all post large declines. While these species are variable by definition, negative trends of this magnitude over more than 30 years are alarming. The abundance of winter conifer crops is frequently cited as a causal factor in the southward dispersal of these birds.

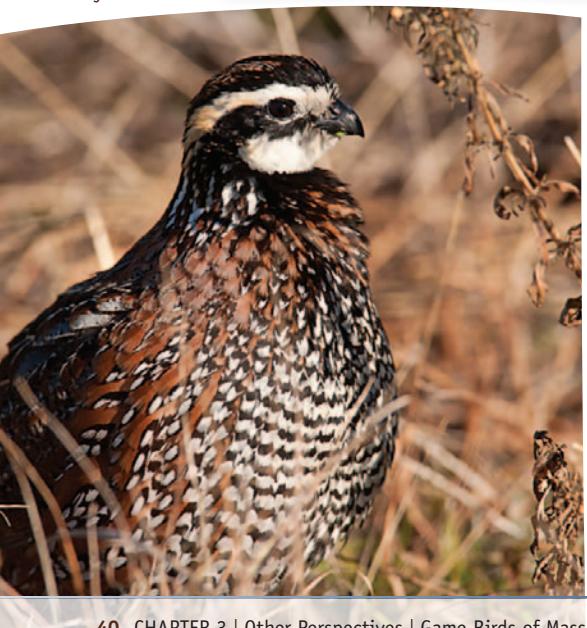


Marsh birds like the Virginia Rail face population pressures from more than just hunting.

The American Woodcock seems to have become more widespread, but less numerous.



Populations of the native Northern Bobwhite quail have crashed in recent years.



GAME BIRDS OF MASSACHUSETTS

There are 25 species of game birds that breed in Massachusetts and an additional 15 species that migrate through or winter in the state. All 40 are managed according to state and federal game laws and regulations. Five of the breeding species are resident year-round so their success in the breeding season in Massachusetts directly influences the number available during their hunting season. Two of the five residents, Northern Bobwhite and Ring-necked Pheasant, are also stocked, so their in-state reproduction is “enhanced” with farm-raised birds.

Our game species are diverse, comprising species of waterfowl, gallinaceous birds, rails, crows, and even members of the sandpiper family. These species occupy many different habitats across the state from forested wetlands and freshwater marshes to the open ocean. *We investigated game species by grouping them into the habitats in which they breed and reside. These groups did not reveal increases or declines in game birds in comparison to all nongame birds that use each habitat type. However, there are notable trends when we look at some species.*

Upland Game Species — All five species in this category nest in Massachusetts and four are year-round residents. Their conservation status is mixed. Extirpated from the state by 1855, the Wild Turkey was reintroduced by MassWildlife beginning in the 1950s and is now flourishing across the Commonwealth. This recovery is evident in all of our long-term data sets (Atlas, BBS, and CBC), to many home owners, and even to urban residents, and a hunting season has been reestablished. The Ring-necked Pheasant, native from the Caucasus to Japan, is one of the world’s most popular game birds and has been widely and repeatedly introduced in Europe and North America. Through regular restocking by MassWildlife and successful breeding, pheasants remained common here through the early 1990s. But for various reasons, populations of the species do not survive well, and, while stocking continues, numbers have dropped precipitously as confirmed by Atlas and BBS data. Our native Ruffed Grouse has maintained a consistent number of blocks between Atlas 1 and 2. However, the distribution within Massachusetts has shifted westward, while Ruffed Grouse is no longer present in many blocks in the southeast and northeast. This may be due in part to reforestation and the shrinking of forest openings, an important component of grouse habitat.

The Northern Bobwhite presents a more complex picture. It is unquestionably declining across its entire range and regionally (BBS), and Atlas and CBC wintering data confirm this decrease. However, there appear to be several causes for the bobwhite’s dwindling population, including overharvest historically and die-offs from cold and wet weather. It appears that the original, native, cold-hearty New England bobwhite may have been extirpated by the mid-1800s, so that the species’ continued survival, like that of the pheasant, may now depend on restocking. The American Woodcock, our one migratory upland species, has enjoyed a 26% increase in its breeding distribution according to the Atlas. However, long-term estimates of woodcock populations collated by the U.S. Fish & Wildlife Service indicate a 2.29% annual decline in the number of woodcocks heard during the singing-ground survey between 1968 and 2010. In 1968, 3.42 singing males were encountered on each of the survey routes in Massachusetts. For the past five years, fewer than 1.50 males have been encountered on each route (Cooper and Parker 2010).

TABLE 20. Resident game species and their long-term trends according to Atlas, BBS, and CBC.

Visit www.massaudubon.org/
StateoftheBirds to generate
summary tables of not only
game birds, but all of the
other groupings used
throughout this report.

Common Name	Atlas 1 Blocks	Atlas 2 Blocks	Percent change in blocks occupied	BBS Trend (1966-2008) Percent change per year	BBS P-value	CBC Trend (1964-2008) Percent change per year	CBC Significant (Y/N)
Wild Turkey	16	674	4112.5	18.1	0.06	25.20%	Yes
Canada Goose	281	747	165.8	3.9	0.03	8.24%	Yes
Ruffed Grouse (SWAP)	373	369	-1.1	0.0	0.99	-5.34%	Yes
Northern Bobwhite (SWAP)	238	60	-74.8	-10.2	0.01	-15.94%	Yes
Ring-necked Pheasant (Non-native)	341	77	-77.4	-7.3	0.04	-9.86%	Yes

Freshwater Ducks and Geese — The majority of our freshwater waterfowl nest here in such small numbers that their contribution to the Massachusetts harvest is negligible. However, the status of a few species deserves discussion. Our resident Canada Goose population has exploded to near pest proportions locally due to human agency. Once largely migratory in the Commonwealth, the species has become a year-round resident due to (1) release of live decoys in the 1930s after which this practice was outlawed; (2) further releases of locally bred birds in the 1970s; and (3) winter feeding programs. A core problem for management of Canada Geese is that the migratory population is declining while the resident population is burgeoning, making it difficult to increase hunting pressure while the two populations feed and roost together in spring and fall.

The Mallard is another species whose “success” has become problematic. Uncommon and migratory historically, the species is now ubiquitous year-round, supported by releases from waterfowl production facilities and by the well-meaning but misguided feeding of feral urban and suburban populations by the public.

The American Black Duck presents a sobering picture. Until recently, this species was one of our commonest breeding ducks, but its distribution as a Massachusetts breeding bird has declined by 240 blocks. Thus, it occupies only 44% of its 1979 distribution, according to the BBA. This decrease is echoed across its range in the United States. Habitat loss seems like an unlikely cause of this decline since many of the other ducks that use the same habitats are doing well. There is evidence of hybridization with Mallards, though it is difficult to accept this as a major cause

given the scale of decline. For its wintering numbers, Black Ducks are stable according to the CBC; however, it is likely that the wintering birds—a mainstay of our late fall and winter duck hunting season along the coast—originate mainly from breeding populations in Eastern Canada rather than from the Bay State. The Wood Duck and Hooded Merganser are showing notable increases in their breeding populations, due in no small measure to the success of nest box programs sponsored and implemented by MassWildlife as well as many citizen conservationists.

Freshwater Marsh Birds — Only four true marsh birds may be legally hunted in Massachusetts: Virginia Rail, Sora, American Coot, and Wilson’s Snipe. Given the seasons on these species, it is likely that most of the birds taken are passage migrants or wintering birds from the North, and the number of sportsmen targeting these species is very small. It should be noted, however, that many of the marsh specialists are also species of conservation concern described in the State Wildlife Action Plan, and the Sora has recently been a candidate for listing under the Massachusetts Endangered Species Act.



An introduced species, the Ring-necked Pheasant remains in the wild only where it is stocked for hunting.



Modest increases in distribution of the still-rare Sora do not change the fact that this small rail and its marsh habitat will need protection to survive the coming years.



The Canada Warbler may be struggling in part due to nest depredation.



Nesting on the ground is a risky proposition even for common species like the Ovenbird.

GROUND-NESTING BIRDS

Ground-nesting birds have evolved a variety of strategies that make this breeding behavior successful. Hidden nest locations, camouflaging nest materials, and cryptic plumage of incubating parents all make vulnerable nests harder for potential predators to find. Distraction behaviors by adult birds can also help to prevent nest depredation. And birds that nest in the open, such as terns, often form colonies for mutual defense. Despite these strategies, many of these ground-nesting birds are currently in trouble in Massachusetts.

Of the 82 species of Massachusetts breeding birds that nest on or close to the ground, 34 species (42%) are already on the state endangered species list or the State Wildlife Action Plan. In our current ranking system, 39 species are in need of conservation action (26 are rated “Red” and are in urgent need of conservation and 13 are “Orange” and continued action or monitoring are needed). *Of the ground nesters, birds that breed in shrubland habitats are particularly vulnerable and are decreasing faster than other groups. For the 12 species of shrubland ground nesters surveyed in the BBS, the mean decline was 5.8% since 1980.* The eight obligate shrubland ground nesters are declining even faster, at an average of 7.9%.

What has happened to disrupt this time-tested breeding strategy? While conclusive evidence is lacking for many declining ground nesters, the increase in populations of predators of eggs and nestlings seems to explain the problem for many species. The numbers of raccoons, skunks, opossums, and foxes, all significant nest predators, have increased dramatically in the last 50 years as a result of urban and suburban development and the consequent increase in food sources and den sites (Prange et al. 2003). Free-ranging domestic and feral pet animals also add to this human-derived burden on ground nesters. Loss of ground cover due to browsing by the increasing population of White-tailed Deer may also be connected to this trend, and warrants further research.

TABLE 21. The eight obligate shrubland ground-nesting species and their long-term trends according to Atlas, BBS, and CBC.

Common Name	Atlas 1 Blocks	Atlas 2 Blocks	Percent change in blocks occupied	BBS Trend (1966-2008) Percent change per year	BBS P-value	CBC Trend (1964-2008) Percent change per year	CBC Significant (Y/N)
Mourning Warbler (SC)	10	23	130.0	-9.7	0.07		
Blue-winged Warbler (SWAP)	231	425	84.0	-1.9	0.15		
Golden-winged Warbler (E)	64	3	-95.3	-18	0.06		
Brown Thrasher (SWAP)	582	360	-38.1	-9.7	0	-4.8979	yes
White-throated Sparrow (SWAP)	309	148	-52.1	-7.2	0	2.3053	yes
Field Sparrow (SWAP)	488	444	-9.0	-6	0	-2.1245	yes
Nashville Warbler	154	92	-40.3	-2.5	0.31	7.9907	yes
Eastern Towhee (SWAP)	753	729	-3.2	-8.4	0	-2.9330	yes

AERIAL INSECTIVORES

Aerial insectivores are birds that feed almost exclusively in the air on flying insects. They nest in a variety of habitats including open ground (nightjars), shrublands (*Empidonax* flycatchers) and forests (Great Crested and Olive-sided flycatchers); and many are habitual users of human-made structures (swifts and swallows). While they are earthbound for nesting purposes, they depend on the diversity and abundance of insects that fill the air during the warm seasons—both for their own sustenance and to feed their young. As their name implies, the nightjars are nocturnal feeders and specialize in eating large insects such as beetles and moths. The flycatchers and swallows feed by day, swallowing flies and other small airborne insects.

Of the 20 species of aerial insectivores that nest in Massachusetts, 11 species show declining trends in either Atlas or Breeding Bird Survey, or both. Many of these declines are striking. Between 1979 and the present, Atlas results show Common Nighthawk records to be down by 74.5%, Eastern Whip-poor-will by 46.1%, and Cliff Swallow by 53.9%. Perhaps even more troubling are sharp decreases, identified by the Breeding Bird Survey, of birds we think of as common or even abundant, e.g., Chimney Swift and Barn Swallow. We may take some comfort from the fact that Massachusetts surveys show some species—e.g., Northern Rough-winged Swallow, Eastern Wood-Pewee, Great Crested Flycatcher—to be stable or increasing but our relief may be short-lived. The recently completed Ontario Breeding Bird Atlas shows all of these species to be declining significantly and has placed Chimney Swift, Common Nighthawk, and Olive-sided Flycatcher on the Canadian list of threatened species. Indeed, all but two of the Massachusetts aerial insectivores are considered to be decreasing in nearby Ontario, and those two, Chuck-will's-widow and Acadian Flycatcher, are southern species that do not nest in Ontario.

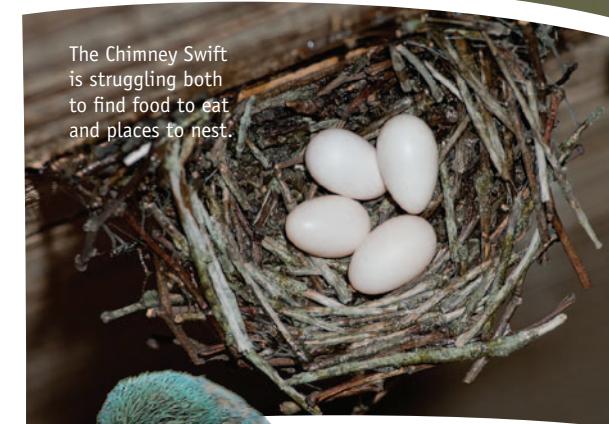
No one has yet proposed a comprehensive explanation for what might be happening to these quintessential birds of the air. There are a number of theories however, some familiar, some distinctly discomfiting, and all hard to prove conclusively.

- **Fewer artificial nest sites.** There are fewer barns and other agricultural outbuildings in the landscape nowadays, structures that once hosted many pairs of Cliff and Barn swallows; and many people now cap their chimneys, which have become virtually the only nest sites used by Chimney Swifts.
- **Decline of agricultural land** and other open habitats that provide ideal hawking grounds for low-flying species.
- **Dwindling populations of aerial insects** have been well documented (Nebel et al. 2010). Among the suspected causes are the following.
 - **Night Lighting.** The illumination of our cities and suburbs is suspected of killing and disrupting the life cycles of many kinds of insects.
 - **Climate Change.** Shifts in climate include changes to the peak emergence times of various insect species, putting them “out of sync” with the life cycles of birds that depend on these peaks to successfully rear their young.
 - **Water quality.** Many flying insects are the adult stages of aquatic insects that use the air to disperse out of their natal habitats and are thus important food sources for aerial birds. Acid rain and other changes in water chemistry caused by industrial pollution have been shown to sharply reduce populations of aquatic insects in some areas.
 - **Pesticides.** A threat that remains insidious and pervasive even today (see pages 50 and 51).

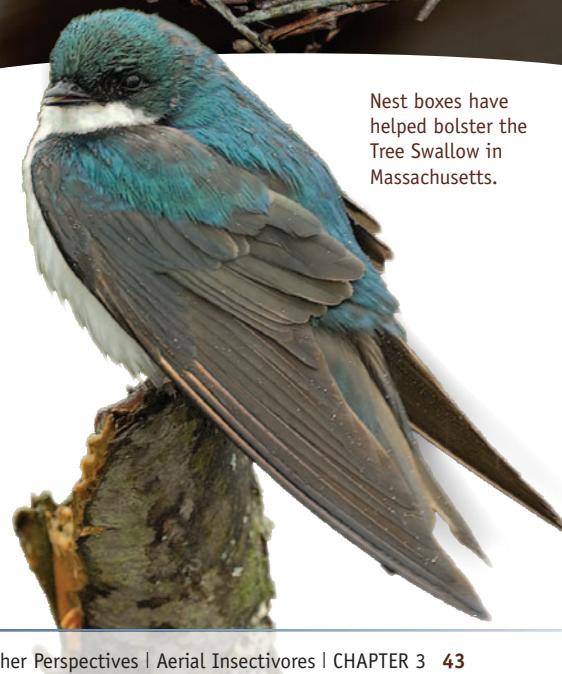
The Bank Swallow depends on clean waters and abundant insect populations.



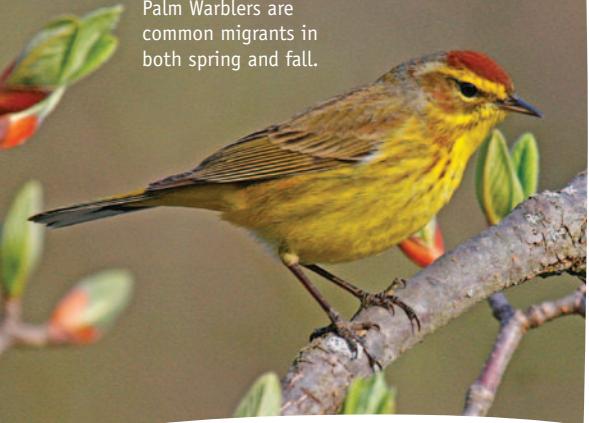
The Chimney Swift is struggling both to find food to eat and places to nest.



Nest boxes have helped bolster the Tree Swallow in Massachusetts.



Palm Warblers are common migrants in both spring and fall.



PASSAGE MIGRANTS

Not all migratory birds end their journey in Massachusetts. Many birds spend only a few days or weeks of the year in the Bay State, where they rest and feed before continuing on to their nesting or wintering grounds. Because these birds often pass through in large numbers and tend to make fairly intensive use of habitats in refueling, trends in these numbers can serve as another useful lens through which to examine the state of the Commonwealth's birdlife.

Since 1969 the most important source of data on migratory birds in Massachusetts has been the Manomet Center for Conservation Sciences. Manomet is ideally situated on the South Shore of Massachusetts for capturing the annual movements of passerine birds along the coast. A recent paper by Manomet scientists summarizing almost 40 years of continuous bird netting and banding suggest that migratory birds are facing serious challenges (Lloyd-Evans and Atwood 2004).

The Manomet data shows that out of more than 70 species captured for banding during the study period, 45 fall migrants (58% of all fall species) and 36 spring migrants (50% of all spring species) showed statistically significant declines in capture rates. Perhaps even more alarming, only four fall birds (5% of fall species) and four spring migrants (6% of spring species) showed significant increases in capture rates.

Three species showed significantly increased capture rates in both spring and fall migration: Tufted Titmouse, Carolina Wren, and Northern Cardinal. All three of these birds have greatly expanded their ranges northward and increased tremendously as breeding birds in the past few decades. The other two significantly increasing species—Orchard Oriole in the spring and Black-throated Blue Warbler in the fall—have shown striking increases in breeding distribution according to the Breeding Bird Atlas.

Assessing the causes of declines in the numbers of migratory birds is especially challenging because of the many variables involved in the lives of these long-distance travelers. Using BBA and BBS data, we can gain some insights into population trends on the breeding grounds. But how are the populations of these birds affected by the many hazards they face during their migratory journeys—including collisions with human-made structures, pollution, and destruction of food sources among others—and in their winter quarters, which in many cases have suffered from wholesale habitat destruction? As with many of the bird species that we have found to be declining, the cause may well prove to be a combination of the threats.

Productive Massachusetts tidal flats provide essential food for migrating shorebirds like Marbled Godwits.

Least Sandpipers are common migrants along our shores, especially during the fall.



For species that neither breed nor winter in the Bay State, these migration figures are some of the only clues we have to track changes in population. Many passage migrants appear to be facing significant challenges. Tennessee Warbler has seen a stunning -95% change in spring capture rates, as well an -82% shift in fall captures. Bay-breasted Warbler showed a -86% change in fall capture rates. Wilson's Warbler shows significantly lower capture rates in both spring (-52%) and fall (-36%). Nor are the problems restricted to passage migrant species. Many bird species that breed in Massachusetts are experiencing startling drops in their migrant populations. The migrant populations of Eastern Towhees, Chestnut-sided Warblers, and Common Yellowthroats are all significantly declining in both seasons (Lloyd-Evans and Atwood 2004).

In recent years, ornithologists have begun to document a new challenge facing long-distance migrants: our changing climate. Each bird species has evolved its own characteristic migratory scenario using a variety of environmental clues such as star patterns and prevailing wind directions, and their routes and arrival dates are timed to coincide with the availability of food sources such as horseshoe crab eggs or insect hatches. Many migratory species depend on insects both as fuel along their way and to provide food for their young during spring and early summer. Just a few days of desynchronization between a hatch of flies and the hatching of nestling birds can mean starvation for a warbler or flycatcher brood.

Recent research by Manomet examined this issue by analyzing changing spring arrival dates over a 33-year period (Miller-Rushing et al. 2008). Mean arrival dates were used rather than first arrival dates, since first arrival dates are affected by weather and by changes in the number of birds migrating each year. The analysis concluded that short-distance migrants (such as cardinals and titmice) can better judge fluctuating temperatures on their breeding grounds and adjust their migration schedules accordingly. By contrast, long-distance migrants do not appear to respond to any climactic cues; they simply migrate according to their own long-established internal rhythm. As the birds' natural rhythm and the flow of the seasons are driven out of sync by a changing climate, many migratory bird species may find it more difficult to survive the rigors of their amazing journeys.

The Manomet studies underscore how little we know about the effects of human alterations of the biosphere on birdlife and inspire many additional questions. For example, there are also a large number of migratory waterfowl and shorebirds that make use of Massachusetts habitats as passage migrants, yet little work has been done to learn more about these birds and the time that these birds spend in the Bay State.



Patterns of migration in Bay-breasted Warblers are linked with spruce budworm cycles.



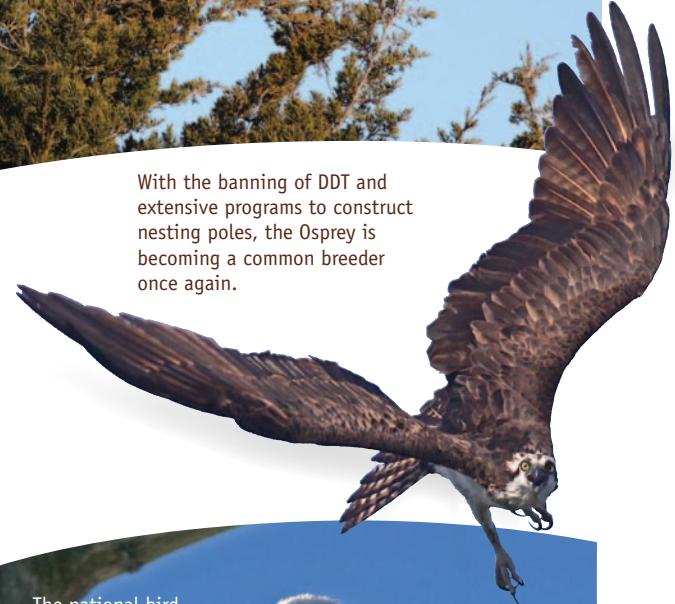
Wilson's Warblers are fairly common migrants in both spring and fall, but are seldom seen in other seasons.



Perhaps the most common warbler in the state of Massachusetts, the widespread Common Yellowthroat can be found in areas of second growth, often near water.



Rough-legged Hawk, an uncommon migrant and winter visitor to the state, has seen strong declines.



With the banning of DDT and extensive programs to construct nesting poles, the Osprey is becoming a common breeder once again.



The national bird has returned as a breeder to Massachusetts since DDT has been banned and hacking programs have returned it to our lakes and rivers.

REGIONAL STATUS OF RAPTORS

For the purposes of this summary, the diurnal (day-flying) raptors are defined as including the members of three different bird families: the hawks and eagles, the falcons, and the New World vultures. Combined, these families comprise 16 species that occur regularly in Massachusetts, all but one of which have nested here. All are migratory to some degree, and several winter in the neotropics, though individuals of some species regularly remain in the Commonwealth year-round. The migratory species travel by day, aided by rising warm air currents called “thermals,” by updrafts that occur along mountain ridges, and by prevailing winds. They also follow so-called “leading lines” such as coastlines and river valleys. Because thermals are not generated over water, large numbers of these (and other) soaring birds are often forced into bottlenecks of land between bodies of water. And because they also use the landmarks and reliable air currents of mountain ranges, large concentrations of mixed species of these birds of prey can often be observed from favorable peaks.

All of these conditions—plus the fact that most of these birds tend to be seen by people as majestic, fascinating, and challenging to identify—has made hawk watching an especially popular specialty among birdwatchers. During spring and fall migration, hundreds of birders gather at favorable sites in the hope of seeing thousands of Broad-winged and Sharp-shinned hawks, a smattering of other species, and perhaps a rarity such as a Golden Eagle as they soar and glide to the north or south. And the tradition of hawk watching has always included counting the passing migrants.

As is the case with pelagic birds, accurately counting birds that travel over very broad fronts is fraught with difficulties. Variations in wind direction and velocity, sky conditions, and temperature inevitably change the positions and concentrations of the birds from year to year and hour to hour in relation to the relatively stationary people trying to count them. Accordingly, population trends derived from visual observations at single sites were long deemed unreliable as credible indicators of population trends.

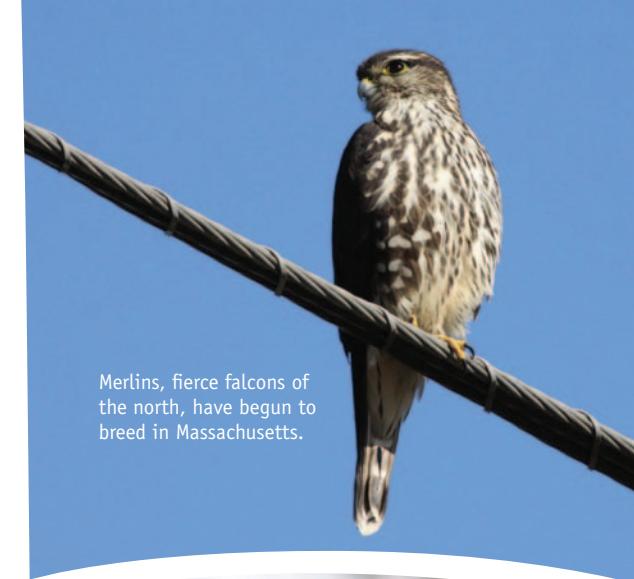
In recent decades, however, hawk watchers have made concerted efforts to standardize monitoring methods and coordinate counts from multiple key sites. As this data has accumulated and been compared across many years, broad but statistically credible patterns have begun to emerge.

In the mid-1970s, the Hawk Migration Association of North America (HMANA) began publishing summaries of hawk counts from dozens of key migration watch sites across North America. In 2003, using information derived from this extensive database, along with data obtained from the Breeding Bird Survey (BBS) and the Christmas Bird Count (CBC), the Raptor Population Index (RPI) was established to produce a series of conservation status reports for 20 species of North American birds of prey. And in 2007, a joint meeting of HMANA and the Raptor Research Foundation (RRF) resulted in the *State of North America's Birds of Prey* (2008), a publication representing the current state of knowledge regarding North American raptors.

Using migration data from the RPI relating to hawk watching sites in Northeastern North America, it is possible to detect regional trends in raptor populations that pertain to Massachusetts. Population trends were calculated for 1974-2004, 1980-1990, and 1990-2000 from seven watch sites in northeastern North America. The seven sites that were analyzed were at similar latitudes along an east-to-west transect running from coastal Connecticut to the western shoreline of Lake Superior to achieve a level of comparability. Not surprisingly, a degree of variation was found between trends at these sites; however, there was also distinct congruence among several species.

Seven species increased throughout the entire study period (1974-2000) and also showed positive trends in both decadal periods of which 5—Turkey Vulture, Osprey, Bald Eagle, Merlin, and Peregrine Falcon—occur regularly in Massachusetts. The Broad-winged Hawk and American Kestrel, however, showed significant decreases in the Atlantic Coast and Inland subregions, despite increases detected in the Great Lakes subregion. Most significant perhaps was the primarily negative trend in all periods from the two Atlantic Coast sites (Lighthouse Point, Connecticut, and Cape May, New Jersey) for Sharp-shinned Hawk, Red-shouldered Hawk, and American Kestrel (Bildstein et al. 2008; RPI website).

An overall summary for the region that includes Massachusetts indicates that following the 1972 ban of DDT (1974-2004), migration counts at watch sites increased or remained stable for Turkey Vulture, Osprey, Bald Eagle, Cooper's Hawk, Merlin, and Peregrine Falcon. During the same period, the trends for Northern Harrier, Sharp-shinned Hawk, Northern Goshawk, Red-shouldered Hawk, and Red-tailed Hawk varied across the region—although the American Kestrel showed a significant long-term decrease in the Atlantic Coast and Inland subregions (Bildstein et al. 2008; RPI website).



Merlins, fierce falcons of the north, have begun to breed in Massachusetts.



Numbers of migrating Sharp-shinned Hawks are decreasing in the state and region.

CHAPTER 4. What's causing current changes in bird populations?



Short-eared Owls once nested in many of our grasslands, but now inhabit only a handful.

The Whip-poor-will is threatened by raccoons, cats, and other ground predators.

Understanding change and rarity in bird populations. Populations of plants and animals, including birds, change constantly. In many cases the changes occur so gradually that they go unnoticed unless they are the subjects of long-term scientific studies, while in others they may happen with striking rapidity. Some of these changes are “natural,” i.e., part of some phenomenon that is not the result of human activity (e.g., the El Niño cycle in the Pacific Ocean) while others are caused by the actions of people, as when rats or domestic cats escape from ships and eliminate whole populations of island bird species that have no experience with such predators.

Likewise, it is important to distinguish species that are naturally rare from those whose rarity has been caused by people. For example, the Atlas data reveals that 49 species—nearly a quarter of the state’s entire breeding bird fauna—were recorded in 10 or fewer Atlas 2 blocks. These are rare birds (at least in Massachusetts), but for most of these species their rarity is not attributable to human carelessness or malice, but to natural “rules” of biological distribution. These cases differ categorically, however, from the human-induced rarity of species such as the Eskimo Curlew, once an abundant fall migrant through Massachusetts, that was rapidly decimated by market gunners and is now exceedingly rare if not extinct.

Many bird species may be at (or beyond) the tipping point. In trying to understand the causes of declines in bird populations, it is important to realize how these populations are affected when confronted with one or several threats created by human activity. All populations of birds are constrained by certain limiting factors, such as food supply and availability of nesting habitat. In addition, each species has evolved a reproductive strategy that allows for various natural threats that individuals of that species are likely to encounter as part of their particular life cycle.

For example, Eastern Whip-poor-wills face a nearly “perfect storm” of risks in their life history: (1) they nest on the ground; (2) they depend heavily on successional habitats; (3) they feed mainly on flying insects; and (4) they undertake long-distance migrations to and from Central America each year. For the species to survive, it must produce enough offspring not only to replace the whip-poor-wills currently living, but to compensate for the toll that one or more of these special risk factors may take on the population. The margin for error is not great, so that in some years during which multiple natural risk factors kill large numbers of birds, the population may decrease, but, over time, these events should be balanced by good years during which mortality is relatively low.

However, if risks of human origin (e.g., loss of nesting habitat or predation by cats) are added, the balance could be tipped and populations of these nightjars could start to decline. Though we cannot yet document specific causes, we do know that whip-poor-wills—like many other once-common species—are experiencing unmistakable declines that coincide with vastly increased human influence on the Massachusetts landscape.

What follows is an annotated list of human-induced causes of bird population declines, most of them amply documented.

Habitat Destruction (Development). When forests in southern New England were converted to farmland in the 18th and 19th centuries, populations of grassland and shrubland birds increased markedly while forest species declined proportionately, but the land was not destroyed and the ability for natural succession to take place remained, eventually allowing reforestation.

By contrast, when habitat is converted to transportation, commercial, and residential development, the natural communities and the bird species that depend on them are for all practical purposes permanently lost. Massachusetts is the third most densely populated state in the nation, and, in the recent past, development here has been especially intense. Between 1985 and 1999, a period of rapid development in the Commonwealth, just over 200,000 acres of forested and agricultural land were converted to development. And while the 4th edition of Mass Audubon's *Losing Ground* series documents a slowing of development between 1999 and 2005, we can expect a resurgence of building once demand rebounds. Despite this slowdown, land is still developed at a rate of 22 acres lost per day, which is like creating a development the size of New Bedford, Lawrence, and Springfield combined every 5 years.

Habitat Fragmentation. Many bird species, including some small songbirds, require relatively large amounts of habitat in order to maintain their populations. When habitats are fragmented by housing tracts, roads, and other infrastructure, all but the most adaptable bird species tend to decrease even though small patches of woodland or other habitat remains and the landscape appears "natural" to the human eye. In addition to species' basic needs for sufficient acreage of habitat, negative effects of fragmentation include the following.

- An increase in "edge predators" of eggs and nestlings such as crows, raccoons, and the brood parasitic Brown-headed Cowbird, which thrive in suburban and edge habitats.
- Collateral damage. In addition to the habitat consumed by the actual footprint of human development, a host of ancillary phenomena, e.g., pets, traffic, noise, and artificial light, also act to reduce bird populations in surrounding habitats, even though these appear undisturbed.
- Inadequate rates of reproduction. It is well documented that small islands of habitat reduce the fitness of populations. Though a few pairs of a given species may nest in such fragments, there are not enough individuals in the population to sustain it over time. These habitat islands are called "sinks" because they do not contribute to the species' survival and the reproductive capacity of the birds that breed there is essentially wasted.

The structures and mechanics of human society cause enormous bird mortalities annually. Few figures are available specifically for Massachusetts, but all of the phenomena described below are especially relevant in our densely populated, heavily urbanized Commonwealth.

- When there is fog or a low cloud ceiling, migratory birds can become disoriented by the lights of skyscrapers and either crash into the buildings or die of exhaustion in their confusion. As many as 1,000 birds per major building may be killed in a single night, and a season's death toll can be in the hundreds of thousands. (See sidebar on Lights Out Boston, page 58.)
- Up to 900 million birds die annually in North America in collisions with glass windows (U.S. Fish & Wildlife Service fact sheet 2002).



Fragmented landscapes render many songbirds vulnerable to numerous threats, such as nest parasitism by Brown-headed Cowbirds.



Sprawling suburban developments are altering areas that were once field and forest.



Feral cats often congregate in areas where food is plentiful. These cats pose a danger to many bird species.



Growing populations of mammalian predators accompany human settlements.

Purple Loosestrife is a highly invasive wetland plant that displaces native vegetation.



- 174 million birds are killed by colliding with power lines across the continent (USFWS fact sheet 2002).
- Motor vehicles are responsible for the demise of 67 million birds a year (USFWS fact sheet 2002).
- These death tolls come on top of the natural hazards that all wild birds face as part of their regular life cycle, and at least some species may not be able to make up the extra losses within their normal reproduction rate, and will therefore steadily decrease.

Invasive Species. This term does not refer to all non-native species but is restricted to those alien species that have an explicit negative effect on native species or on the biodiversity of entire ecosystems. Invasives have a negative impact on Massachusetts bird populations in a variety of ways. For example, the wetland invasives Purple Loosestrife and Common Reed (*Phragmites*) tend to replace native wetland plants, altering the structure of our wetlands and limiting or eliminating the ability of bird species such as bitterns and rails that depend on freshwater marshes to feed and nest. It is likely that these plant species are implicated in the striking decline in many marsh birds that has been observed for decades. Seven species on the Massachusetts Endangered Species List depend on habitats threatened by Purple Loosestrife and Common Reed.

Another example is the Woolly Adelgid, a small colonial insect related to aphids and native to Asia. It has already decimated stands of Eastern Hemlock, and many forest ecologists predict that the adelgid will eliminate hemlock from Massachusetts forests within decades. Winter Wren, Black-throated Green and Blackburnian warblers, and Louisiana Waterthrush all favor the cool, shady bottomland forests where hemlock tends to be dominant, and the removal of hemlock could affect the populations of these bird species.

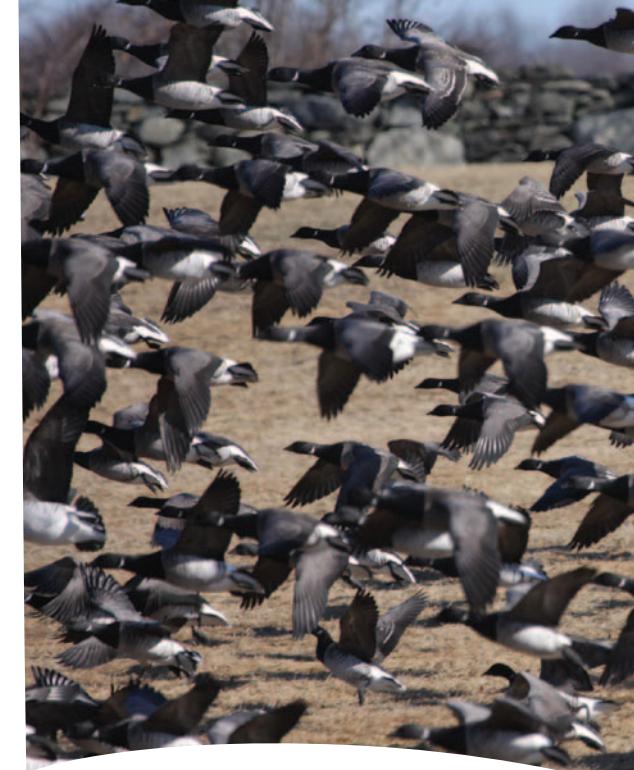
Feral and Free-Ranging Domestic Cats. A feral cat is one that has escaped from or been abandoned by an owner and survives by catching live prey (especially birds) in the wild. It is estimated that there are about 60 million feral cats at large in the U.S. In addition there are 60-88 million owned cats, a large percentage of which are allowed to run free. Cats are responsible for the extinction of 33 bird species worldwide and kill an estimated 480 million birds each year in the United States (Hildreth et al. 2010).

Other Predator Increases Due to Human Influences. Cities and suburbs have proven to be ideal habitats for a range of wild mammals such as raccoons, skunks, opossums, foxes, and coyotes that prey on ground-nesting birds, nestlings, and eggs. Our houses and outbuildings provide luxurious den sites, and poorly secured waste containers offer a feast of leftovers that allow these animals to increase their populations. The human-driven population explosion of such predators is responsible not only for significant mortalities of urban and suburban birds, but also spills out into less developed areas, wreaking havoc, for instance, in tern colonies on barrier beaches that are connected to the mainland.

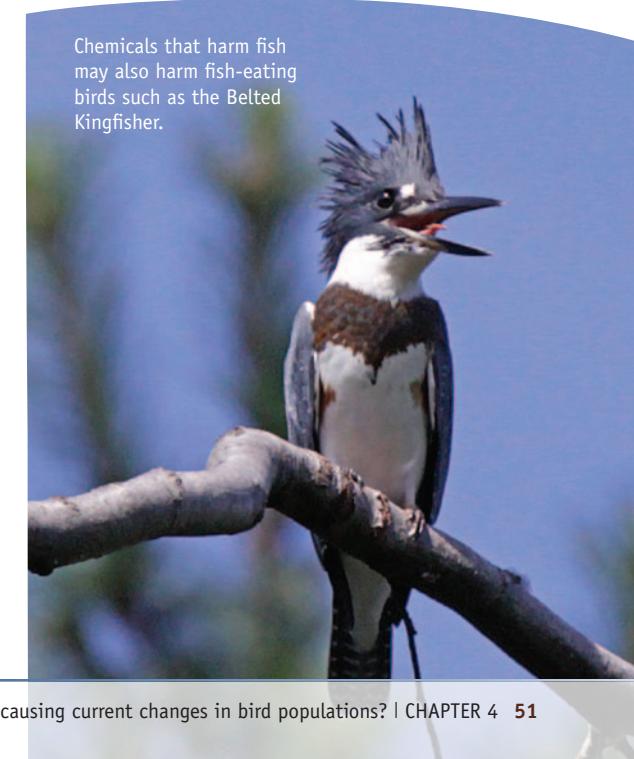
Toxic Chemicals in the Environment. Since the discovery of the devastating effects of the pesticide DDT, toxic pollution is recognized as one of the most notorious threats to the environment. Yet the ban on DDT in the U.S. in 1972 created the erroneous impression that the danger had been eliminated, and concern about toxics is often eclipsed by more recent threats such as suburban sprawl, climate change, and invasive species. The fact is, however, that a daunting variety of toxic substances still find their way into our air and water, and can have a significant impact on the fitness of birds and humans alike.

As an indication of the scope of this issue, annual studies undertaken since 2007 by the Biodiversity Research Institute in Maine of 23 species of birds, ranging from Bald Eagles to Virginia Rails to Tree Swallows, have detected the presence of over 100 potentially toxic chemicals, in some cases at levels judged to be harmful to the birds' organs, nervous and immune systems, and the ability to reproduce. Substances of particular concern, some of them now banned, include mercury, electric transformer coolants (PCBs), flame retardants (PBDEs), industrial repellents (PFCs), and organic pesticides (DDT). The fact that birds are not falling from the trees as they did during the worst years of DDT spraying provides little reassurance given the array of new manufactured toxins that have leaked into our environment in the 50 years since the publication of Rachel Carson's *Silent Spring*. Some widespread chemicals of special concern include the following.

- Brominated flame retardants such as polybrominated diphenyl ethers (PBDEs) are found in most consumer electronics, and other household items such as paints and upholstery. Recent studies exposing captive American Kestrels to concentrations of brominated flame retardants similar to those measured in the wild showed that the birds laid smaller eggs with thinner eggshells (Fernie et al. 2009). The Massachusetts Department of Environmental Protection (DEP) is sufficiently concerned about the effects of these chemicals on people to have listed brominated flame retardants as a Priority Emerging Contaminant.
- Perchlorates are salts often used as oxidizing agents in explosives that are utilized in construction, defense, and fireworks. People and wildlife are exposed to perchlorates if they drink contaminated water. Perchlorates interfere with the uptake of iodide by the thyroid gland, which plays an important role in releasing hormones to regulate development. Research has shown that birds can experience thyroid disruption from exposure to perchlorates—presumably at much smaller doses than those affecting people (Gentles et al. 2005). Massachusetts is the first state in the nation to institute drinking water standards for levels of perchlorates.
- Pharmaceuticals and Personal Care Products (PPCPs), including many over-the-counter drugs as well as synthetic hormones and other endocrine-disrupting chemicals, have been shown to adversely affect reproductive success in fish, and their survival in and discharge from sewage treatment facilities where they end up have raised serious concerns about health issues such as recent declines in human fertility (Bowe 2007).



Brant depend on aquatic plants that are sensitive to changes in marine water quality.



Chemicals that harm fish may also harm fish-eating birds such as the Belted Kingfisher.

CLIMATE CHANGE AND MASSACHUSETTS BIRDS

Changes that have already been observed

Bird populations all over the world, from penguins in Antarctica to seabirds off the Pacific Coast and geese in the Arctic, are responding to the warming of the earth. Climate change is affecting Massachusetts birdlife as well, and the data used in this report points to some likely climate-driven changes. The impacts of warming are particularly evident for birds that formerly occurred only south of Massachusetts or were at the northern edge of their range in the Commonwealth. For example, the number of blocks occupied by 10 forest-dwelling “southern expanders” has increased by 560% from Atlas 1 to Atlas 2. This increase contrasts with a notably smaller 74% increase for forest birds at the center of their ranges and a 52% increase for northern species. Changes in distribution from Atlas 1 to Atlas 2 also show real increases for southern species in both freshwater marsh and urban habitats when compared to northern species, or those at the center of their range in Massachusetts.

In addition to range expansions, BBS data indicate that these species are also increasing in abundance. Some examples of these expanding southern forest birds are Red-bellied Woodpecker, Warbling Vireo, and Pine Warbler. Similar results were found for urban/suburban-dwelling birds, including Carolina Wren and Tufted Titmouse. Urban birds are likely also responding to the expansion of urban and suburban habitats.

Although one would predict that birds at the southern edge of their ranges (“northern species”) will decline in response to global warming as in the case of the decreasing White-throated Sparrow, the climate “signal” from these northern species is mixed. Some northern species have expanded their ranges south in recent years, or recovered from losses during the last century, including Common Loon and Common Merganser.

Future Projections of Bird Distributions in Massachusetts

It is likely that most of the rapid changes observed to date reflect the mobility of birds rather than large changes in Massachusetts ecological communities resulting from warming. Plant species, however, are beginning to respond to global warming, and future projections suggest that the oak-pine forests that predominate in central and eastern Massachusetts will completely cover all of Massachusetts in the future (Bertin 2011, Frumhoff et al. 2007). Spruce-fir forests, which occur on a few isolated mountaintops in Massachusetts, are expected to disappear from the Commonwealth. The northern hardwood forests—dominated by Sugar Maple, American Beech, and Yellow Birch, common in central and western Massachusetts—are also predicted to disappear. Bird species such as Blackpoll Warbler that breed only in these forest types will most likely also disappear from the state.

A US Forest Service report on climate change effects on birds (Matthews et al. 2004) modeled the current distribution of 150 birds of northeastern forests in relation to temperature and tree distribution deriving an association among birds, certain tree species, and key temperature parameters (e.g., summer highs, winter lows). Using anticipated changes in temperature and tree distribution, the report projected future abundances and distributions of birds, concluding that 78 forest bird species will decrease in numbers by at least 25% in the future and 33 species will increase by about the same percentage. Overall abundances and species richness will remain the same, but the suite of species will change

CURRENT TRENDS AND FUTURE PROJECTIONS OF THE CLIMATE OF MASSACHUSETTS

Our changing climate:

- Current CO₂ levels are higher than they have been in at any time in the past 700,000 years.
- Climate change is driven by increases in CO₂, the result of burning of fossil fuels and deforestation.
- Since 1970, the northeastern United States has experienced a temperature increase of approximately 0.5 degrees Fahrenheit per decade. Winter temperatures have risen faster than the average at 1.3 degrees Fahrenheit per decade.
- On average, relative sea level has risen about 2 millimeters per year in New England over the last 100 years. The current rate is about 3 millimeters per year.



Tufted Titmice are southern cousins of the Black-capped Chickadee and have taken Massachusetts by storm in the past thirty years.

Our climate in 2100

- Winters in the northeast U.S. may be 5 to 12 degrees Fahrenheit warmer and summers 3 to 14 degrees Fahrenheit warmer, giving Boston a climate similar to that of Baltimore, Maryland, or Charleston, South Carolina.
- An increase of 4 to 8 degrees Fahrenheit in sea surface temperatures is projected to potentially affect the distribution of prey fish important to coastal bird species.
- Annual precipitation may increase approximately 10% in the Northeast, primarily as rain during winter months.
- Sea levels are predicted to rise between 18 and 58 centimeters. This prediction does not take in to account the melting of ice caps and glaciers, thus underestimating future sea level rise.

(Frumhoff et al. 2007, Pachauri and Reisinger 2007, Hayhoe et al. 2006).

The Blue Grosbeak is predicted to move into Massachusetts as a breeding species.



dramatically. The species predicted to decrease include some of our most familiar birds: Tree Swallow, Black-capped Chickadee, Gray Catbird, Yellow Warbler, and Song Sparrow. Many species predicted to increase in the Northeast have already become more common in Massachusetts, including Red-bellied Woodpecker, Yellow-billed Cuckoo, and Orchard Oriole. Other species predicted to increase are not yet present as Massachusetts breeders (Blue Grosbeak, Summer Tanager).

Matthews et al. (2004) indicated that migratory species are more likely to decline than residents because migrants need to adapt to climate-induced changes in several different regions. As an example, Massachusetts breeding birds that migrate to the Caribbean may experience reduced overwinter survival as wintering habitats dry out (Matthews et al. 2004). In Arctic regions where warming has been particularly pronounced, temperature increases could disrupt the nesting of vast numbers of Arctic birds, many of which spend significant time in Massachusetts during spring and fall migrations or during winter months (Price 2000).

Accelerated sea-level rise, due to melting ice caps and thermal expansion, could undo major conservation successes that have protected endangered coastal birds, including Roseate, Common, and Least terns, Piping Plover, and Saltmarsh Sparrow. Obligate salt marsh species, such as Saltmarsh Sparrow and Willet, are currently common residents of the salt marshes of Massachusetts, but both are considered conservation priority species on the State Wildlife Action Plan due to the vulnerability of salt marshes to future sea-level rise. The current prediction is that our salt marshes will not be able to keep up with sea-level rise and will therefore decline in area (Kirwan et al. 2010). Marshes that are surrounded by undeveloped upland could possibly expand inland if the slope is not too steep, however, many of our marshes are bordered by development. Barrier beaches that support nesting terns and plovers are more likely to be subjected to severe erosion events due to accelerated sea-level rise. And, the increased frequency of intense storms are likely to disrupt nesting.

Climate change projections, such as those proposed by Mathews et al. (2004) tend to focus on single species. However, the consequences of climate change must take into account effects on species interactions, which are difficult to predict. Disruption of the timing of annual ecological events for Massachusetts species has been documented, including bird nesting, amphibian breeding, flowering, and the synchrony of species interactions (e.g., pollination, prey availability during nesting; see also section on passage migrants on page 44).

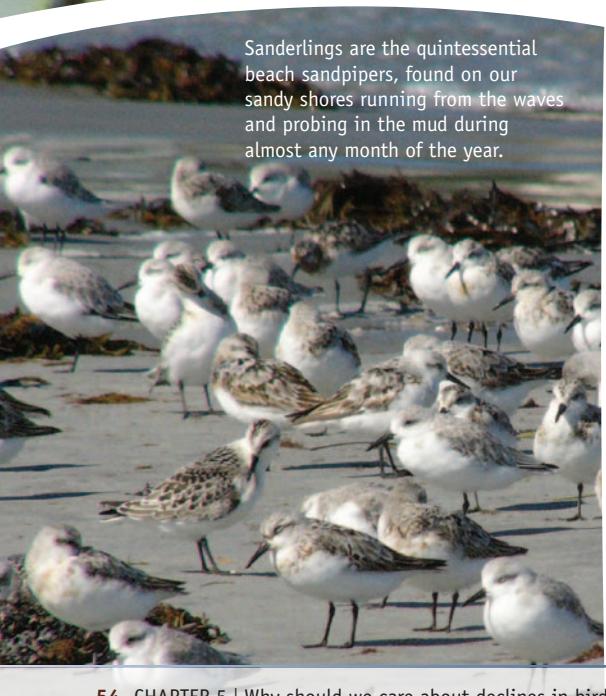
Responding to Climate Change

The key to mitigating the most extreme effects of climate change is the timely and significant reduction of greenhouse gas emissions. Many Massachusetts organizations are working together to accomplish this goal (Mass Audubon statement 2010). The Massachusetts Global Warming Solutions Act (GWSA) sets a near-term statewide CO₂ emissions reduction target of 10-25% by 2020 (all percentages refer to the 1990 baseline) and a longer term target of 80% by 2050. Existing and planned energy efficiency and renewable energy production policies are projected to lead to emission reductions of approximately 18% from 1990 levels by 2020. Actions for climate change adaptation are focusing on providing future viable habitats for all wildlife and enhancing regional partnerships beyond state boundaries to provide connections between protected areas to enable species ranges to respond to changing climates. Specific attention will need to focus on the protection of coastal habitats that are at considerable risk from accelerated sea-level rise.

CHAPTER 5. Why should we care about declines in bird populations?



The Nashville Warbler was once a fairly common breeder in areas of forest edge and old fields, but this species is declining as early-successional habitat becomes harder to find.



Sanderlings are the quintessential beach sandpipers, found on our sandy shores running from the waves and probing in the mud during almost any month of the year.

Roger Tory Peterson said he was often asked, “What good are birds?” He was appalled by the question and so frustrated by its frequency that he once blurted out in response “What good is a newborn baby?” One of the world’s most famous bird men did not mean of course that we should value birds as highly as we do our children, but simply that there are some things whose worth is immeasurable. But the fact that he was asked this question often suggests that many people would not be especially concerned about a world without birds, or lack a basic understanding of animals and ecosystems and want to understand what role birds play in our world. So perhaps then it is worth answering the question more methodically.

Intrinsic Worth. If we leave aside utilitarian values—What do birds do for us?—we are left to make a basic ethical and moral assessment of our relationship to all of the other species that inhabit our world. While some philosophies assert the right of human beings to dominate all other species, and even use this concept to justify human-caused extinctions, perhaps a more worthy model for a species that has unquestionably acquired significant powers of destruction is stewardship, i.e., respecting and recognizing a responsibility to other life-forms and the global ecosystem we share with them. Massachusetts harbors a number of bird populations of worldwide significance, most notably the globally rare Piping Plover and Roseate Tern. We would argue that we have a responsibility to preserve their existence or at least to prevent their destruction by our hand. While it is certainly possible to demonstrate the economic value of birdlife, the true value of, say, a Saltmarsh Sparrow, is ultimately what we decide it is. Sadly, some would say “worthless” while others (most of us, we hope) would say “priceless.”

The Watchmaker’s Rule. “Keep all the pieces.” Of the 10 to 100 million species that are estimated to exist at present, we have identified a mere million and half or so, and we are still very far from understanding the “clockwork” of the complex ecosystem that supports such astonishing abundance and diversity. Biodiversity studies have taught us that complex living systems tend to be more stable than simpler ones and that, at some point, loss of a certain number of species or perhaps just one or two “keystone” species can trigger the collapse of a natural community. And yet we are presently in the midst of a global extinction event that is progressing perhaps a hundred times more rapidly than the great extinctions recorded in the fossil record. Birds are the second largest class of vertebrate animals, numbering around 10,000 species worldwide. They are nearly ubiquitous, occurring everywhere except the most desolate Antarctic deserts, and they exist in uncountable billions. As such they provide a vast, unmeasured array of “ecosystem services” such as food, nutrients for soil and water, seed dispersal, and pest control. We don’t understand exactly how this large group of organisms functions to help keep the global ecosystem “ticking.” Any individual bird or species may strike us as relatively trivial. But it is a reasonable apprehension that a massive loss of bird diversity and abundance could signal a larger unraveling of the web of life. The extinction of the Passenger Pigeon from “overharvest” demonstrated that very large populations can crash very rapidly, and it is certain that about 20% of the world’s bird species fly in the shadow of extinction. In other words, we have already lost some pieces of our watch and it is just common sense to try to keep track of what remains.

The Universal Canary. Dead and dying birds and declining populations often signal impending environmental disasters that threaten human health and well-being. It was the decimation of the plume birds, killed for the millinery trade in the late 19th century, that inspired the first sustained bird conservation movement and the founding of the Massachusetts Audubon Society in 1896. Large numbers of dead robins and other songbirds, killed by pesticide spraying for nuisance insects, provided a frightening justification for the title of Rachel Carson's classic, *Silent Spring*. And proof that the effects of DDT were responsible for the steep population declines in Ospreys, Bald Eagles, and other birds of prey provided a powerful argument for the banning of this class of pesticide in the United States in 1972.

Many airborne and waterborne contaminants are not readily detectable by human senses; hence the once-traditional practice of carrying a caged canary into a coal mine to give early warning of the buildup of toxic or explosive gasses. Numbers of dead birds have often sounded the alarm about oil spills, air pollution, the illegal dumping of toxic chemicals into water bodies, and the presence of communicable diseases such as West Nile virus.

Recreation. Birdwatching is the fastest growing outdoor recreational activity in the United States, surpassing fishing, gardening, and golf. An estimated 48 million Americans over the age of 16 self-identify as birdwatchers, and 20 million of these will take time to bird "away from home." According to the U.S. Fish and Wildlife Service, 24% of Massachusetts residents are birdwatchers, three percentage points above the national average. In addition, 14,000 sportspersons enjoy hunting waterfowl and upland gamebirds, such as Wild Turkey and Ring-necked Pheasant, in the Commonwealth. Birds are also a major element of the deeper, literal sense of "re-creation" as spiritual renewal. Asked what they especially enjoy about their favorite outdoor activities, many hikers, beachgoers, canoeists, cyclists, picnickers, and others will mention the sight and sound of birds. They stand for the restorative quality of nature as a whole.

TABLE 22. The economic impact of birding in the United States in 2006.

Trip expenditures (Food, lodging, transportation, etc.)	\$12 billion
Equipment	\$24 billion
Total output (Direct, indirect, and induced effects of expenditures by birders)	\$82 billion
Number of jobs created	671,000
Average annual salary for these jobs	\$41,000
Employment income	\$28 billion
State tax revenues	\$6 billion
Federal tax revenues	\$4 billion

Economic Impact. The growing popularity of birdwatching has an enormous positive impact on our economy and the world's. Because there is great geographical variation in birdlife, many birders travel—some all over the planet—in pursuit of their quarry. In economic terms this translates into purchases of food, hotel rooms, airfares, rental cars, tours, books, optical equipment, and all the other goods and services that birders require. Table 21 above gives a summary of the economic impact of birding in the United States in a single year as reported by the U.S. Fish and Wildlife Service. All figures are for 2006 (rounded to nearest million).

The Commonwealth's approximately 1.4 million birders contribute roughly \$560 million to the Massachusetts economy.

CHAPTER 6. Recommendations



PLANNING AND PUBLIC POLICY

Integrate *State of the Birds* findings and recommendations into Mass Audubon, other private conservation organizations, and government bird conservation strategies and management initiatives.

- Establish a comprehensive bird management strategy that seeks to maintain the diversity of bird species present in Massachusetts, in cooperation with state and federal agencies, neighboring state governments, and partner organizations.
- Work with government agencies to incorporate the results of the *State of the Birds* in both state and regional conservation plans, such as USFWS wildlife refuge plans, Cape Cod National Seashore avian management plans, the Massachusetts Division of Fisheries and Wildlife State Wildlife Action Plan, future iterations of Massachusetts climate change plans, and the Massachusetts Ocean Management Plan.
- Work with Commonwealth land protection agencies to incorporate key *State of the Birds* findings into land protection programs.
- Work with the Massachusetts Division of Fisheries and Wildlife Natural Heritage & Endangered Species Program to review *State of the Birds* data and the status of bird species listed under the Massachusetts Endangered Species Act and the State Wildlife Action Plan, and make listing recommendations accordingly.
- Establish a strategy for developing and sustaining early successional habitat with the Massachusetts Department of Fisheries and Wildlife and the Department of Conservation and Recreation as well as other federal, state, and local entities, and academic researchers. The strategy will assess the current amount and geographic distribution of grassland and shrubland habitat present and target active management goals; the roles of public and private lands; monitoring and research needs; and the functions of natural disturbances.
- Identify and pursue funding sources for state agencies and conservation organizations to help implement *State of the Birds* recommendations. Also, work in partnership with other conservation organizations to shape state and federal law, regulation, and policy regarding bird conservation as well as identifying funding resources such as changes in the federal tax code regarding charitable gifts of fee interests in lands that would facilitate bird habitat protection.

CONSERVATION AND MANAGEMENT OF HABITAT AND BIRD SPECIES AT RISK

- Identify sites and financial resources needed to actively manage for grassland and shrubland birds within the Commonwealth, such as the Eastern Meadowlark, Vesper Sparrow, and White-throated Sparrow.
- Enhance and strengthen the protection and management of freshwater marsh habitat to benefit bird populations (e.g., removal of invasive plant species and implementation of projects that would restore hydrological function to impacted wetlands).
- Acquire remaining key parcels of undeveloped land adjacent to sensitive coastal habitats so as to enhance the status of salt marsh and other coastal bird populations, particularly as part of an adaptive strategy to mitigate against the accelerated rise of sea levels associated with climate change.
- Strengthen protection and management of habitat used by coastal waterbirds during breeding and migration.
- Expand programs, such as Mass Audubon's Important Bird Areas (IBA) program, and the Birds to Watch program, to help identify and prioritize habitats and encompass additional species identified as declining in this report.

RESEARCH PRIORITIES REGARDING NEW ENGLAND'S MOST PRESSING BIRD CONSERVATION ISSUES

- Investigate the decrease in ground-nesting species, especially the potential link to increases in deer populations and midsized mammalian predators.
- Gain a better understanding of the emerging threat of climate change on bird populations and their habitats.
- Identify bird species and their habitats to be included in survey and monitoring protocols for environmentally protective renewable energy siting standards.
- Investigate the potential role of particular toxic chemicals on declining bird populations.
- Investigate the decline of aerial insectivores such as the Common Nighthawk.
- Support and encourage long-term bird monitoring programs such as the USGS Breeding Bird Survey.
- Support monitoring of grassland, shrubland, and freshwater marsh birds, especially those whose abundance and distribution are declining.



Lake Wampanoag Wildlife Sanctuary, Gardner

MASS AUDUBON'S COMMITMENT

The founding of Mass Audubon was inspired by the urgent need to protect egrets, terns, and other “plume birds” from the ravages of commercial exploitation. During its 115-year history, the organization has steadily invested in its commitment to the conservation of birdlife, advocating for strong environmental laws and regulations, conducting research, protecting habitat, practicing active habitat management on our statewide system of wildlife sanctuaries, supporting conservation partnerships, and offering education programs to people of all ages.

In this tradition, Mass Audubon will act on the insights gained from the *State of the Birds* report, through the following.

- Provide sustained leadership to realize the recommendations and findings contained in *State of the Birds*.
- Establish and implement a Mass Audubon-wide bird management strategy based on the findings in *State of the Birds*.
- Review and strengthen the ecological management plans for our wildlife sanctuaries in order to identify additional opportunities to manage habitats for birds at risk, especially grassland, shrubland, and marshland species.
- Continue long-term monitoring of birds and their habitats at Mass Audubon wildlife sanctuaries.
- Expand the impact of our Coastal Waterbird and Important Bird Areas programs.
- Protect land that provides critical habitat for the birds identified as requiring action in the *State of the Birds* report.
- Incorporate the findings from *State of the Birds* into Mass Audubon's education initiatives and programs consistent with Massachusetts education standards at all grade levels.
- Establish a series of publications modeled on Mass Audubon's grassland bird manuals (www.massaudubon.org/Birds_and_Birding/grassland/index.php) to help landowners, municipalities, and citizen conservationists to manage habitat for shrubland birds and other species of concern.
- Support funding and strict enforcement of state and federal laws protecting birds and their habitats and defend such laws against efforts to weaken them.
- Update the *State of the Birds* reports at regular intervals, and chronicle the status of Massachusetts birdlife via the *State of the Birds* website on an ongoing basis.

KILL THE LIGHTS, SAVE THE BIRDS

The Bad News is that brightly lit big cities are often avian death traps. The Good News is that something can be done, namely turning off (or at least turning down) the lights in the tallest city buildings. Concerned citizens of Toronto led the charge by founding the Fatal Light Awareness Program (FLAP) in 1993 with a mission to “safeguard migratory birds in the urban environment.” This led to the formation of Lights Out Toronto, a partnership involving environmental groups, city government, and building owners to minimize bird mortality and in the bargain to cut energy use and greenhouse gas emissions, save money, and reduce light pollution.

There are now Lights Out programs in New York City, Chicago, Detroit, and Minneapolis. And in the fall of 2008, Mass Audubon joined Mayor Thomas Menino in founding Lights Out Boston. Major building owners are enthusiastic about the partnership, with 45 buildings already signed on to the program—more than any other city in the U.S.

We know that Lights Out programs work. A study of a single office tower in Chicago showed that bird mortality was reduced by 80% when architectural and window lighting was turned off during peak migration periods.



WHAT YOU CAN DO...

- Support land and bird conservation in your community and region.
- Learn about birds and their habitats in your community through Mass Audubon or your local bird club.
- Provide bird habitat on your property: landscape using native plants that provide food, shelter, and nesting sites; put up nesting boxes for species such as the Eastern Bluebird; avoid the use of pesticides; and keep cats indoors.
- Become a member of Mass Audubon and volunteer to assist with habitat management, species monitoring, and other conservation projects.
- Share information with online bird conservation projects such as Mass Audubon's Birds to Watch (www.massaudubon.org/Birds_and_Birding/birdstowatch/index.php) and Cornell's eBird (ebird.org). These projects help keep track of how birds are faring and inform bird conservation strategies.
- Use the online tools from Mass Audubon's Shaping the Future of Your Community project (www.massaudubon.org/shapingthefuture/shapingtoc.php) to help conserve avian habitat in your community.
- Go Birding!

References

- Bertin, R. 2011, PowerPoint presentation: Seventy years of change in the flora of Worcester County.
- Bildstein, K.L., et al., eds. 2008. State of North America's Birds of Prey (Series in Ornithology No. 3). Nuttall Ornithological Club, Cambridge, MA, and The American Ornithologists' Union, Washington, D.C.
- Bowe, L. Investigating Emergent Contaminants: Pharmaceutical impacts and possible solutions. 2007. Prepared as part of a research project funded by the Rappaport Institute for Greater Boston, Kennedy School of Government, Harvard University.
- Brown, S., C. Hickey, B. Harrington, and R. Gill, eds. 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.
- del Hoyo, J., A. Elliott, and J. Sargatal, eds. 1992. *Handbook of the Birds of the World*. Vol. 1. Lynx Edicions, Barcelona.
- Eaton, M.A., G.F. Appleton, M.A. Ausden, D.E. Balmer, M.J. Grantham, P.V. Grice, R.D. Hearn, C.A. Holt, A.J. Musgrove, D.G. Noble, M. Parsons, K. Risely, D.A. Stroud, S. Wotton. 2010. The state of the UK's birds 2010. RSPB, BTO, WWT, CCW, JNCC, NE, NIEA and SNH, Sandy, Bedfordshire.
- Fernie, K.J., J.L. Shutt, R.J. Letcher, I.J. Ritchie, and D.M. Bird. 2009. Environmentally relevant concentrations of DE-71 and HBCD alter eggshell thickness and reproductive success of American Kestrels. *Environmental Science & Technology* 43(6): 2124-2130.
- Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles. 2007. Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions. A Report of the Northeast Climate Impacts Assessment. Union of Concerned Scientists. Cambridge, MA.
- Gentles, A., J. Surles, and E.E. Smith. 2005. Evaluation of adult quail and egg production following exposure to perchlorate-treated water. *Environmental Toxicology and Chemistry* 24: 1930-1934.
- Goodale, W. 2008. Preliminary findings of contaminant screening of Maine bird eggs: 2007 Field Season. BioDiversity Research Institute, Gorham, ME.
- Hayhoe, K., C.P. Wake, T.G. Huntington, L. Luo, M.D. Schwartz, J. Sheffield, E. Wood, B. Anderson, J. Bradbury, A. DeGaetano, T.J. Troy, and D. Wolfe. 2006. Past and future changes in climate and hydrological indicators in the U.S. Northeast. *Climate Dynamics* 28(4): 381-407.
- Hildreth, A.M., S.M. Vantassel, and S.E. Hygnstrom. 2010. Feral Cats and Their Management. University of Nebraska Extension. EC1781.
- Karl, T.R., J.M. Melillo, T.C. Peterson, and S.J. Hassol, eds., 2009. Global Climate Change Impacts in the United States. Cambridge University Press, 196 pp.
- Kirwan, M.L., G.R. Guntenspergen, A. D'Alpaos, J.T. Morris, S.M. Mudd, and S. Temmerman. 2010. Limits on the adaptability of coastal marshes to rising sea level, *Geophysical Research Letter* 37: L23401.
- Lane, O.P., and D.C. Evers. 2008. Methylmercury availability in New England estuaries as indicated by Saltmarsh Sharp-tailed Sparrow, 2004-2006. BioDiversity Research Institute, Gorham, ME.
- Lloyd-Evans, T.L., and J.L. Atwood. 2004. 32 years of changes in passerine numbers during spring and fall migrations in coastal Massachusetts. *The Wilson Bulletin* 116(1): 1-16.
- Marshall, M.R., J.A. DeCecco, A.B. Williams, G.A. Gale, and R.J. Cooper. 2003. Use of regenerating clearcuts by late-successional bird species and their young during the post-fledging period. *Forest Ecology and Management* 183: 12
- Mass Audubon statement (2010): Sustaining People and Nature in a Rapidly Changing Climate. <http://www.massaudubon.org/PDF/climatechange/MassAudubonClimateChangeStatement.pdf>.
- Matthews, S., R. O'Connor, L.R. Iverson, and A.M. Prasad. 2004. Atlas of climate change effects in 150 bird species of eastern United States. USDA Forest Service technical report NE- 318.
- Melvin, S.M. 2010. Survey of Coastal Nesting Colonies of Cormorants, Gulls, Night-Herons, Egrets, and Ibises in Massachusetts, 2006-2008. Final Report. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife.
- Miller-Rushing, A.J., T.L. Lloyd-Evans, R.B. Primack, and P. Satzinger. 2008. Bird migration times, climate change, and changing population sizes. *Global Change Biology* 14: 1-4.
- Milton, G.R., P.J. Austin-Smith, and G.J. Farmer. 1995. Shouting at shags: a case study of cormorant management in Nova Scotia. *Colonial Waterbirds* 18: 91-98.
- Mostello, C.S. 2007. Natural Heritage and Endangered Species Program fact sheet: Roseate Tern. http://www.mass.gov/dfwele/dfw/nhesp/species_info/nhfacts/roseate_tern.pdf.
- Mostello, C.S. 2010. Inventory of terns, laughing gulls, and black skimmers nesting in Massachusetts in 2009. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife.
- Nebel, S., A. Millis, J.D. McCracken, and P.D. Taylor. 2010. Declines of aerial insectivores in North America follow a geographic gradient. *Avian Conservation and Ecology* 5(2): 1.
- Pachauri, R.K., and A. Reisinger, eds. 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland.
- Powers, K.D. 1983. Pelagic distributions of marine birds of the Northeastern United States. U.S. Department of Commerce. NOAA. NMFS-F/NEC-27.
- Prange, S., S.D. Gehrt, and E.P. Wiggers. 2003. Demographic Factors Contributing to High Raccoon Densities in Urban Landscapes. *The Journal of Wildlife Management*, Vol. 67(2): 324-333.
- Price, J.T. 2000. Modeling the potential impacts of climate change on the summer distributions of Massachusetts' passerines. *Bird Observer* 28: 224-230.
- Raptor Population Index website: <http://rpi-project.org/index.php>.
- U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Office of National Marine Sanctuaries. 2010. Stellwagen Bank National Marine Sanctuary Final Management Plan and Environmental Assessment. Silver Spring, MD.
- U.S. Fish & Wildlife Service fact sheet (2002): Migratory Bird Mortality, Many Human-Caused Threats Afflict our Bird Populations.

Acknowledgments

State of the Birds 2011 is the product of a yearlong collaboration among the core project team and many others. However, it relies heavily on nearly five years of work associated with Mass Audubon's Breeding Bird Atlas 2, which has been coordinated by Joan Walsh and her strong statewide team of volunteers. It also draws on decades of information collected by citizen conservationists during the annual Breeding Bird Surveys and Christmas Bird Counts.

Thanks for the strong support and encouragement of Laura Johnson, President of Mass Audubon during this project, as well as the consistent guidance provided throughout by Gary Clayton, Vice President of Conservation Programs.

The core project team responsible for creating this document included (in alphabetical order): James DeNormandie, John Galluzzo, Matt Kamm, David Larson, Chris Leahy, Wayne Petersen, and Joan Walsh. All members of the team deserve thanks for the assembly and analysis of the data, writing the document, reviewing many drafts, and providing feedback and support since the first project meeting in the late fall of 2010. Thanks as well to all those involved in the creation of the project website, especially Kathy Santos and Matthew Smith. We are grateful to have had Rob Levine as the graphic designer throughout this project; his design skill and flexibility was key to success given the aggressive project schedule. Thanks to Ann Prince, and her meticulous attention to detail, who provided copyediting throughout the project. Scott Schlossberg (Post-doctoral Fellow, Department of Environmental Conservation, University of Massachusetts) provided statistical analysis that strengthened the conclusions of the report.

Many people reviewed the draft document and provided feedback on the project including: Taber Allison (American Wind Wildlife Institute), Jim Baird, Robert Buchsbaum, Chris Buelow (Natural Heritage & Endangered Species Program within the Massachusetts Division of Fisheries and Wildlife), Jack Clarke, Gary Clayton, Jeff Collins, Tom French (Assistant Director for Natural Heritage & Endangered Species Program within the Massachusetts Division of Fisheries and Wildlife), Lucy Gertz, H Heusmann (Massachusetts Division of Fisheries and Wildlife, Wildlife Section), Laura Johnson, Elaine Kile, Tom Lautzenheiser, Susannah Lund, Scott Melvin (Natural Heritage & Endangered Species Program within the Massachusetts Division of Fisheries and Wildlife), Michael O'Connor, Tom O'Shea (Assistant Director of Wildlife, Massachusetts Division of Fisheries and Wildlife), Heidi Ricci, Jennifer Ryan, John Scanlon (Massachusetts Division of Fisheries and Wildlife, Wildlife Section), David Scarpitti (MassWildlife Division of Fisheries and Wildlife, Wildlife Section), Scott Schlossberg, and Lou Wagner.

A special thanks to Taber Allison and Robert Buchsbaum for writing the section on the impacts of climate change on Massachusetts birds.

Finally, we thank the EnTrust Fund and Susan Lisowski Sloan for providing leadership financial support for this publication and we are enormously grateful to the many individual donors whose contributions, dedication, and commitment to this project enabled its success.

Photo Credits

Phil Brown: Saltmarsh Sparrow (32); **Shawn P. Carey (Migration Productions):** Eastern Meadowlark (10), American Robin (10), American Black Duck (12), Broad-winged Hawk (15), Bobolink (19), Prairie Warbler (21), Evening Grosbeak (38), Northern Bobwhite (40), Chimney Swift eggs (43); **Chris Ciccone:** Ruffed Grouse (16); **Eduardo del Solar:** Wild Turkey (12), Northern Cardinal (26), Northern Cardinal (38), Ring-necked Pheasant (41); **James DeNormandie:** Map of agricultural change (20); **Jim Fenton© (jfenton@natureandwings.com):** Piping Plover tracks in sand (1), Brown Thrasher (2), Mixed flock of shorebirds (2), Migratory shorebirds (4), Piping Plover and chick (8), Least Terns (9), Winter birding (15), Peregrine Falcon (26), Blue-winged Teal (28), Osprey (32), Bank Swallow (43), Tree Swallow (43), Marbled Godwit (44), Brown-headed Cowbird (49), Red Knot (56), Mixed flock of shorebirds (Back cover); **Sara Golemon:** Feral cats (50); **John Harrison:** Black-capped Chickadee (Inside cover), Eastern Phoebe (2), Purple Finch (2), Rose-breasted Grosbeak (5), Red-bellied Woodpecker (10), Pileated Woodpecker (14), Eastern Towhee (14), Turkey Vulture (16), Blue-winged Warbler (22), American Redstart (25), Black-and-white Warbler (25), Blue Jay (26), Hooded Merganser (30), Hooded Warbler (30), Black-throated Green Warbler (30), Black-crowned Night-Heron (35), Great Egret (35), Ovenbird (42), Palm Warbler (44), Bay-breasted Warbler (45), Common Yellowthroat (45), Wilson's Warbler (45), Osprey (46), Belted Kingfisher (51), Tufted Titmouse (52), Nashville

Warbler (54); **iStockphoto©:** Lights out cover (59); **Richard Johnson:** Red Fox kit (50); **Matt Kamm/Joan Walsh:** Maps of Carolina Wren (5); **David Larson:** Long-tailed Ducks (4), Snowy Owl (8), Mourning Warbler (9), American Kestrel (9), Savannah Sparrow (19), Purple Finch (25), Common Raven (25), Great Blue Herons (31), Double-crested Cormorants (33), Harlequin Ducks (36), Great Shearwater (37), Rough-legged Hawk (37), Virginia Rail (40), American Woodcock (40), Sora (41), Canada Warbler (42), Rough-legged Hawk (46), Merlin (47), Sharp-shinned Hawk (47), Purple Loosestrife (50), Flock of Brant (51), Blue Grosbeak (53), Sanderlings (54); **Greg Lavaty:** Golden-winged Warbler (23); **William Lawless:** American Bittern (2); **Chris Leahy:** Shrublands (21), Suburban neighborhood (26), Salt Marsh (32); **Jerry Liguori:** American Kestrel (Cover), American Kestrel (2), Upland Sandpiper (3), Bald Eagle (4), American Kestrel (13), Cooper's Hawk (16), American Black Duck (38); **Bill McAdams:** Bald Eagle (46); **Len Medlock:** Vesper Sparrow (20); **Paul Rezendes©:** Grassland/agricultural habitat (18 and 19), Quabbin Reservation forest (24), Harvard Pond (28), Atlantic White Cedar swamp (30), Coastal habitat panorama (34), Lake Wampanoag Wildlife Sanctuary (57); **Sandy Selesky:** Eastern Whip-poor-will (48); **Kathy Sferra:** New subdivision road (49); **Dominic Sherony:** Grasshopper Sparrow (20); **John Van de Graaff:** Willet (12), Scarlet Tanager (15), White-throated Sparrow (21), White-eyed Vireo (23), Brown Thrasher (23), Common Loon (28), Least Sandpiper (44), Short-eared Owl (48).



0-932691-45-5 (978-0-932691-45-3)