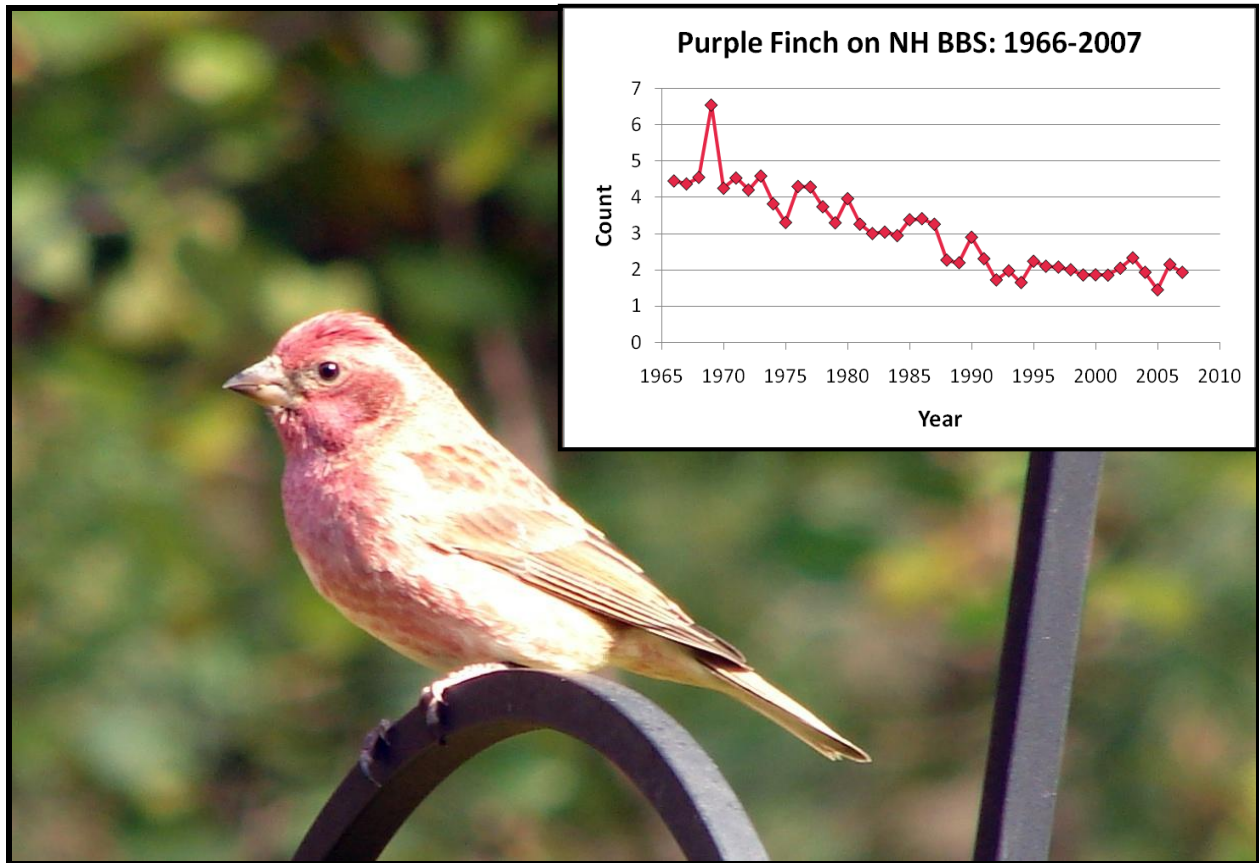


# The State of New Hampshire's Birds: 2009



A report to the Nongame and Endangered Wildlife Program,  
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## EXECUTIVE SUMMARY

Over 180 species of birds breed in the varied habitats of the Granite State, from salt marsh sparrows building nests just above the high tide line, to pipits performing sky dances in the alpine meadows of Mount Washington. In between are the far more familiar birds of New Hampshire's fields, forests, wetlands, and cities. Outside the breeding season, another 120 species are regular migrants, summer visitors, or winter residents. This diverse avifauna is the subject of this report: "The State of New Hampshire's Birds: 2009." It is an attempt to provide an overview of the conservation status of New Hampshire's birds, including their population trends, the threats they face, and the strategies that have been proposed to help them out. The analysis in the report draws from a combination of state and regional population trend data and the threats and conservation strategies identified in the New Hampshire Wildlife Action Plan. Trends, threats, and strategies are initially summarized by habitat categories, and these summaries constitute the bulk of the report.

Wildlife populations are always changing, often for reasons independent of human activity. As a result, it is not unexpected to see some species increasing, others declining, and some apparently stable during a given time period. However, when the trends for several species in the same habitat all show the same direction, and/or trends are maintained for several years in a row, it is reasonable to assume the pervasive influence of additional factors. In the language of conservation, these external factors are often called "threats" or "stresses," and minimizing them is a core goal of conservation biology. A close examination of population trends is thus an important first step in identifying conservation priorities.

So how *are* New Hampshire's birds doing? Of 186 breeding species, 42 are clearly increasing and 65 decreasing. Of the remainder, 27 appear stable and 52 either show uncertain trends or lack sufficient data entirely. Irrespective of increases and decreases, a clear need is thus better information on those 52 species, since ideally we need to identify birds at risk before they reach threatened or endangered status. By breaking the state's avifauna down into habitat categories, it becomes easier to evaluate the nature of this mix of trends, and in turn identify the important conservation issues in each habitat. Such is the format of this report, as summarized below.

As befits a forested state, roughly half of New Hampshire's bird species are found in forests of one type or another. In "The State of the Birds," these have been placed in two categories corresponding to spruce-fir and hardwood-mixed forests. The picture is far from clear regarding the state of spruce-fir forest birds. More species are decreasing than are increasing, but there are insufficient data for nearly a third of the entire group. Main concerns for spruce-fir birds include conversion of spruce-fir to hardwood, declining forest condition, loss of later successional stages, climate change, and possibly events outside of New Hampshire during the non-breeding season. Implementing plans for maintaining spruce-fir forests via sustainable forestry practices may be the best long term strategy to ensure healthy populations of birds in spruce-fir forests.

In contrast, there are good population trend data for most birds of hardwood/mixed forests, and these show an even split between increasing and decreasing species. Increasing species tend to be those that adapt well to human-altered landscapes, including several that are expanding their ranges northward, whereas the majority of declining species are mix of ground nesters, area sensitive species, and birds typical of mid-successional stages (see below). The vast majority of declining species in this habitat are also those that winter in Latin America or the Caribbean, while increasing species tend to be residents or short-distance migrants. It is also worth noting that several forest species have increased since the mid-1900s simply as a result of reforestation. As present trends in land use continue, southern New Hampshire's forests will become older and more fragmented, and land protection focused on large habitat blocks is probably the best strategy to ensure that populations of most forest birds remain viable into the future. At the same time, it remains critical to address potential threats to long-distance migrants both on their winter grounds and during migration.

A disproportionate number of early successional species are in clear and persistent decline. Within the shrub-scrub and grassland habitat groups, ten times as many species are decreasing as increasing, a pattern repeated across much of the Northeast. The reasons for these declines are relatively clear, and involve a gradual reversion of open habitats to forest as a result of agricultural abandonment or altered natural disturbance regimes, as well as direct loss to development. While debate continues about the historic extent of these habitats in northern New England, it is important to develop strategies that prioritize early successional habitats in such a way as to enhance their suitability for grassland and shrubland birds without compromising the suitability of the larger forested landscape in which they are embedded. Grassland birds also experience reduced reproductive success in fields managed intensively for agriculture, and where possible would benefit from the implementation of management that allows for a complete nesting cycle.

In clear contrast to birds of terrestrial habitats, those of wetlands are very poorly known. Such species, particularly those that breed in freshwater and estuarine marshes, are rarely detected by most monitoring programs, and as a result accurate trend information is not available. As a result, over half the New Hampshire species that use wetlands have unknown or uncertain trends. Given that these habitats face potentially significant threats associated with development, climate change, and human activity, a key need is better information on the status of wetland birds. For two subsets of wetland birds, the data appear much more consistent. Among wetland and riparian songbirds, there have been small but persistent declines since the mid-1970s, and while reasons for the declines are unclear, many of the affected species are long-distance migrants, suggesting again the potential importance of factors operating during the non-breeding season. In contrast, many of the larger fish-eating birds of fresh and salt water habitats have shown recent increases, often as a direct result of intensive population management. While such rebounding populations are a testament to the ability of birds to respond when threats are mitigated or removed, these recoveries are only as good as our ability to remain vigilant and continue to manage their habitats or populations.

Although an important threat facing many birds is the ongoing conversion of natural habitats to urban, commercial, and residential developments, it is important to acknowledge that such habitats do provide habitat for several species of birds. Of species which have shown the

ability to adapt to developed landscapes (or even thrive in them), half are declining and half increasing, although the magnitudes of the declines appear less than the magnitudes of the increases. Declining species in this group tend to be either non-native exotics or those that use developed areas intermittently (meaning that they are predominately species of adjacent habitats). Increasing species are typically birds that have adapted particularly well to human habitation, including several common “feeder birds” and a few species that are expanding their ranges to the north. Given this diverse mix of species, it is hard to summarize threats and conservation actions in a concise manner, and in many cases the best approach may be to focus on individual cases (e.g., Peregrine Falcon, Common Nighthawk).

In addition to the clear declines in early successional birds, one other group of breeding species stands out as being in general decline. These are the aerial insectivores, including swallows, nightjars, swifts, and flycatchers. While their specific habitat needs may vary – and habitat change may certainly be behind the declines in some cases – all these species share the common characteristic of feeding almost entirely on flying insects. As such, declines in their populations could be the result of reduced insect populations or more direct effects of insecticides on survival or reproduction, either here or on the wintering grounds. More research is clearly needed throughout the annual cycle if we are to effectively conserve this guild of birds.

Last but not least, several previous paragraphs have alluded to the fact that New Hampshire is not an island; that most of our birds are both affected by broader regional factors *and* spend a significant portion of their lives away from their breeding habitats in the Granite State. Hundreds of shorebirds stop to feed in coastal salt marshes each fall, migratory waterfowl follow the Connecticut and Merrimack Rivers north each spring, and in both spring and fall the entire state is blanketed by the mass migratory movements of thousands – if not millions – of songbirds heading to or from their breeding grounds to the north. We need to consider another whole suite of habitats and issues when we think about conservation at the scale of a species’ annual cycle, and in many cases a failure to do so may result in missed opportunities or – at worst – a poor use of limited resources.

In the broadest sense, our priorities for bird conservation in New Hampshire are threefold: conserve important habitats, manage habitat where most appropriate, and gather data that can inform our understanding of limiting factors. Habitats most in need of outright protection include forests, salt marshes (here including restoration and the consideration of climate change effects), and climax shrublands such as pine barrens. This last habitat can also benefit greatly from the restoration of fire, while the management of anthropogenic shrublands and grasslands needs to consider landscape context, historical population sizes, and economic feasibility before proceeding at a large scale. For poorly known groups such as wetland birds, aerial insectivores, and many spruce-fir forest birds, a key need is some combination of monitoring and research that can both clarify population trends and identify the most important threats.

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## INTRODUCTION

Over 300 species of birds regularly occur in the state of New Hampshire, including 186 that have been confirmed as regularly breeding. Over half these species (both breeders and overall) are listed as being of conservation concern in one or more lists, including New Hampshire (New Hampshire Fish and Game Department Nongame and Endangered Species Program), Bird Conservation Regions (BCRs) 14 and 30 (which together encompass all of New Hampshire: Figure 1), U.S. Fish and Wildlife Service (USFWS) Region 5 (the Northeast, including 13 states from Maine to Virginia), and the United States as a whole (USFWS “Birds of Conservation Concern,” National Audubon/American Bird Conservancy “Watch List”).

Birds are arguably the best-monitored group of organisms in North America, with extensive data sets from continent-wide programs (Breeding Bird Survey, Christmas Bird Count) and more targeted surveys for individual species (e.g., state and federally listed species). This wealth of data has been recognized by the inclusion of birds as important indicators in the 2008 “Northeast Monitoring and Performance Reporting Framework” (Stem et al. 2008, hereafter “NE Framework”). The goal of the present document is to summarize the population status of the state’s bird species, tied where appropriate to both the indicators presented in the NE Framework and to the critical wildlife habitats identified in the New Hampshire Wildlife Action Plan (WAP) in 2005. In many ways it also serves as a New Hampshire version of the recently released “State of the Birds” report for the United States as a whole (see Part III: Bird Conservation Resources).

The last overview of this sort with respect to New Hampshire’s avifauna was summarized in the *New Hampshire Audubon* magazine in the fall of 2005 (Vol. 41, No. 3), and the current report will follow much of the same format. Information on bird species of conservation concern is summarized by ecological groupings under the assumption that species using the same habitat or with the same basic life history characteristics will be responding to the same suites of threats. Where possible, this summary will follow the habitat categories used in the New Hampshire WAP.

This document includes two main sections. The first is a series of habitat-based bird narratives that summarize the threats facing each habitat, population trends of species that use each habitat, and some discussion of conservation strategies appropriate for each habitat. These summaries are supported by several tables at the end of the report. Following the habitat summaries, there is a summary and prioritization of broad conservation strategies (from the New Hampshire WAP) as they apply to birds and bird habitats (see also Hunt 2008). For the most part, this section does not refer to species-specific conservation actions, many of which are listed in the WAP appendices. This document is best viewed as a work in progress, and will be updated periodically as new information becomes available.

## METHODS

The list of bird species in New Hampshire was derived from “A Checklist of the Birds of New Hampshire” (Hunt et al. 2004), and supplemented by observations in the *New Hampshire Bird Records* database (ASNH). To be included in this list, a species had to be either annual in occurrence or documented breeding at least once in the last 10 years. Using this definition, several species are still relatively rare (e.g., Greater White-fronted Goose, Mississippi Kite, and Hoary Redpoll) and as such lack data on both population trends and potential threats. These species are only peripherally treated in this document if at all, and generally only when their status in the state can clearly be tied to better-understood regional patterns. Using these general rules, there are 186 regularly-breeding species in New Hampshire, and approximately 120 more that occur only as non-breeders. The majority of this report focuses on the breeding species, since data on population trends are more readily available.

Data on population trends for each of the 186 breeding species were compiled from several sources. In most cases these data were from the Breeding Bird Survey (BBS), a nationwide program administered since 1966 by the U.S. Geological Survey. Trends based on BBS data are available at several spatial scales, including states, BCRs, and USFWS regions. When possible, New Hampshire trends were used in this analysis, but for some species there were not sufficient data to produce an accurate and/or reliable trend at this scale. In such cases, trends for the appropriate BCR or the entirety of USFWS Region 5 were also referenced. The BBS analysis includes a “regional credibility measure” which indicates the degree of confidence analysts have in the trends, based on factors including sample size, annual variation, and each species’ biology. Only trends for species ranked as “moderate” or “good” using this system are considered in the present analysis. More details on trends are available in the legend for Tables 2-13. In many cases, there are additional data sets that can serve to supplement the BBS at both state and regional scales. These include monitoring programs for threatened and endangered species, repeated Breeding Bird Atlases, raptor migration counts, and the National Audubon Society’s Christmas Bird Count (CBC). When appropriate, these data sources were used to evaluate the population trends of New Hampshire’s breeding bird species, and were especially useful to place these trends in a regional context.

In addition to providing information on population trends, the habitat summaries include an overview of the threats that are believed to influence the birds in each habitat category. These were derived from either habitat or species profiles in the New Hampshire WAP, and take into consideration the overall seriousness of a given threat. Under this approach, only high ranking threats were considered in this document, unless more recent data suggest that a given threat was underestimated in the WAP. It is important to consider that not all species respond to threats equally, and that special cases involving single species (e.g., effects of poor housing maintenance on Purple Martins) were often not treated at all (again, refer to the WAP appendices for this information). Finally, in the context of the more important threats facing New Hampshire’s avifauna, the document concludes with an overview of the conservation strategies that have the greatest potential to improve the habitat condition or species’ status. These were extracted from a comprehensive list of strategies derived from the WAP species and habitat profiles. The format of this section follows the classification of strategies in the New Hampshire WAP.

## PART 1: HABITAT SUMMARIES

### *Birds of Forests*

Except during a few decades in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, forests of various types have dominated the New Hampshire landscape since the last ice age. The New Hampshire WAP recognizes five matrix forest types (lowland spruce-fir, high elevation spruce-fir, northern hardwoods-conifer, hemlock-hardwood-pine, and Appalachian oak-pine), plus three additional habitats to some extent dominated by trees (floodplain forests, peatlands, and pine barrens). With the exception of the Bicknell's Thrush (found only in high elevation spruce-fir), there are no bird species that are restricted to a single forest type, and as a result these habitats have been lumped into two broader groups corresponding to spruce-fir and hardwood-mixed forest, as defined in the sections that follow. This separation is based on differences in bird communities and threats in each forest group, as well as variation in the underlying data on bird populations. Note that there are some widespread species that occur in both forest groups and which therefore have been included in the analysis for each.

Four trend indicators relative to forest birds are proposed in the NE Framework: 1) woodland breeding birds, 2) early successional birds, 3) cavity nesters, and 4) mid-story and canopy nesters. Each of these is intended to reflect broader indicators of forest condition including area, structure, and age class composition. Information on three of these indicators is presented in the discussion below, with "Indicator 1" divided into the two forest groups mentioned above. Birds that predominantly use early successional forests (i.e., those dominated by seedlings or saplings) are treated in more detail in a separate habitat category.

### Spruce-Fir Forests

This habitat grouping includes the following three habitats from the New Hampshire WAP: 1) high elevation spruce-fir, 2) lowland spruce-fir, and 3) peatlands. In the last case, the habitat is restricted to forested peatlands such as black spruce bogs, and does not include open fens, kettle bogs, and any peatland that is primarily an aquatic habitat. Aquatic peatlands support no specialized birds and will be included in the wetland habitat category. Spruce-fir forests as thus defined are restricted to the northern and western parts of the state, save for isolated pockets in highlands or peatlands in the southeastern third of the state (and these rarely support "typical" spruce-fir bird species). New Hampshire's spruce-fir forests are at the southern edge of the vast boreal forest zone that stretches from the Canadian Maritime provinces and northern New England west across Canada to the Rocky Mountains and beyond to Alaska. Roughly half of the birds using this habitat in New Hampshire could be considered "spruce-fir obligates," meaning that they occur only in this habitat type. Most are found only rarely south of the White Mountains. The other half are more widespread forest species that regularly use spruce-fir, and which usually reach higher densities there than in forests with a more significant hardwood component. Species that use early successional stages of spruce-fir are also included in this category only if they are largely restricted to coniferous habitat (e.g. Magnolia Warbler and



Lincoln's Sparrow); otherwise they are included in the shrubland category (e.g., Chestnut-sided and Mourning Warblers).

The primary threats facing New Hampshire's spruce-fir birds are related to 1) timber harvesting practices, 2) climate change, and 3) atmospheric deposition. Timber harvest has the potential to affect birds in several ways. Not only can habitat be lost entirely in the short term, but in many cases the forest that returns is hardwood rather than conifer, and thus less suitable for this suite of species. In addition, timber management practices that reduce the intensity of spruce budworm and beetle outbreaks (e.g., shorter rotations, salvage harvests, pesticide application) can have especially dramatic impacts on species that rely on these insects for food (e.g., Cape May and Bay-breasted warblers, Evening Grosbeak, woodpeckers). Shorter rotations will also reduce the amount of mature forest available on the landscape, and thus the habitat available to birds that need later seral stages. Even if mature spruce-fir is not cut, isolated patches resulting from extensive harvesting may be too small to sustain long-term populations and too isolated from other patches to allow for immigration of loss-mobile species such as Spruce Grouse.

Acid deposition and climate change affect this habitat by altering the local environment and creating conditions that may be detrimental to certain plant species. For instance, spruces at higher elevations are more susceptible to acid deposition, and when these die back they are replaced by fir. Acid deposition may also result in reduced calcium availability, and this indirectly affects avian reproductive success. With respect to climate change, a warmer and/or drier climate in New Hampshire may limit the ability of "northern" species to compete favorably with hardwoods and pines, resulting in a gradual shift of spruce-fir habitats upslope or to the north. To the extent that spruce-fir specialist birds follow migrating habitats, they risk being forced into smaller and smaller areas of the state (and of their ranges as a whole). Development pressure, including wind power installations at high elevation, is increasing in spruce-fir habitat, although the immediate threat is still perceived as significantly lower than in hardwood/mixed forests.

Of the 42 species that occur regularly in spruce-fir habitats, one third (Tables 1 and 2, Figure 2b) are clearly in decline, and trends for another seven are uncertain. The group of declining species includes several that are recognized as conservation priorities at multiple scales: Olive-sided Flycatcher, Bicknell's Thrush, Bay-breasted and Canada Warblers, and Rusty Blackbird. These species, along with other declining spruce-fir specialists (American Three-toed Woodpecker; Boreal Chickadee; Ruby-crowned Kinglet; and Tennessee, Cape May, and Blackpoll Warblers) should guide future conservation efforts directed toward the birds of this habitat. For many species the causes of decline are still unknown (e.g., Rusty Blackbird, Purple Finch, Canada Warbler, Olive-sided Flycatcher), and may include factors operating outside the breeding grounds. Winter ground habitat loss is a limiting factor for Bicknell's Thrush, and habitat shifts in response to climate change may ultimately affect this species on the breeding grounds as well. Several species of warblers (Tennessee, Cape May, and Bay-breasted) and possibly the Boreal Chickadee, have declined as a result of the suppression of budworm cycles, as already discussed above. In the absence of more detailed data on limiting factors, conservation measures in this habitat should focus on maintaining adequate areas of spruce-fir forest, with a special emphasis on encouraging or maintaining older forests that would support natural insect

cycles and a disturbance regime that promotes uneven age forests with high structural heterogeneity. With respect to lowland spruce-fir, this goal is most attainable on the large protected areas of Coos County (e.g., Connecticut Lakes Natural Area, Second College Grant, Umbagog and Pondicherry NWRs, and Nash Stream SF) where uniform management can be implemented. Many of these declining species are poorly monitored, and standardized programs need to be developed that both refine our understanding of population trends and identify potential factors behind the declines. At the same time, further research is needed to learn more about limiting factors for several species, especially those of wetland habitats and/or which winter in South America.

It is worth noting that many of the spruce-fir birds with stable population trends are typical of early seral stages in this habitat (e.g., Magnolia Warbler and Lincoln's Sparrow). This suggests that there is currently enough early successional habitat being generated in northern New Hampshire to sustain these species. Their long term trends should continue to be tracked, especially if trends toward reduced logging continue or rotations are lengthened significantly as proposed above. Of the increasing spruce-fir species, the majority are not specialists, and several (e.g., Merlin and Palm Warbler) are actually expanding their ranges southward across a large portion of the Northeast.

#### Hardwood and Mixed Forests

This habitat grouping occurs throughout the state, and includes all the other forest types identified in the New Hampshire WAP: Appalachian oak-pine, hemlock-hardwood-conifer, northern hardwood-conifer, and floodplain forests. No bird species in New Hampshire are restricted to only one or two of these habitats, and as a result all will be considered together in any analysis related to forested habitats other than those dominated by spruce and/or fir. Some species with particularly wide habitat breadth are included in both this and the spruce-fir category. Not included here are widespread species typical of early successional stages, even if these occasionally use open canopy shrubby forests (e.g., Eastern Towhee) or small regenerating clear-cuts within a forest matrix (e.g., Chestnut-sided Warbler). All such species are treated in the shrubland category.

By far the most significant threat facing this habitat group is development, which results in both direct loss and fragmentation. Accompanying development but currently either rare or poorly documented in New Hampshire are the increased possibilities of invasive species or forest pathogens that alter the composition of the forest. To a large extent, the indirect effects of such pathogens on birds have not been studied in depth. Predators associated with human-dominated landscapes (e.g., raccoons, domestic cats) and brood parasites (Brown-headed Cowbird) are also more likely to impact forest birds in fragmented landscapes. There is increasing evidence that calcium depletion from forest soils – itself a side effect of acid deposition – has significant effects on avian reproductive success, and thus on overall population trends.

More birds use this habitat than any other in the state (Tables 1 and 3), and their population trends are evenly split between increasing and decreasing species (Figure 2c). Declining species in this habitat group include several that are more typical of mid-successional stages or edges (e.g., Ruffed Grouse, Whip-poor-will, Least Flycatcher, Wood Thrush, American

Redstart, White-throated Sparrow). Declines in such species are primarily a result of a statewide trend toward more mature deciduous forests and less frequent natural disturbance (see below), which in combination have reduced the amount of seedling or sapling size trees both in forest understories and as distinct patches. Some of these mid-successional species (e.g., Wood Thrush), plus others typical of mature forest (e.g., Scarlet Tanager), are known to be area sensitive, and declines are likely influenced in part by the increasing fragmentation of New Hampshire's forests. For several other birds the reasons for declines are poorly understood, but potentially include winter ground factors (Chimney Swift and Canada Warbler), loss of nest sites (Chimney Swift and Northern Flicker), and climate change (Purple Finch). Conservation of hardwood forest birds at the statewide scale should focus on preservation of unfragmented blocks in combination with, when appropriate, active forest management intended to create conditions suitable for early and mid-successional species. More detail on birds typical of shrub-dominated habitats will be presented in the shrubland section. Finally, note that the majority of declining species are long-distance migrants that spend the winter in Latin America or the Caribbean. An overview of limiting factors that affect birds outside of the breeding season is included at the end of the habitat summaries.

The majority of increasing species are those that regularly occupy habitats near human habitation, often benefiting from supplemental feeding (e.g., Black-capped Chickadee and White-breasted Nuthatch). Included in this group are several species that have expanded their ranges into New Hampshire in the last 30 years (e.g., Red-bellied Woodpecker and Tufted Titmouse). At the same time at least one such human commensal – the Northern Mockingbird – has actually been declining since the mid-1980s. Other increasing species have benefited from deliberate reintroduction programs (Wild Turkey), gains in overall forest cover (Pileated Woodpecker), or adaptation to forests in developed landscapes (Cooper's Hawk, Common Raven, and Pine Warbler).

### Forest Bird Nesting Guilds

Because two of the indicator groups in the NE Framework are related to nesting guilds, all species were assigned to one of four nesting groups: bole nesters, canopy/subcanopy nesters, shrub nesters, and ground nesters. Tables 4-6 provide the trend data for species in all these groups except shrub-nesters, of which there are only a handful of species. Overview of bole, canopy, and ground nesting forest birds are presented below.

Twenty-five of the state's breeding species are obligate cavity nesters, with a 26<sup>th</sup> – the Brown Creeper – always associated with the boles of larger trees. Of these, 23 are associated with forests and forest edges. They are generally considered as indicators of forest condition because many require large, dead, and/or dying trees in which to excavate their nest cavities (or in the case of secondary cavity nesters, use holes created by other species). If suitable nest trees are rare in a habitat, bole nesting species should decline because their populations are limited by the availability of nest sites. Forestry practices such as clear cutting, short rotations, and selective removal of diseased trees all have the potential to reduce nest site availability for these species.

The population data for this guild are unclear (Tables 1 and 4, Figure 2d). Some species are increasing, fewer are declining, and for many (e.g., waterfowl and owls) there are too few

data to indicate a trend. From this it would appear that species are responding to changes in forest composition in very different ways. The only species that are significantly declining are the Chimney Swift, Northern Flicker, and Boreal Chickadee, which share few other ecological attributes and whose declines are probably better explained by other factors. In contrast, the increasing species are often associated with human habitation (e.g., Red-bellied Woodpecker, Tufted Titmouse, White-breasted Nuthatch) or have benefited from targeted management programs (Wood Duck).

Birds that nest in the forest canopy or subcanopy are also typical of mature forests with high structural heterogeneity. Included in this group are a few species of birds (e.g., Wood Thrush and Rose-breasted Grosbeak) that could also be considered shrub nesters, but which are included in this category because they tend to use large saplings rather than dense shrubs. Many canopy nesters are also known to be area sensitive as described above. The population data for this nesting guild show slightly more species decreasing than increasing (Tables 1 and 5, Figure 2e). Because these declining species have very different life histories, from budworm specialists of spruce-fir (e.g. Bay-breasted Warbler), to mid-successional understory birds (e.g., Least Flycatcher), to resident species that tolerate human disturbance (e.g. Blue Jay), it is hard to ascribe an underlying cause to the general decline. Increasing species often share some of the same life history traits as declining ones, making generalization even more difficult. However, several are species that have adapted to areas near human habitation (e.g., Cooper's Hawk and Fish Crow), suggesting that the guild as a whole may be something of an artificial construct as currently defined. In more natural forested settings, forestry practices that allow for a diversity of vertical structure will likely enhance habitat for this group of birds.

Although ground-nesting forest birds were not listed as an indicator in the NE Framework, they are included here because their trends are the most unequivocal of any nesting guild. Slightly more than half are clearly in decline (Tables 1 and 6, Figure 2f), and even some of those with stable or uncertain populations are either showing declines elsewhere in their ranges or remain of high conservation concern (e.g., Yellow-bellied Flycatcher and Ovenbird). Among the potential threats to ground-nesting birds are increased nest predation from mammalian predators, a risk that may be exacerbated near human habitation. The majority of declining species are also long-distance migrants, so once again it remains important to consider factors that operate during the non-breeding season.

### *Birds of Early Successional Habitats*

Broadly defined, these are terrestrial habitats that are maintained to some degree by periodic disturbance, making it difficult for trees to establish themselves. It is generally acknowledged that such habitats were less widespread in New Hampshire prior to European colonization of North America, at which point 90-97% of New England was covered in forest (Lorimer and White 2003). At this time, early successional habitats were maintained by a combination of fire, Native American agriculture, flooding (including by beavers), and extreme weather events (e.g., hurricanes, ice storms, etc.). Because these disturbances were often localized in space and/or widely spaced in time, there were likely few areas that remained in an

early successional state for extended periods. As a result, many species currently associated with these seral stages were probably uncommon or even rare in most of New England.

Large areas of New Hampshire were cleared for farming by the mid-1800s following the introduction of more intensive agriculture, and especially livestock husbandry. At the agricultural peak, forest cover in the region dropped below 50%. Concomitant with the decline in forest cover, several species of wildlife more typical of open or edge habitats are believed to have colonized the state (e.g., grassland birds) or increased in local abundance (e.g., birds of shrub-dominated habitats). Following a shift of agricultural production to the American Midwest, New Hampshire farms were abandoned beginning in the late 1800s, and formerly open areas gradually began to revert to forest. By the close of the 20<sup>th</sup> century, the state was once again mostly forested (~85%), and grasslands and shrublands occupied less than 10% of the land area. Although forest is once again dominant, the mix of early successional habitats is likely different than during pre-colonial times, with more large grasslands in river valleys and coastal areas, extensive linear shrublands associated with power lines, and a significant reduction of pine barrens and similar fire-adapted habitats.

As grasslands and shrublands declined over the past century, so have the populations of birds that rely on these habitats. It is important to examine these population declines in the context of historic changes in land use. Many early successional species might be best considered as recent colonists that benefitted from a temporary increase in habitat. Their declines thus reflect a return to “natural” habitat conditions. As current members of the state’s avifauna, these species should still receive the benefit of conservation activity, but conservation objectives must recognize to some extent the history of shifting habitats on the New Hampshire landscape. In this context, a more targeted approach to conserving early successional birds is warranted, one that considers both *where* early successional habitat is best conserved and *how* it is maintained. For example, efforts to conserve grassland birds may need to prioritize the largest habitat parcels, and research is needed into the contributions of power line rights-of-way to regional populations of shrubland birds.

### Shrubland Habitats

This habitat grouping includes two WAP habitats that are both characterized by an extensive shrub layer and an open or absent canopy: anthropogenic shrublands and pine barrens. The latter is included here because most of the pine barrens’ bird species of greatest conservation need are more typical of shrub-dominated than tree dominated habitats (e.g., Eastern Towhee and Prairie Warbler). Pine barrens species that use primarily forest (e.g., Hermit Thrush and Pine Warbler) are treated in the hardwood-mixed forest category. In general, species considered shrubland birds are those that require relatively large areas of shrub-dominated habitat and which are widespread across the state. Not included are those found primarily in spruce-fir regeneration (see above), shrubby wetlands, or edge habitats associated with commercial or residential development (see developed habitats, below), but in some cases the latter distinction was difficult to make and a species was included in multiple categories. Representative examples of shrub-scrub habitats in New Hampshire include power line rights-of-way, shrubby old fields, wildlife openings, and pine barrens.

As habitats that are maintained by disturbance, shrublands are most at risk from altered disturbance regimes, irrespective of whether a given disturbance is natural or anthropogenic. In pine barrens, fire suppression has resulted in a gradual maturation of forest to the extent that natural heterogeneity has been reduced. Many other former shrublands are simply reverting to forests in the absence of active management. As for most other habitats, shrublands are being lost to development, perhaps at relatively high rates because they tend to lack the aesthetic values of forested and grassland habitats.

Far more species of shrubland birds are declining than increasing (Tables 1 and 7, Figure 2g). The reasons for these declines should be clear from the preceding paragraphs. It is important to consider the possibility that many of these species are “simply” declining to population levels more typical of pre-settlement conditions (Dettmers 2003), implying that populations increased “artificially” in response to extensive forest clearing for agriculture and timber through at least the middle of the 20<sup>th</sup> Century. Under this hypothesis, these species are less at risk because they are adapted to a shifting mosaic of suitable habitat generated by natural and usually small-scale disturbance. However, present patterns of land use have reduced the frequency and size of such disturbances, meaning that suitable habitat – and thus bird populations – will continue to decline. The important question becomes one of determining what population levels are appropriate to maintain these species in New Hampshire and the region as a whole (e.g. Dettmers 2003). Answers to this question can then guide the implementation of habitat management at an intensity and scale that benefits shrub-scrub species while not eliminating habitat for species that need intact forest. Little is known about the overall suitability of some anthropogenic shrublands (e.g., power line corridors) for shrub-scrub birds – all early-successional habitats may not be considered equal. The small number of increasing shrub-scrub birds includes primarily those that are able to use shrubby areas in developed landscapes (e.g., Northern Cardinal and American Goldfinch).

### Anthropogenic Grasslands

For the purposes of the New Hampshire WAP, extensive grasslands were defined as agricultural lands, large non-agricultural grasslands (e.g., airports), and adjacent disturbed areas with a combined area of at least 10 hectares (25 acres). As defined, this habitat includes extensive areas of agricultural lands that are not dominated by perennial grasses (e.g., cornfields, row crops) and thus rarely if ever used by breeding grassland birds. Significant non-agricultural grasslands include airfields, capped landfills, and reclaimed gravel pits. All grasslands must be maintained by mowing, grazing, or burning to prevent their reverting to shrublands or ultimately forests. The suite of birds requiring grasslands is well-defined, and includes several non-breeding visitors in addition to the breeding species that are the focus of this overview. Also included here are some species that do not actually nest in grasslands but which use them extensively for foraging (e.g., American Kestrel and Brown-headed Cowbird).

The primary immediate threat to grassland birds is direct mortality (nests and young, rarely adults) associated with regular mowing, whether for agriculture (hay cropping) or airfield maintenance. Mowing may also make otherwise acceptable habitat less suitable because of a loss of appropriate structure or plant species composition. At the same time, mowing can enhance habitat for certain species (e.g., foraging areas for Upland Sandpiper) and obviously serves to

prevent the encroachment of woody plants. In addition, as agriculture continues to decline in New Hampshire, many former grasslands are being developed, converted to uses less suitable for nesting birds (e.g., corn and recreational fields), or simply allowed to mature into shrubland and eventually forest.

As was the case for shrubland birds, the majority of grassland birds are declining in New Hampshire (Tables 1 and 8, Figure 2h). Most of these are the typical ground nesting species subject to mowing related mortality. These same species are often area-sensitive, meaning that they do not occupy fields below a certain minimum size. Grassland birds present something of a conservation conundrum in that they – more than any other group – are relatively recent additions to the state’s avifauna. Although debate on the historic presence of grassland in the Northeast continues, it is clear that its associated bird species increased dramatically in range and abundance following extensive forest clearing in the 1800s. This is especially true for New Hampshire, where grasslands were likely limited to smaller and more scattered sites resulting from flooding (including by beavers), fire, and Native American activity (Foster and Motzkin 2003, Askins et al. 2007). As such, current grassland bird declines can be considered an artifact of “artificially high” baseline levels, as previously discussed for shrubland species. In this context, efforts to conserve grassland birds need to be targeted at those landscapes where the long-term presence of extensive habitat is more likely, rather than scattered across a number of smaller more isolated fields. At the same time, it is acknowledged that smaller areas – if properly managed – can continue to provide habitat for species with smaller area requirements. A Grassland Bird Conservation Plan is being drafted that identifies priority “grassland focal areas,” with the intent that these guide future conservation of grasslands through habitat management agreements, land protection efforts, and federal cost share programs. To the extent possible, management agreements should be pursued with airports that support significant populations of grassland birds. Educational efforts for landowners managing small fields appear to be successful at maintaining habitat for grassland birds that are not area sensitive (e.g. Bobolink and Savannah Sparrow).

Several other species use grasslands for foraging, but do not actually nest in the habitat. Some of these are largely restricted to grassland habitats (e.g., American Kestrel) or historically occurred primarily in grasslands (e.g., Brown-headed Cowbird). These species are included in the analysis for this habitat. Two species are cavity nesters (American Kestrel and Eastern Bluebird), and their populations may be affected in part by nest-site availability. This relationship is demonstrated by the Eastern Bluebird. This is the only grassland-associated species that is increasing, almost certainly a result of the proliferation of nest boxes across its range. The ongoing decline of American Kestrels in the Northeast is a matter of much speculation, and in addition to nest sites, other limiting factors may include pesticides or interactions with other raptors (e.g., predation by increasing Cooper’s Hawk populations). Several other species that frequently use grasslands or agricultural areas are not considered “typical” grassland birds and thus not considered in this habitat summary. Examples include some swallows (treated in the “Aerial Insectivores” category) and forest edge birds such as the Northern Flicker.

## *Birds of Wetlands and Aquatic Habitats*

This group includes a wide range of habitats that share the common feature of proximity to fresh water. It includes one habitat from the WAP (marsh and shrub wetlands) and two that were created solely for this summary (riparian edge, lakes and rivers). The latter two differ from true wetlands in that they tend to have a “hard edge,” in which woody vegetation abruptly ends at the shoreline and there are few if any emergent plants. Included in the “lakes and rivers” habitat are several large fish-eating birds that nest and/or forage in such systems.

### Marsh and Shrub Wetlands

This habitat type includes a wide range of plant communities sharing the common features of persistent standing water and emergent vegetation. The two broad types are dominated by either shrubs or sedges, grasses, and other graminoid plants (i.e., marshes), although these regularly intergrade with each other. Shrubby wetlands also intergrade with floodplain forests, especially those dominated by red maple. Wetland birds similarly fall into two types, with typical “marshbirds” occupying cattail and sedge wetlands (with some use of shrub wetlands) and several passerines restricted to shrub wetlands or their edges (e.g., Alder Flycatcher and Yellow Warbler). It is sometimes useful to consider these bird groups separately, and this will be done as appropriate in the summary that follows. A third broad category of wetlands, peatlands, rarely supports unique bird species. Peatland birds have either been included in the spruce-fir forest discussion, or also use marsh or shrub wetlands and are discussed in the context of those habitats.

Threats to wetlands include losses associated with filling and altered hydrology. In developing areas of the state, expansion of residential areas and road networks continues to eliminate or fragment smaller wetlands, although larger ones are generally less at risk through a combination of their sheer size and wetlands regulations. Even if wetlands are not lost to development, undersized culverts may restrict water flow to the extent that wetlands shrink in size or become flooded, in both cases reducing their suitability to certain birds. Another threat to wetlands is invasive plants, although the effects of invasives on bird populations in New England remain poorly documented. The effects of pesticides used to control mosquitoes or invasive plants have largely unknown effects on birds, their prey, and habitat structure. In all cases, development or degradation of adjacent uplands may negatively affect wetland habitats through siltation or agricultural run-off (e.g., pesticides and fertilizers)

Seven wetland birds are showing significant population declines (Tables 1 and 9, Figure 2i), and these include species with a broad range of habitat needs. Declining species include those that use emergent marshes (e.g., Marsh Wren and Common Moorhen), shrubby wetlands (e.g., Yellow Warbler and Rusty Blackbird), and beaver ponds with standing trees (e.g., Olive-sided Flycatcher). At the same time, there are also species in these same habitats that have either increasing or stable populations: American Bittern and Virginia Rail in marshes, Alder Flycatcher and Swamp Sparrow in shrubby wetlands, and Great Blue Heron and Osprey in wetlands with standing trees. As a result, it is difficult to apply blanket statements to birds of this habitat group, and the diversity of trends within a sub-habitat may reflect natural variation in populations, non-habitat factors (e.g., pesticides), and/or the effects of factors operating during



the non-breeding season. Clear cases where increases can be explained include the Osprey, which has benefited from active management and the elimination of DDT from food webs, and the Canada Goose, which has similarly benefited from management and early deliberate introductions. Accurate trend data are not available for the majority of wetland birds, and a critical conservation need is a more rigorous system for monitoring their populations.

### Riparian Edge

The New Hampshire WAP did not classify aquatic systems based on habitat features, but rather grouped them by watershed characteristics. This habitat and the one that follows are derived categories that do not correspond to any particular habitat in the WAP. Instead, they are intended to reflect sets of habitat conditions that are both clearly identifiable on the landscape and which often support species of birds that do not fit well into the other habitats discussed in this report.

Riparian edges are essentially the interfaces between forest and open water. They are typically dominated by trees, and often occur in narrow bands between a river or lake and non forested habitat (e.g., fields or development). Along rivers and streams in particular, erosion may result in vertical sandy or rocky banks. The birds in this habitat include a mix of species that nest in overhanging trees or shrubs (e.g., Eastern Kingbird and Warbling Vireo), holes in banks (e.g., Belted Kingfisher and Bank Swallow), or the ground (e.g., Spotted Sandpiper, Table 10). As a group, these birds are probably affected by a variety of factors specific to their nesting or foraging needs, although all are likely impacted by alteration of riparian buffers. Rivers and lakeshores have been subject to human habitation longer than most other habitats in New Hampshire, and continued development pressure may be partially responsible for declines in the species that use these habitats (Tables 1 and 10, Figure 2j). In addition, it is possible that they are responding to non-habitat threats – such as pesticide application – that may disproportionately affect riparian habitats.

### Lakes and Rivers

This group includes a very disparate mix of species (Table 11), from large piscivorous eagles and loons, to smaller piscivores like kingfishers, to the Common Mergansers breeding along our larger rivers and the Spotted Sandpipers that forage along them. All share some affinity for large water bodies, and there is some overlap with the preceding category. In many cases, as with the preceding habitat, species with different foraging or nesting behaviors may need to be considered independently when assessing threats and population trends.

Unlike the habitats discussed earlier, actual loss is not a significant risk for lakes and rivers. Birds using these habitats often face threats related to contaminants and human disturbance. Many of the focal birds of lakes and rivers are top predators and as a result are known to accumulate toxins in their tissues, often with adverse physiological effects. Although DDT is no longer an issue for these species, they face threats from mercury, lead, flame-retardants, and likely other chemicals yet to be “discovered.” Lake front development impacts water quality, increases bacteria levels, and effects prey availability. Because human recreational use is often high on lakes and rivers, many species that nest in such habitats risk being disturbed

to the extent that they abandon nests. This risk is proportional to the accessibility and overall level of development around a particular water body. In some case, excessive development will actually eliminate nest or roost sites for species such as loons and eagles. Most of the large piscivorous birds that use this habitat have been the beneficiaries of a long history of targeted management, as reflected in the large number of species with increasing populations (Tables 1 and 10, Figure 2k). Foremost in this group are the Common Loon, Osprey, and Bald Eagle, all of which have recovered dramatically from previous declines.

### *Birds of Coastal Habitats*

New Hampshire's small coastline contains three habitats not found elsewhere in the state: salt marsh, dunes, and coastal islands. These are considered as a group in this overview because they support a relatively small number of breeding species. Salt marsh is the most extensive of the three, and is also found inland along Great Bay, its tributary rivers, and upstream along the Salmon Falls River. Dunes are only found in Seabrook and Hampton. The third habitat – coastal islands – is broadly defined, and includes both the Isles of Shoals and islands in Great Bay and Portsmouth Harbor. Most of these islands are rocky and poorly vegetated.

Threats to coastal habitats vary extensively depending on the habitat involved. Salt marshes are largely protected from development, but have been impacted by past ditching and tidal restrictions, which often facilitate invasion by non-native plant species. As was the case for terrestrial wetlands, they may also be affected indirectly through alterations of the adjacent uplands. Many salt marsh species also show elevated levels of mercury, with yet unknown effects on reproductive success. Most of the state's dunes have been lost to development, and the small area that remains is subject to intensive human use that makes it difficult for beach-nesting birds to successfully reproduce without direct human intervention. Birds nesting on coastal islands, particularly those in Great Bay or Portsmouth Harbor, may be easily disturbed by people landing on those islands for recreational purposes. All three habitats are at risk from sea level rise resulting from climate change, a threat compounded by adjacent development that precludes their ability to migrate inland. Finally, predation is a significant risk, particularly for species of dunes and islands. Predators include a mix of human commensals (e.g., feral cats) and those that have shown increases in response to human activity (e.g., raccoons and gulls). Islands close to the mainland suffer from predation at nearly unsustainable levels for nesting terns. In most cases, ongoing predator control measures are required to maintain populations of terns and plovers. For piscivorous coastal species such as terns, a final potential threat relates to the impacts of fisheries policies on prey populations.

With the exception of closely-monitored species such as terns (Arctic, Common, and Roseate) and Piping Plovers, there are few data with which to evaluate population trends for coastal birds (Tables 1 and 12, Figure 2l). Terns and plovers have shown either stable or slightly increasing populations largely because of intensive management including predator exclusion/removal, habitat alteration, and restriction of human access. Without such interventions, none of those species would breed in New Hampshire at current population levels. At the other extreme, there are currently no long-term monitoring programs available for salt marsh birds such as Willets and *Ammodramus* sparrows, either at a state or regional scale. It is

generally assumed that they have declined as habitat extent and quality have declined, but there are few if any hard data on historical populations. Willets expanded their range northward in New England during the late 20<sup>th</sup> century, perhaps recolonizing their historic range after declines associated with market hunting, but limited habitat probably prevents continued increases along the New Hampshire coast.

### *Birds of Developed Landscapes (Urban/suburban)*

This last habitat type is *not* included in the WAP, but by some measures occupies 2% of the land area of New Hampshire. It includes a broad set of conditions ranging from urban centers to low density residential developments where natural cover rarely occupies more than half the available space. These moderate-to-heavily developed areas are nonetheless home to several species of birds that are rarely found in the other habitats outlined above, or that reach their highest densities in areas near human habitation. Many of the species in this group are showing similar population trends. For the purposes of this summary, urban/suburban habitats are those where native vegetation occupies roughly half or less of the available area, although this is not a fixed threshold. By this definition, some low-density housing developments may be better considered as forest habitat, although many of the urban/suburban bird species will still be common. Birds in this habitat category are of two broad types. The first are the human commensals that rarely if ever occur far from developed areas in New Hampshire (e.g., European Starling, Carolina Wren, and Northern Cardinal), while the second includes species that occur more broadly across the landscape but which have also adapted to developed areas with suitable habitat conditions (e.g., Peregrine Falcon, Pine Warbler, and American Robin).

No threat analysis was completed in the WAP for this habitat or the birds that it supports (exceptions include Peregrine Falcon and Common Nighthawk). Given that most of the birds that use developed areas are by definition tolerant of often extensive habitat alteration, direct loss of habitat is not likely a significant factor. Many birds in urban or residential areas may be at risk from increased predator populations in the form of domestic cats and birds such as crows, and it is possible that contaminant levels may be higher in such environments. Otherwise, threats to this suite of birds are often species specific, such as changes to rooftop construction that may be behind declining populations of Common Nighthawks.

As was the case for wetland and coastal species, there are few clear patterns in the mix of positive and negative trends for urban/suburban birds (Tables 1 and 13, Figure 2m). A large number of the increasing species are either those showing northward range expansion and/or which are well adapted to living near human habitation (e.g., most common “feeder birds”). Those that are declining tend to be species for which the developed landscape represents the edge of their habitat (e.g., many shrub-scrub birds), in which case the declines are less related to urban conditions than to larger scale population processes. Also declining are some of the non-native species that were introduced into the Northeast at various times in the past. There are a few species for which trends can be explained with species-specific hypotheses, as discussed in the following paragraph.

Peregrine Falcons began using urban nest sites (bridges and buildings) in the 1990s, not long after populations began to recover in the Northeast. Such sites provide a reliable source of prey and appear equally suitable to natural sites, with perhaps less stress from weather, predators, and human disturbance. As a result it is reasonable to assume that falcons will continue to occupy such sites, and occupy new ones as populations increase. Increasing Cooper's Hawk populations may reflect both a recovery from DDT-related declines and this species' adaptation to feeding and nesting in more developed landscapes. At the other extreme, the near disappearance of Common Nighthawks from urban areas may be the result of changes in rooftop construction, although other hypotheses (e.g., events on the wintering grounds) remain to be tested. Conditions and events during migration and wintering may similarly play a role in declines of Chimney Swifts and several swallow species that often nest near human habitation, although again the causes of these declines remain poorly understood. Among the non-native species, recent declines in House Finch populations are tied to an outbreak of avian conjunctivitis in the mid-1990s, and the possibility of disease as a limiting factor for other species should not be discounted.

### *Other Habitats*

The above habitat classification captures the majority of bird habitats in New Hampshire. Among the remaining WAP habitats that are used by birds, three deserve brief mention. These are cliffs, rocky ridge/talus slopes, and alpine, and each will be discussed briefly in the following paragraph. There is no summary of population trends for these species, although all but American Pipit have been referenced under a previous habitat summary.

The primary cliff-nesting birds in the state are the Peregrine Falcon and Common Raven. After being extirpated in the eastern United States as a result of DDT, the Peregrine Falcon benefited considerably from dedicated management beginning in the 1980s. The main remaining threats to Peregrine Falcons are recreational climbing, which is currently carefully managed to benefit the species, and the largely unknown effects of chemical contaminants such as mercury and flame retardants. Falcons have also adapted to nesting in urban areas, as discussed in the previous section. Although Common Ravens were essentially extirpated from the state by the early 1900s, the species expanded its range southward during the late 20<sup>th</sup> Century, and now regularly uses non-cliff nesting sites such as trees and structures. While Golden Eagles historically nested on cliffs in northern New England, they are currently absent from New Hampshire's breeding avifauna. The only bird associated with rocky ridges is the Common Nighthawk, a species that is also treated in shrubland and developed habitats, and aerial insectivore categories. Nighthawks have recently been documented nesting on a least two ridges in the western part of New Hampshire, where the predominant risk is likely to be the yet unknown impacts of wind power development and recreational activity. Otherwise, the species is probably more likely to be impacted by threats related to its food supply or on its wintering grounds. Finally, there are two species associated with the limited alpine habitat at the highest peaks in the White Mountains. One of these, the Dark-eyed Junco, is a spruce-fir species that "overflows" this habitat at its upper elevation limit. The state's only true alpine species is the American Pipit, which maintains a small population of 10-15 pairs at the top of Mount

Washington. This habitat and population are most threatened by climate change, which has the potential to eliminate alpine areas entirely from the state.

### *Aerial Insectivores*

Aerial insectivores are broadly defined as those species that eat primarily insects captured in flight. The group includes two sub-guilds: species that forage continuously on the wing (hawkers) and those that fly out from a perch, capture a prey item, and return to a perch (salliers). Although not members of a habitat group *per se*, increasing concern over population declines of these species warrants a discussion in this document. Birds in this foraging guild occupy a wide range of habitats, from urban areas to wetlands to farmland to mature forests. Examination of the guild as a group provides an alternative approach to summarizing bird conservation issues, since it needs to be acknowledged that habitat-level factors may not be the only things influencing population trends.

Irrespective of sub-guild, the majority of aerial insectivores are in decline (Tables 1 and 14, Figure 2n). If there is one characteristic that applies to most of these declining species, it is the fact that they winter in South America (8 of 11 species). Five of these eight, plus the possibly-declining Purple Martin, belong to the sub-guild that feeds on the wing, often in open areas. Although the winter ecology of these species is poorly known, there is speculation that they may be susceptible to the effects of pesticides used in South American agricultural areas. There is evidence for this hypothesis in the documented mass die-off of Swainson's Hawks resulting from the insecticide monocrotophos in Argentina. Given that the aerial insectivores under consideration are all significantly smaller than the Swainson's Hawk, detection of such die-offs is more difficult. However, this hypothesis cannot explain all declines in species that winter in South America. For example, Eastern Kingbirds feed primarily on fruit in the forest canopy during the non-breeding season, making them far less likely to be affected by agricultural pesticides. Nonetheless, declines in species with highly variable breeding ecology (swifts, nighthawks, swallows) that otherwise share a wintering area may be best explained by events occurring away from New Hampshire. And as a result, it remains important to consider the entire annual cycle when proposing conservation strategies for any migratory bird of conservation concern. At the same time, increased pesticide use on the breeding grounds, or disruption of prey cycles resulting from climate change, could also reduce reproductive success in New Hampshire.

### *Non-habitat Threats*

In addition to the threats and strategies discussed above, which are often specific to a subset of habitats or foraging guilds, there are several other threats that potentially operate broadly across habitat lines. Although the population level effects of these threats are often poorly known, they are summarized briefly here so as to provide a more complete picture of the range of factors one needs to consider when considering conservation actions.

The potential effects on diseases on bird populations vary considerably. In some cases, particularly when a pathogen is not native, they can cause significant mortality (e.g., West Nile

Virus and crow populations). The ability of bird populations to develop immunity to such diseases is an important factor to consider when evaluating the overall risks associated with this threat. Directly related to human attempts to control disease vectors is the increased pressure to use pesticides. Pesticides may have direct effects on birds (e.g., mortality), but can also disrupt food supplies for insectivorous species as mentioned in the previous section. Other activities that deplete food supplies (e.g., fisheries policy) also fall into this category.

At the broadest scale, several atmospheric perturbations can have indirect effects on bird populations. Acid deposition can leach calcium from forest soils, which in turn reduces the availability of calcium in prey items such as snails. The end result of such calcium depletion can be reduced reproductive success resulting from thin or poorly developed eggshells. This threat is more significant in habitats with poorly buffered soils. Birds in salt marsh and high elevation forests have been shown to have relatively high mercury levels, presumably because this toxic element is more easily methylated in such habitats, but at present the long-term impacts of high mercury levels are largely unknown. Finally, as alluded to several times previously, climate change has the potential to “decouple” the breeding seasons of birds from those of their prey, resulting in peak prey abundance occurring at a different time than peak food needs by nestling birds. At present the relative importance of this threat is poorly known, and it is obviously mitigated by the extent to which birds can also alter their breeding phenology.

### *Non-breeding Birds*

All the previous discussion has focused on the conditions faced by birds during the breeding season, but as pointed out in several sections it is important to acknowledge that many birds face threats during migration or winter. The Non-breeding Birds habitat profile in the New Hampshire WAP identifies habitat loss (including both stopover and winter habitat), poisoning, human disturbance, and migration mortality (e.g., towers, windows, and cats) as the primary threats facing birds during the non-breeding season. State-specific data on these threats and their effects within New Hampshire are limited, and as a result there will not be a detailed overview of non-breeding issues in the present version of the “State of New Hampshire’s Birds.” That said, it is important to present the broader migration themes as they are currently understood in the state and region.

There is considerable evidence that the populations of many shorebirds are declining in North America. These species face risks both at their high-latitude breeding and wintering areas and at critical stopover sites in between. In this global perspective, New Hampshire’s small coastline is likely less important to migrating shorebirds than higher use areas to the north and south, but a few species (e.g., Semipalmated Plover and Semipalmated Sandpiper) can reach regionally significant congregations. It is important to consider the role of the state’s primary stopover site – the Hampton-Seabrook Estuary – in facilitating the southbound migration of these species.

Passerine migrants tend to move in a broad front through New Hampshire in both spring and fall, with slight concentrations along major river valleys in spring and along the coast in fall. Although the effects of invasive plants, climate change, and ridgeline wind power development

on migrating songbirds are largely unknown at present, these represent potential stresses in the form of either direct mortality or reduced survival. Even less clear are the conservation strategies that would best mitigate these threats. Studies have shown that appropriate placement of wind turbines is important in mitigating potential mortality. Additional sources of anthropogenic mortality in migrating songbirds include predation by domestic cats and collisions with windows and other structures. The latter is often exacerbated by excessive or unnecessary lighting.

A habitat that is often overlooked in avian conservation assessments is the open ocean. Although New Hampshire has a small coastline, several species are only found in the state's offshore waters, most of which occur there primarily during their non-breeding seasons (e.g., sea ducks, shearwaters, and alcids). Activities that potentially affect birds in this habitat include fisheries, aquaculture, and offshore wind power development.

Not considered here, but still of critical importance (as evidenced by the discussion under Aerial Insectivores), are the multitude of stresses that affect birds during their period of residence on their wintering grounds (in contrast to during migration). There is a wealth of evidence that loss or alteration of wintering habitat can influence survival and the dynamics of breeding populations, and in some cases these effects are far more important than those operating on the breeding grounds. A clear example of this is Bicknell's Thrush, which breeds in the White Mountains and winters primarily on the Caribbean island of Hispaniola. Although the species faces threats associated with climate change and loss of high elevation spruce-fir habitat, extensive deforestation on Hispaniola is probably more directly tied to population declines observed in the Northeast. If such is the case, no amount of protection of breeding habitat will reverse the decline, and efforts should be directed toward conservation of the species' wintering habitat. As said earlier, proactive conservation of migratory species needs to consider the entire annual cycle, especially if the most important limiting factors are not operating where a particular species breeds.

## PART 2: CONSERVATION STRATEGIES FOR NEW HAMPSHIRE’S BIRDS

Two previous documents have summarized some of the conservation strategies proposed or needed for New Hampshire’s birds: 1) a set of monitoring priorities (Hunt 2007) and 2) a broad overview of strategies relating to birds (Hunt 2008). These earlier documents focused extensively on monitoring and research, sometimes to the neglect of habitat-based strategies. This report will focus on broad reaching strategies and consider habitat-based strategies in more detail. Where appropriate, the summary that follows will refer to species-specific strategies. Names and numeric codes for broad strategies follow those developed for the New Hampshire WAP, which should be consulted for more specifics on a given strategy.

The broad strategies with the greatest potential to benefit multiple bird species and their habitats have been grouped into the six “themes” below. Each theme begins with a synopsis of the types of strategies included in the theme, followed by a list of the strategies themselves. Note that not every strategy from the WAP is included here, since several have limited relevance to bird conservation. For example, strategy 104 refers to importation and possession of wildlife, which has not been identified as a threat for any of New Hampshire’s birds.

### **Improve and enhance our ability to monitor species of concern**

There is still a recognized need for new monitoring programs to fill significant gaps in our understanding of New Hampshire’s bird populations and/or the threats they face. Based on both this document and the earlier monitoring analysis (Hunt 2007), there are several groups of birds for which we have very limited data (particularly spruce-fir species, wetland birds, and colonial nesters), and such data are important if we wish to make informed conservation decisions in those habitats. Strategies included under this category include both baseline population monitoring and distributional surveys (e.g., colony mapping, breeding bird atlas).

There is also a need to centralize monitoring activity in such a way as to improve efficiencies. This can be achieved in several ways, including database development, coordinated bird monitoring, and development of regional indicators (e.g., the NE Framework). It is also increasingly important to create direct links between monitoring and the effects of management or other conservation actions, which may eventually modify how monitoring programs are currently implemented. Monitoring programs should also strive to communicate their results to the decision makers and conservation planners who are seeking to implement specific conservation actions.

[202] Maintain wildlife database

[408] Require monitoring to demonstrate success of mitigation

[901] Conduct surveys to describe distribution

[902] Detect changes in the condition of wildlife and habitat

[903] Monitor population trends for threatened and endangered species

[904] Measure direct effects of management

[906] Select an efficient set of indicators by habitat

[907] Report the condition of wildlife health by habitat



[1001] Evaluate the viability of wildlife populations

### **Maintain intact forests**

Given that New Hampshire remains a predominately forested state, it has an important role to play in regional conservation for several forest bird species, and conservation of forest habitats remains a priority. Key issues to address in forest conservation plans include fragmentation (primarily in the south) and maintenance of a diversity of seral stages (statewide). Preservation of intact forests can also benefit adjacent or imbedded habitats such as lakeshores and wetlands. There are numerous opportunities to enhance or protect forests through management, land use planning, and outright habitat protection.

- [205] Map potential wildlife corridors and buffers
- [302] Landowner education series
- [305] Promote sustainable forestry practices
- [306] Advise town conservation commissions and planning boards
- [503] Restore and maintain late-successional forests
- [505] Restore rare habitats and natural communities
- [604] Promote a sustainable development working group
- [606] Promote reactivation of the Forest Sustainability Work Team
- [701] Protect riparian/shoreland habitat and other wildlife corridors
- [702] Protect unfragmented blocks and other key habitats
- [801] Financial and technical assistance for habitat management and restoration
- [802] Financial incentives to maintain private land in open space
- [803] Financial incentives to promote sustainable forest practices
- [904] Measure direct effects of management
- [906] Select an efficient set of indicators by habitat
- [1301] Incorporate habitat conservation into local land use planning
- [1302] Advise conservation commissions and open space committees
- [1303] Promote role of Regional Planning Commissions in landscape-scale conservation

### **Prioritize early successional habitats**

Given that species of grassland and shrubland are more consistently declining than any other group of birds, it is clear that New Hampshire needs to address issues related to the availability and suitability of early successional habitats. At the same time, such efforts need to acknowledge the historical distribution and abundance of these species, and set clear spatial and/or population objectives. Given limited resources, it will also be important to coordinate conservation activity directed toward these habitats wherever possible, such as with current efforts to restore fire to pine barrens and conserve the New England Cottontail. Incorporating shrubland or grassland birds in such projects as they are implemented can go a long way towards creating the suite of habitat conditions that would benefit early successional birds in the long term.

- [302] Landowner education series
- [304] Revise and promote agricultural best management practices

- [501] Reclaim or maintain grassland and shrubland habitats
- [502] Generate early successional and young forest habitats
- [505] Restore rare habitats and natural communities
- [801] Financial and technical assistance for habitat management and restoration
- [802] Financial incentives to maintain private land in open space
- [904] Measure direct effects of management
- [906] Select an efficient set of indicators by habitat
- [1301] Incorporate habitat conservation into local land use planning
- [1302] Advise conservation commissions and open space committees

### **Protect sensitive habitats**

While forests, shrublands, and grasslands are clear examples of habitats where several broad strategies apply, it is important to remember that many smaller-scale habitats (e.g., wetlands, riparian corridors) are also used by bird species of concern. Such habitats may require very different approaches as a result of their landscape context, species composition, or local threats. While there are few specific strategies for these habitats, many are covered by the strategies listed below, and will need to be considered on a case-by-case basis. Included here are several strategies relating to direct human use of these habitats. Although human disturbance is also addressed directly in the next theme, these strategies are included here because they also address threats to habitat condition.

- [101] Revise protocols to review threatened and endangered wildlife habitat
- [103] Develop protocols for limiting activity in sensitive habitats
- [105] Minimize OHRV wildlife impacts
- [306] Advise town conservation commissions and planning boards
- [403] Develop guidelines to minimize impacts to endangered, threatened, and special concern species
- [405] Expand existing protection to include significant wildlife habitats that currently lack protection
- [504] Develop and implement an urban wildlife management plan
- [505] Restore rare habitats and natural communities
- [701] Protect riparian/shoreland habitat and other wildlife corridors
- [804] Safe Harbor agreements to protect habitat of threatened and endangered species
- [906] Select an efficient set of indicators by habitat
- [1301] Incorporate habitat conservation into local land use planning
- [1302] Advise conservation commissions and open space committees

### **Minimize human disturbance**

The effects of human activity on birds are varied, but can include disturbance that results in nest abandonment or compromised physiological condition. It is also possible that even passive recreation – such as along trails – can alter birds’ behavior with unknown demographic consequences. In addition, some forms of recreation (e.g., off-road vehicles) not only disturb birds but may also damage habitat (see above). Disturbance is probably a greater threat to coastal

birds and large raptors than to most other groups. Three WAP strategies cover the need to limit or otherwise mitigate the threats associated with human activity.

- [103] Develop protocols for limiting activity in sensitive habitats
- [105] Minimize OHRV wildlife impacts
- [306] Advise town conservation commissions and planning boards
- [307] Educate recreational users regarding threats to wildlife and natural communities
- [403] Develop guidelines to minimize impacts to endangered, threatened, and special concern species
- [504] Develop and implement an urban wildlife management plan
- [605] Recreation working group

### **Maintain a regional perspective**

In many cases, coordinating with regional efforts is the most effective way to achieve conservation success. Although any of the previous strategies can benefit from a regional perspective, there are several for which this is especially useful. Included here are research projects to investigate limiting factors or the effects of specific threats, policy initiatives with broad implications (e.g., air and water quality), and any activity related to conservation of most birds during the non-breeding season.

- [203] Assess threats to wildlife health
- [602] Incorporate reduced wildlife mercury levels as a priority endpoint for air and water quality assessments
- [1101] Develop and implement existing regional conservation plans
- [1102] Regional conservation planning for species and habitats at risk
- [1201] Prioritize research needs
- [1202] Facilitate funding of priority conservation research

### PART 3: BIRD CONSERVATION RESOURCES

This final section is primarily a list of the many documents or websites available that can provide additional information on bird population trends, conservation priorities, and conservation actions.

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### *Statewide Organizations*

#### New Hampshire Audubon ([www.nhaudubon.org](http://www.nhaudubon.org))

NH Audubon is the primary statewide non-governmental organization with a focus on wildlife. Its mission is “to protect New Hampshire’s environment for wildlife and people.” NH Audubon was instrumental in creating the State nongame and endangered species program in the 1980s, and has played a leading role in monitoring and management of avian species at risk since that time. NH Audubon works closely with N.H. Fish and Game in implementation of the Wildlife Action Plan, and coordinates the N.H. Important Bird Areas program ([www.nhbirdrecords.org/bird-conservation/IBA.htm](http://www.nhbirdrecords.org/bird-conservation/IBA.htm)). NH Audubon also maintains the *New Hampshire Bird Records* database (see below).

#### New Hampshire Fish and Game Department ([www.wildlife.state.nh.us/Wildlife/wildlife.htm](http://www.wildlife.state.nh.us/Wildlife/wildlife.htm))

The Department is charged with conserving all the wildlife in the state, including both game and “non-game” species. The Department created the N.H. Wildlife Action Plan in 2005 as a blueprint to guide wildlife conservation efforts over the following 10-15 years. The Plan is available at: [www.wildlife.state.nh.us/Wildlife/wildlife\\_plan.htm](http://www.wildlife.state.nh.us/Wildlife/wildlife_plan.htm).

#### University of New Hampshire Cooperative Extension ([extension.unh.edu/Wildlife/Wildlife.htm](http://extension.unh.edu/Wildlife/Wildlife.htm))

Extension serves a valuable role in providing outreach and technical assistance to landowners across the state. Statewide and county-based staff conducts workshops, produces informational brochures, coordinates the Coverts program, and delivers services through many other means.

### *Regional or Continental Initiatives*

#### North American Bird Conservation Initiative ([www.nabci-us.org/main2.html](http://www.nabci-us.org/main2.html))

NABCI focuses on implementation of all-bird conservation across Canada, the United States, and Mexico. It provides oversight on issues of continental significance, such as large-scale bird monitoring, and provides connections between game and non-game initiatives. The four main “bird initiatives,” each with a focus on a certain suite of species or habitats, are described briefly below. All these initiatives are collaborations among agencies and organizations with the overall goal of conserving birds and their habitats.

#### Partners in Flight ([www.partnersinflight.org](http://www.partnersinflight.org))

PIF assumes responsibility for conservation planning for “landbirds,” a broadly defined group that includes all species *other* than shorebirds, waterfowl, “waterbirds,” and resident game birds.

Shorebird Plan ([www.fws.gov/shorebirdplan](http://www.fws.gov/shorebirdplan))

[www.fws.gov/shorebirdplan/RegionalShorebird/downloads/NATLAN4.doc](http://www.fws.gov/shorebirdplan/RegionalShorebird/downloads/NATLAN4.doc)

The Shorebird Group works to conserve North American shorebird populations through a combination of research, monitoring, and conservation planning.

Waterbird Plan ([www.fws.gov/birds/waterbirds/MANEM](http://www.fws.gov/birds/waterbirds/MANEM))

Waterbirds are a broadly-defined group that includes both colonial waterbirds (e.g., herons and terns), non-passerine marshbirds (e.g., rails and bitterns), and other solitary species such as loons.

North American Waterfowl Management Plan: ([www.fws.gov/birdhabitat/NAWMP/index.shtm](http://www.fws.gov/birdhabitat/NAWMP/index.shtm))

This is the oldest of the bird initiatives, formed in 1986. As the name implies, it is primarily concerned with the conservation of ducks, geese, and swans.

Bird Conservation Regions (BCRs)

BCRs are large areas that share similarities in avifaunas, physiographic features, and dominant habitats, and were defined for most of North America by NABCI. They serve as units for larger scale conservation planning that involves multiple agencies and organizations, and ideally guide implementation of conservation strategies across state, provincial, or national lines. There are two BCRs in New Hampshire (Fig. 1): the Atlantic Northern Forest (BCR 14) encompasses most of the state, while New England/Mid-Atlantic Coast (BCR 30) includes roughly the portion of New Hampshire south and east of Concord. Summaries of priority species and actions for both BCRs are available at [www.nabci-us.org/bcr14.htm](http://www.nabci-us.org/bcr14.htm) (BCR 14) and [www.nabci-us.org/bcr30.htm](http://www.nabci-us.org/bcr30.htm) (BCR 30).

U.S. Fish and Wildlife Service ([www.fws.gov](http://www.fws.gov))

The federal agency with responsibility for the conservation of both game and non-game bird species.

Atlantic Coast Joint Venture ([www.acjv.org](http://www.acjv.org))

The mission of the ACJV is to provide a forum for federal, state, regional and local partners to coordinate and improve the effectiveness of bird conservation planning and implementation in the Atlantic Flyway region of the United States, which includes 16 states from Maine to Florida.

US State of the Birds ([www.stateofthebirds.org](http://www.stateofthebirds.org))

This 2009 report follows a similar framework to this New Hampshire summary, but on a national scale. It was produced by several agencies and NGO partners.

Northeast Coordinated Bird Monitoring ([www.nebirdmonitor.org](http://www.nebirdmonitor.org))

NECBM focuses on facilitating bird monitoring across USFWS Region 5 (13 states from Virginia to Maine, plus the District of Columbia) by bringing together NGOs and state/federal agencies to develop and implement rigorous monitoring protocols for species and habitats of concern.

*Projects focusing on specific species or habitat groups*

Boreal Songbird Initiative ([www.borealbirds.org/](http://www.borealbirds.org/))

American Woodcock Initiative ([timberdoodle.org/habitatInitiatives](http://timberdoodle.org/habitatInitiatives))

Mass Audubon: Grassland Birds ([www.massaudubon.org/Birds\\_and\\_Birding/grassland/](http://www.massaudubon.org/Birds_and_Birding/grassland/))

Audubon Vermont: Forest Bird Initiative ([vt.audubon.org/conservationNews.html](http://vt.audubon.org/conservationNews.html))

International Bicknell's Thrush Conservation Group ([www.bicknellsthrush.org/](http://www.bicknellsthrush.org/))

International Rusty Blackbird Technical Working Group

([nationalzoo.si.edu/ConservationAndScience/MigratoryBirds/Research/Rusty\\_Blackbird/twg.cfm](http://nationalzoo.si.edu/ConservationAndScience/MigratoryBirds/Research/Rusty_Blackbird/twg.cfm))

Chimney Swift Working Group (contact Rua Mordecai: [rua.mordecai@gmail.com](mailto:rua.mordecai@gmail.com))

Northeast Nightjar Working Group (contact Pamela Hunt: [phunt@nhaudubon.org](mailto:phunt@nhaudubon.org))

*Data Sources*

Breeding Bird Survey (BBS) ([www.mbr-pwrc.usgs.gov/bbs/bbs.html](http://www.mbr-pwrc.usgs.gov/bbs/bbs.html))

The BBS is a nationwide bird monitoring system established in 1966. It includes over 4000 25-mile roadside routes that are surveyed annually during the breeding season. Data from the BBS are used extensively for species assessment and conservation planning. The BBS is coordinated by the Pawtuxent Wildlife Research Center of the U.S. Geological Survey.

Christmas Bird Count ([www.audubon.org/bird/cbc/index.html](http://www.audubon.org/bird/cbc/index.html))

This annual winter bird count began in 1900 and is the oldest survey of its kind. It is conducted by volunteers and coordinated by the National Audubon Society.

New Hampshire Bird Records (NHBR) ([www.nhbirdrecords.org](http://www.nhbirdrecords.org))

NHBR is a statewide database of bird sightings in New Hampshire, and a valuable source of data on the distribution and abundance of the state's birds. The database (and associated quarterly publication) is managed by NH Audubon.

Table 1. Population trends for New Hampshire breeding birds by habitat type. More details on the birds included in each habitat group are presented in Tables 2-14. Trend categories are defined in the legend for Tables 2-14.

Habitat	Number of species in trend category					
	increasing	stable	declining	uncertain	unknown	total
Spruce-fir forest types (includes peatlands)	9	8	13	6	4	40
Hardwood/mixed forest types (includes floodplain forest)	18	13	19	7	6	63
Bole-nesting forest birds	7	3	3	3	7	23
Canopy-nesting forest birds	8	9	12	5	3	37
Ground-nesting forest birds	4	3	11	1	1	20
Shrubland habitats (includes pine barrens)	3	1	22	2	0	28
Grasslands	1	1	9	3	1	15
Marsh and shrub wetlands	5	4	7	10	7	33
Riparian edges	0	4	7	0	1	12
Lakes and rivers	5	1	1	2	1	10
Coastal habitats	5	3	2	6	5	21
Developed areas	17	7	16	3	3	46
Aerial insectivores	1	4	11	3	0	19
Overall *	42	27	65	27	25	186

\* This category does not correspond to the sum of the previous categories because a) some species have been assigned to multiple habitat types and b) not all breeding birds were assigned to one of the preceding habitats.



Legend for Tables 2-14. Population trends for birds at state and regional scales by habitat groups.

#### NH trend; BCR trends

All numeric entries are derived from Breeding Bird Survey (BBS) analysis, predominantly based on 1980-2007 data, and reflect annual percent population change. Values in brackets are based on the entire BBS data set (1966-2007) and are included only if the 1980-2007 trend was in the same direction but not significant. “No data” indicates either an absence of data or that the available data were considered “poor” by the BBS credibility measure for trend interpretation. “NS” indicates that BBS data were sufficient, but showed non-significant trends. “Inc” or “dec” indicate that other data sources suggest an increase or decline when BBS data are unavailable, including cases where the latter are significant but considered poor for other reasons.

#### General trend

Trends are further categorized into five general categories as follows:

- 1) Increasing: significant positive trend at all scales where data are available
- 2) Stable: no trend at all scales where data are available
- 3) Declining: significant negative trend at all scales where data are available
- 4) Uncertain: trends at different scales do not agree
- 5) Unknown: insufficient data to determine trend

In some cases, categories 1 and 3 were assigned when one region did NOT show a significant trend while the other regions DID show such trends. These decisions were informed by other regional data sets (e.g., breeding bird atlases) or consistent positive or negative (but not significant) trends at one or more scales. Other special cases are noted for each habitat.

#### Priority

The “Priority” column lists the regions where a given species is currently considered a conservation priority, as follows:

- 1) NH: the species appears in the New Hampshire WAP and/or on the state list of species of special concern. If listed in NH, this is followed by E (endangered), T (threatened) or SC (special concern).
- 2) BCR: the species is considered “moderate” or higher priority in BCR 14 and/or 30
- 3) FWS: the species appears on the U.S. Fish and Wildlife Service’s “Birds of Conservation Concern” list for Region 5 and /or the country as a whole. Also included are species listed under the Endangered Species Act.

#### Nesting Guild

The final column refers to the species’ nesting guild. Canopy species are those that nest in the forest canopy or mid-story, and in all cases are typical of habitats with mature trees. Shrub nesters can include birds that breed in the forest understory and those that nest in early successional openings (including wetlands) within an otherwise forested landscape. Ground nesters nest on or immediately above the ground. Bole nesters include primarily cavity nesters, but also includes other species, such as the Brown Creeper, that nest in association with tree trunks but not within cavities. “Structure” nesters use a variety of sites, but are often associated with buildings or human artifacts. Also included in this category are species such as the Peregrine Falcon that nest primarily on cliffs.

Table 2. Population trends for birds of spruce-fir forests. Trends for the two crossbill species are listed as uncertain because these species are known to be highly nomadic, resulting in potentially misleading population trends. “Spruce-fir obligate” species (see text) are indicated by an asterisk.

Common Name	Priority	NH trend	BCR 14 trend	General Trend	Nesting Guild
Spruce Grouse *	NH-SC	no data	no data	unknown	Ground
Merlin		inc	inc	increasing	Canopy
Northern Saw-whet Owl		no data	no data	unknown	Bole
Yellow-bellied Sapsucker	BCR	4.9	2.7	increasing	Bole
Am. Three-toed Woodpecker *	NH-E	dec	no data	unknown	Bole
Black-backed Woodpecker *	BCR	no data	dec	unknown	Bole
Olive-sided Flycatcher *	NH-SC,BCR,FWS	-11.4	-4.6	declining	Canopy
Yellow-bellied Flycatcher *	BCR	NS	NS	stable	Ground
Blue-headed Vireo		NS	2.4	stable	Canopy
Philadelphia Vireo *		no data	5.3	increasing	Shrub
Gray Jay *	BCR	no data	NS	stable	Canopy
Common Raven		[4.8]	NS	increasing	Other
Boreal Chickadee *	BCR	no data	-2.3	declining	Bole
Red-breasted Nuthatch		NS	1.2	stable	Bole
Brown Creeper	BCR	NS	3.7	uncertain	Bole
Winter Wren		3.4	1.6	increasing	Ground
Golden-crowned Kinglet		NS	NS	stable	Canopy
Ruby-crowned Kinglet *		NS	-1.9	declining	Canopy
Bicknell's Thrush *	NH-SC,BCR,FWS	dec	dec	declining	Shrub
Swainson's Thrush *		4.4	-1.8	uncertain	Shrub
Hermit Thrush		[2.3]	1.2	increasing	Ground
Tennessee Warbler *		no data	-7.7	declining	Ground
Northern Parula	BCR	5.2	NS	increasing	Canopy
Magnolia Warbler		NS	NS	stable	Shrub
Cape May Warbler *	BCR	no data	NS	stable	Canopy
Yellow-rumped Warbler		[1.7]	[1.4]	increasing	Canopy
Blackburnian Warbler	BCR	NS	-1.1	stable	Canopy
Palm Warbler *	NH,BCR	inc	NS	increasing	Ground
Bay-breasted Warbler *	NH,BCR,FWS	-8.8	-6.0	declining	Canopy
Blackpoll Warbler *	BCR	no data	-8.4	declining	Shrub
Canada Warbler	NH,BCR,FWS	[-4.1]	-6.2	declining	Ground
Lincoln's Sparrow *		NS	-2.9	uncertain	Shrub
White-throated Sparrow		-2.7	-1.5	declining	Ground
Dark-eyed Junco		[-2.1]	-1.7	declining	Ground
Rusty Blackbird *	NH-SC,BCR,FWS	dec	[-5.5]	declining	Shrub
Purple Finch	NH,BCR	-1.6	[-4.6]	declining	Canopy

Red Crossbill		no data	[5.1]	uncertain	Canopy
White-winged Crossbill *		no data	-5.0	uncertain	Canopy
Pine Siskin		NS	-5.6	declining	Canopy
Evening Grosbeak		4.5	-9.6	uncertain	Canopy

Table 3. Population trends for birds of hardwood and mixed forests.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Nesting Guild
Ruffed Grouse	NH,BCR	-14.0	[-6.1]	no data	declining	Ground
Wild Turkey	NH	inc	inc	inc	increasing	Ground
Turkey Vulture		inc	inc	1.8	increasing	Ground
Sharp-shinned Hawk		no data	no data	no data	unknown	Canopy
Cooper's Hawk	NH	no data	no data	no data	increasing	Canopy
Northern Goshawk	NH,BCR	no data	no data	no data	unknown	Canopy
Red-shouldered Hawk	NH	no data	no data	[2.3]	uncertain	Canopy
Broad-winged Hawk	BCR	NS	NS	[-6.9]	stable	Canopy
Red-tailed Hawk		no data	no data	[2.3]	uncertain	Canopy
Merlin		inc	inc	no data	increasing	Canopy
American Woodcock	NH,BCR	no data	dec	dec	declining	Ground
Eastern Screech-Owl		no data		no data	unknown	Bole
Great Horned Owl		no data	dec	[3.2]	uncertain	Canopy
Barred Owl		no data	inc	no data	unknown	Bole
Northern Saw-whet Owl		no data	no data	no data	unknown	Bole
Whip-poor-will	NH-SC,BCR,FWS	dec	dec	-7.1	declining	Ground
Chimney Swift	BCR	-3.3	-4.9	-1.5	declining	Bole
Ruby-throated Hummingbird		[2.5]	2.7	NS	increasing	Canopy
Red-bellied Woodpecker		inc	inc	inc	increasing	Bole
Yellow-bellied Sapsucker	BCR	4.9	2.7	[4.8]	increasing	Bole
Downy Woodpecker		[2.1]	[2.0]	NS	increasing	Bole
Hairy Woodpecker		NS	2.3	NS	stable	Bole
Northern Flicker	BCR	-3.0	NS	-3.0	declining	Bole
Pileated Woodpecker		[3.3]	4.4	3.4	increasing	Bole
Eastern Wood-Pewee	BCR	-2.9	-4.0	-1.0	declining	Canopy
Least Flycatcher		-5.4	-2.7	-6.5	declining	Canopy
Great Crested Flycatcher	BCR	NS	NS	1.5	stable	Bole
Yellow-throated Vireo	BCR	no data	no data	NS	stable	Canopy
Blue-headed Vireo		NS	2.4	NS	stable	Canopy
Red-eyed Vireo		NS	1.7	-2.0	uncertain	Canopy
Blue Jay		-2.0	NS	-2.3	declining	Canopy
American Crow		1.7	1.7	[1.0]	increasing	Canopy
Fish Crow		inc		1.8	increasing	Canopy
Common Raven		[4.8]	NS	inc	increasing	Other
Black-capped Chickadee		[1.5]	1.7	-1.5	uncertain	Bole
Tufted Titmouse		inc	inc	[1.0]	increasing	Bole
Red-breasted Nuthatch		NS	1.2	NS	stable	Bole

White-breasted Nuthatch		1.6	4.7	1.4	increasing	Bole
Brown Creeper	BCR	NS	3.7	-9.9	uncertain	Bole
Blue-gray Gnatcatcher		no data	no data	NS	stable	Canopy
Veery	NH,BCR	-1.6	-3.2	NS	declining	Ground
Hermit Thrush		[2.3]	1.2	NS	increasing	Ground
Wood Thrush	NH,BCR,FWS	-5.2	-5.1	-2.3	declining	Canopy
American Robin		NS	NS	NS	stable	Shrub
Black-throated Blue Warbler	BCR	NS	NS	no data	stable	Shrub
Yellow-rumped Warbler		[1.7]	[1.4]	[3.3]	increasing	Canopy
Black-throated Green Warbler	BCR	3.1	NS	NS	stable	Canopy
Blackburnian Warbler	BCR	NS	-1.1	NS	stable	Canopy
Pine Warbler		5.7	6.0	NS	increasing	Canopy
Cerulean Warbler	NH-SC,BCR,FWS	no data		no data	unknown	Canopy
Black-and-white Warbler	BCR	-3.2	-3.5	-4.0	declining	Ground
American Redstart	BCR	-3.1	-3.3	NS	declining	Canopy
Ovenbird	BCR	NS	NS	-1.0	stable	Ground
Northern Waterthrush		-3.5	-2.1	NS	declining	Ground
Louisiana Waterthrush	BCR	no data	NS	NS	stable	Ground
Canada Warbler	NH,BCR,FWS	[-4.1]	-6.2	-11.0	declining	Ground
Chipping Sparrow		1.6	NS	1.1	increasing	Shrub
White-throated Sparrow		-2.7	-1.5	-11.7	declining	Ground
Scarlet Tanager	BCR	-3.0	-1.4	-1.8	declining	Canopy
Rose-breasted Grosbeak	BCR	-5.2	-5.0	-5.9	declining	Canopy
Baltimore Oriole	BCR	-2.8	-1.4	-3.3	declining	Canopy
Purple Finch	NH,BCR	-1.6	[-1.6]	-8.6	declining	Canopy
Evening Grosbeak		4.5	-9.6	inc	uncertain	Canopy

Table 4. Population trends for bole-nesting forest birds, including those of forest edges. Not included are cavity nesters that occupy shrublands (House Wren), grasslands (American Kestrel, Eastern Bluebird), wetlands (Tree Swallow), and developed areas (Carolina Wren, House Sparrow).

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend
Wood Duck	BCR	inc	inc	NS	increasing
Common Goldeneye		no data	no data	no data	unknown
Hooded Merganser	BCR	NS	no data	no data	unknown
Common Merganser		inc	NS	no data	uncertain
Eastern Screech-Owl		no data	no data	no data	unknown
Barred Owl		no data	inc	no data	unknown
Northern Saw-whet Owl		no data	no data	no data	unknown
Chimney Swift	BCR	-3.3	-4.9	-1.5	declining
Red-bellied Woodpecker		inc	inc	inc	increasing
Yellow-bellied Sapsucker	BCR	4.9	2.7	[4.8]	increasing
Downy Woodpecker		[2.1]	[2.0]	NS	increasing
Hairy Woodpecker		NS	2.3	NS	stable
Am. Three-toed Woodpecker	NH-E	dec	no data		unknown
Black-backed Woodpecker	BCR	no data	dec		unknown
Northern Flicker	BCR	-3.0	NS	-3.0	declining
Pileated Woodpecker		[3.3]	4.4	3.4	increasing
Great Crested Flycatcher	BCR	NS	NS	1.5	stable
Black-capped Chickadee		[1.5]	1.7	-1.5	uncertain
Boreal Chickadee	BCR	no data	-2.3		declining
Tufted Titmouse		inc	inc	[1.0]	increasing
Red-breasted Nuthatch		NS	1.2	NS	stable
White-breasted Nuthatch		1.6	4.7	1.4	increasing
Brown Creeper	BCR	NS	3.7	-9.9	uncertain

Table 5. Population trends for canopy and subcanopy nesting forest birds. Species typical of edges (e.g., Olive-sided Flycatcher, Red-tailed Hawk) are excluded.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend
Sharp-shinned Hawk		no data	no data	no data	unknown
Cooper's Hawk	NH	no data	no data	no data	increasing
Northern Goshawk	NH,BCR	no data	no data	no data	unknown
Red-shouldered Hawk	NH	no data	no data	[2.3]	uncertain
Broad-winged Hawk	BCR	NS	NS	[-6.9]	stable
Merlin		inc	inc	no data	increasing
Ruby-throated Hummingbird		[2.5]	2.7	NS	increasing
Eastern Wood-Pewee	BCR	-2.9	-4.0	-1.0	declining
Least Flycatcher		-5.4	-2.7	-6.5	declining
Yellow-throated Vireo	BCR	no data	no data	NS	stable
Blue-headed Vireo		NS	2.4	NS	stable
Red-eyed Vireo		NS	1.7	-2.0	uncertain
Gray Jay	BCR	no data	NS		stable
Blue Jay		-2.0	NS	-2.3	declining
American Crow		1.7	1.7	[1.0]	increasing
Fish Crow		inc		1.8	increasing
Golden-crowned Kinglet		NS	NS		stable
Ruby-crowned Kinglet		NS	-1.9		declining
Blue-gray Gnatcatcher		no data	no data	NS	stable
Wood Thrush	NH,BCR,FWS	-5.2	-5.1	-2.3	declining
Northern Parula	BCR	5.2	NS	NS	increasing
Cape May Warbler	BCR	no data	NS		stable
Yellow-rumped Warbler		[1.7]	[1.4]	[3.3]	increasing
Black-throated Green Warbler	BCR	3.1	NS	NS	stable
Blackburnian Warbler	BCR	NS	-1.1	NS	stable
Pine Warbler		5.7	6.0	NS	increasing
Bay-breasted Warbler	NH,BCR,FWS	-8.8	-6.0		declining
Cerulean Warbler	NH-SC,BCR,FWS	no data		no data	unknown
American Redstart	BCR	-3.1	-3.3	NS	declining
Scarlet Tanager	BCR	-3.0	-1.4	-1.8	declining
Rose-breasted Grosbeak	BCR	-5.2	-5.0	-5.9	declining
Baltimore Oriole	BCR	-2.8	-1.4	-3.3	declining
Purple Finch	NH,BCR	-1.6	[-1.6]	-8.6	declining
Red Crossbill		no data	[5.1]		uncertain
White-winged Crossbill		no data	-5.0		uncertain
Pine Siskin		NS	-5.6		uncertain
Evening Grosbeak		4.5	-9.6	inc	uncertain

Table 6. Population trends for ground-nesting forest birds.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend
Ruffed Grouse	NH,BCR	-14.0	[-6.1]	no data	declining
Spruce Grouse	NH-SC	no data	no data		unknown
Wild Turkey	NH	inc	inc	inc	increasing
American Woodcock	NH,BCR	no data	dec	dec	declining
Whip-poor-will	NH,BCR,FWS	dec	dec	-7.1	declining
Yellow-bellied Flycatcher	BCR	NS	NS		stable
Winter Wren		3.4	1.6	no data	increasing
Veery	NH,BCR	-1.6	-3.2	NS	declining
Hermit Thrush		[2.3]	1.2		increasing
Tennessee Warbler		no data	-7.7		declining
Palm Warbler	NH,BCR	inc	NS		increasing
Black-and-white Warbler	BCR	-3.2	-3.5	-4.0	declining
Ovenbird	BCR	NS	NS	-1.0	stable
Northern Waterthrush		-3.5	-2.1	NS	declining
Louisiana Waterthrush	BCR	no data	NS	NS	stable
Mourning Warbler		NS	-2.5		uncertain
Wilson's Warbler		no data	-7.2		declining
Canada Warbler	NH,BCR,FWS	[-4.1]	-6.2	-11.0	declining
White-throated Sparrow		-2.7	-1.5	-11.7	declining
Dark-eyed Junco		[-2.1]	-1.7	dec	declining



Table 7. Population trends for shrubland birds.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Nesting Guild
Ruffed Grouse	NH,BCR	-14.0	[-6.1]	no data	declining	Ground
Northern Harrier	NH-E,BCR	no data	NS	inc	uncertain	Ground
American Woodcock	NH,BCR	no data	dec	dec	declining	Ground
Yellow-billed Cuckoo		no data	no data	-4.0	declining	Shrub
Black-billed Cuckoo	BCR	-7.3	-6.3	dec	declining	Shrub
Common Nighthawk	NH-E,BCR	dec	dec	dec	declining	Ground
Whip-poor-will	NH-SC,BCR,FWS	dec	dec	-7.1	declining	Ground
Willow Flycatcher	BCR,FWS	no data	inc	4.7	increasing	Shrub
Eastern Kingbird	BCR	-4.1	-1.4	-3.6	declining	Shrub
House Wren		-3.5	-2.7	[-1.0]	declining	Shrub
Gray Catbird	BCR	-2.1	-2.2	NS	declining	Shrub
Northern Mockingbird		-2.7	NS	-1.2	declining	Shrub
Brown Thrasher	BCR	-15.5	-6.1	[-3.5]	declining	Shrub
Cedar Waxwing		-2.3	-1.2	2.1	declining	Shrub
Blue-winged Warbler	BCR,FWS	no data	-6.8	-3.7	declining	Ground
Golden-winged Warbler	NH-SC,BCR,FWS	dec	dec	dec	declining	Ground
Nashville Warbler		-3.2	-1.1	NS	declining	Ground
Chestnut-sided Warbler	BCR	-3.1	-1.5	-3.2	declining	Shrub
Prairie Warbler	BCR,FWS	no data	no data	-3.5	declining	Shrub
Mourning Warbler		NS	-2.5		uncertain	Shrub
Common Yellowthroat		-1.1	-1.4	-2.0	declining	Ground
Wilson's Warbler		no data	-7.2		declining	Shrub
Eastern Towhee	NH,BCR	-9.8	-7.3	-1.6	declining	Ground
Field Sparrow	BCR	-7.1	-7.7	-2.9	declining	Ground
Song Sparrow		[-1.3]	NS	-1.2	declining	Ground
Northern Cardinal		inc	9.2	1.1	increasing	Shrub
Indigo Bunting		-2.2	NS	NS	stable	Shrub
American Goldfinch		2.6	1.8	4.6	increasing	Ground

Table 8. Population trends for grassland birds.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Guild
Northern Harrier	NH-E,BCR	no data	NS	inc	unknown	Ground
Red-tailed Hawk		no data	no data	[2.3]	uncertain	Canopy
American Kestrel	NH-SC	dec	-4.0	-8.7	declining	Bole
Killdeer	BCR	-4.3	-4.8	NS	declining	Ground
Upland Sandpiper	NH-E,BCR,FWS	dec	NS	no data	uncertain	Ground
Horned Lark	NH,BCR	no data	-11.1	4.1	uncertain	Ground
Eastern Bluebird		inc	[1.6]	2.6	increasing	Bole
Vesper Sparrow	NH-SC,BCR	dec	[-3.6]	NS	declining	Ground
Savannah Sparrow		NS	-1.3	[-7.4]	declining	Ground
Grasshopper Sparrow	NH-T,BCR	dec	dec	[-4.8]	declining	Ground
Song Sparrow		[-1.3]	NS	-1.2	declining	Ground
Bobolink	BCR,FWS	-2.6	-5.1	-2.1	declining	Ground
Red-winged Blackbird		NS	-1.6	NS	stable	Ground
Eastern Meadowlark	NH-SC	-8.7	-6.5	-3.6	declining	Ground
Brown-headed Cowbird		-4.0	-5.8	NS	declining	Other

Table 9. Population trends for birds of marsh and shrub wetlands.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Nesting Guild
Canada Goose	BCR	inc	inc	7.9	increasing	Ground
Mute Swan		inc	no data	9.3	increasing	Ground
Wood Duck	BCR	inc	inc	NS	increasing	Bole
American Black Duck	NH,BCR	NS	NS	dec	stable	Ground
Mallard	BCR	3.2	16.1	3.9	increasing	Ground
Green-winged Teal	BCR	no data	no data		stable	Ground
Ring-necked Duck		no data	no data		unknown	Ground
Hooded Merganser	BCR	NS	no data	no data	unknown	Bole
Pied-billed Grebe	NH-T,FWS	no data	no data	no data	unknown	Other
American Bittern	NH,BCR,FWS	dec	dec	no data	uncertain	Ground
Least Bittern	NH-SC,BCR,FWS	no data	no data	no data	unknown	Shrub
Great Blue Heron	NH	inc	dec	[2.5]	uncertain	Canopy
Green Heron		no data	no data	-1.9	uncertain	Shrub
Osprey	NH-SC	inc	2.2	6.2	increasing	Canopy
Northern Harrier	NH-E,BCR	no data	NS	inc	uncertain	Ground
Virginia Rail		no data	inc	no data	unknown	Ground
Sora	NH-SC,BCR	dec	inc	no data	uncertain	Ground
Common Moorhen	NH	dec	no data	no data	unknown	Ground
Spotted Sandpiper	BCR	-4.2	-3.7	inc	uncertain	Ground
Wilson's Snipe	BCR	NS	-3.8	no data	uncertain	Ground
Olive-sided Flycatcher	NH-SC,BCR,FWS	-11.4	-4.6		declining	Canopy
Alder Flycatcher		[2.7]	NS	no data	uncertain	Shrub
Eastern Kingbird	BCR	-4.1	-1.4	-3.6	declining	Shrub
Tree Swallow		-2.9	-3.3	2.2	uncertain	Bole
Sedge Wren	NH-E,BCR,FWS	dec	no data	no data	unknown	Shrub
Marsh Wren	BCR	dec	inc	-4.5	uncertain	Shrub
Yellow Warbler		-2.6	-2.1	NS	declining	Shrub
Northern Waterthrush		-3.5	-2.1	NS	declining	Ground
Common Yellowthroat		-1.1	-1.4	-2.0	declining	Ground
Swamp Sparrow		NS	NS	-3.3	stable	Shrub
Red-winged Blackbird		NS	-1.6	NS	stable	Shrub
Rusty Blackbird	NH-SC,BCR,FWS	dec	[-5.5]		declining	Shrub
Common Grackle		-1.7	NS	-1.8	declining	Shrub

Table 10. Population trends for birds of riparian edges.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Nesting Guild
Spotted Sandpiper	BCR	-4.2	-3.7	inc	uncertain	Ground
Belted Kingfisher		NS	-2.8	NS	stable	Bank
Eastern Kingbird	BCR	-4.1	-1.4	-3.6	declining	Shrub
Warbling Vireo		NS	2.6	NS	stable	Shrub
N. Rough-winged Swallow		inc	NS	NS	stable	Bank
Bank Swallow	NH-SC,BCR	-3.8	-8.0	-8.7	declining	Bank
Cedar Waxwing		-2.3	-1.2	2.1	declining	Shrub
Yellow Warbler		-2.6	-2.1	NS	declining	Shrub
Louisiana Waterthrush	BCR	no data	NS	NS	stable	Ground
Common Grackle		-1.7	NS	-1.8	declining	Shrub
Orchard Oriole		no data		1.0	unknown	Canopy
Baltimore Oriole	BCR	-2.8	-1.4	-3.3	declining	Canopy

Table 11. Population trends for birds of lakes and rivers.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Nesting Guild
Canada Goose	BCR	inc	inc	7.9	increasing	Ground
Mallard	BCR	3.2	16.1	3.9	increasing	Ground
Common Goldeneye		no data	no data	no data	unknown	Bole
Common Merganser		inc	NS	no data	uncertain	Bole
Common Loon	NH-T,BCR	inc	[2.4]	no data	increasing	Ground
Great Blue Heron	NH	inc	dec	[2.5]	uncertain	Canopy
Osprey	NH-SC	inc	2.2	6.2	increasing	Canopy
Bald Eagle	NH-T,BCR,FWS	inc	inc	inc	increasing	Canopy
Spotted Sandpiper	BCR	-4.2	-3.7	inc	uncertain	Ground
Belted Kingfisher		NS	-2.8	NS	stable	Bank

Table 12. Population trends for birds of coastal habitats. Specific habitats as follows: M = salt marsh, D = dunes, I = coastal islands.

Common Name	Specific habitat	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend
American Black Duck	M	NH,BCR	NS	NS	dec	stable
Mallard	M	BCR	3.2	16.1	3.9	increasing
Common Eider	I	BCR	no data	no data	no data	unknown
Double-crested Cormorant	I		no data	[3.7]	inc	increasing
Osprey	M	NH-SC	inc	2.2	6.2	increasing
Virginia Rail	M		no data	inc	no data	unknown
Piping Plover	D	NH-E,BCR,FWS	dec	inc	inc	increasing
Spotted Sandpiper	M, I	BCR	-4.2	-3.7	inc	uncertain
Willet	M	NH-SC,BCR	no data	NS	NS	stable
Herring Gull	I		dec	-3.9	NS	declining
Great Black-backed Gull	I		no data	-5.8	[7.9]	uncertain
Roseate Tern	I	NH-E,BCR,FWS	NS	NS	dec?	uncertain
Common Tern	I, M	NH-T,BCR	NS	-15.9	inc?	stable
Arctic Tern	I	NH-SC,BCR,FWS	NS	no data	dec	declining
Black Guillemot	I	NH	no data	no data	inc	increasing
Horned Lark	D	NH,BCR	no data	-11.1	4.1	uncertain
Tree Swallow	M		-2.9	-3.3	2.2	uncertain
Marsh Wren	M	BCR	dec	inc	-4.5	uncertain
Nelson's Sparrow	M	NH-SC,BCR,FWS	no data	NS	no data	unknown
Saltmarsh Sparrow	M	NH-SC,BCR,FWS	no data	no data	no data	unknown
Seaside Sparrow	M	NH-SC,BCR,FWS	no data	no data	NS	unknown

Table 13. Population trends for birds of developed areas.

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend	Nesting Guild
Sharp-shinned Hawk		no data	no data	no data	unknown	Canopy
Cooper's Hawk	NH	no data	no data	no data	increasing	Canopy
Peregrine Falcon	NH-T,BCR,FWS	inc	inc	inc	increasing	Structure
Killdeer	BCR	-4.3	-4.8	NS	declining	Ground
Rock Pigeon		NS	NS	-4.3	uncertain	Structure
Mourning Dove		1.9	3.7	NS	increasing	Shrub
Eastern Screech-Owl		no data		no data	unknown	Bole
Common Nighthawk	NH-E,BCR	dec	dec	dec	declining	Ground
Chimney Swift	BCR	-3.3	-4.9	-1.5	declining	Bole
Ruby-thr. Hummingbird		[2.5]	2.7	NS	increasing	Canopy
Red-bellied Woodpecker		inc	inc	inc	increasing	Bole
Downy Woodpecker		[2.1]	[2.0]	NS	increasing	Bole
Hairy Woodpecker		NS	2.3	NS	stable	Bole
Northern Flicker	BCR	-3.0	NS	-3.0	declining	Bole
Eastern Phoebe		NS	NS	NS	stable	Structure
Great Crested Flycatcher	BCR	NS	NS	1.5	stable	Bole
Warbling Vireo		NS	2.6	NS	stable	Shrub
Blue Jay		-2.0	NS	-2.3	declining	Canopy
American Crow		1.7	1.7	[1.0]	increasing	Canopy
Fish Crow		inc		1.8	increasing	Canopy
Purple Martin	NH-SC	dec	-12.1	4.1	uncertain	Structure
Black-capped Chickadee		[1.5]	1.7	-1.5	uncertain	Bole
Tufted Titmouse		inc	inc	[1.0]	increasing	Bole
Red-breasted Nuthatch		NS	1.2	NS	stable	Bole
White-breasted Nuthatch		1.6	4.7	1.4	increasing	Bole
Carolina Wren		inc	no data	2.2	increasing	Structure
House Wren		-3.5	-2.7	[-1.0]	declining	Shrub
Eastern Bluebird		inc	[1.6]	2.6	increasing	Bole
American Robin		NS	NS	NS	stable	Shrub
Gray Catbird	BCR	-2.1	-2.2	NS	declining	Shrub
Northern Mockingbird		-2.7	NS	-1.2	declining	Shrub
European Starling		-2.9	-2.2	-2.1	declining	Structure
Cedar Waxwing		-2.3	-1.2	2.1	declining	Shrub
Pine Warbler		5.7	6.0	NS	increasing	Canopy
Chipping Sparrow		1.6	NS	1.1	increasing	Shrub
Song Sparrow		[-1.3]	NS	-1.2	declining	Ground
Northern Cardinal		inc	9.2	1.1	increasing	Shrub

Red-winged Blackbird		NS	-1.6	NS	stable	Shrub
Common Grackle		-1.7	NS	-1.8	declining	Shrub
Brown-headed Cowbird		-4.0	-5.8	NS	declining	Parasite
Orchard Oriole		no data		1.0	unknown	Canopy
Baltimore Oriole	BCR	-2.8	-1.4	-3.3	declining	Canopy
Purple Finch	NH,BCR	-1.6	[-1.6]	-8.6	declining	Canopy
House Finch		inc	no data	1.6	increasing	Structure
American Goldfinch		2.6	1.8	4.6	increasing	Ground
House Sparrow		-3.0	-3.5	-2.2	declining	Structure

Table 14. Population trends of aerial insectivores. Following each species' name are two codes indicating its sub-guild and primary wintering area, as follows:

Sub-guild: 1 = forages entirely in flight, 2 = sallies after insects from a perch

Wintering area: N = North America, C = Central America, S = South America

Common Name	Priority	NH trend	BCR 14 trend	BCR 30 trend	General Trend
Common Nighthawk (1,S)	NH-E,BCR	dec	dec	dec	declining
Whip-poor-will (2,C)	NH-SC,BCR,FWS	dec	dec	-7.1	declining
Chimney Swift (1,S)	BCR	-3.3	-4.9	-1.5	declining
Olive-sided Flycatcher (2,S)	NH-SC,BCR,FWS	-11.4	-4.6		declining
Eastern Wood-Pewee (2,S)	BCR	-2.9	-4.0	-1.0	declining
Yellow-bellied Flycatcher (2,C)	BCR	NS	NS		stable
Alder Flycatcher (2,S)		[2.7]	NS	no data	uncertain
Willow Flycatcher (2,C)	BCR,FWS	no data	inc	4.7	increasing
Least Flycatcher (2,C)		-5.4	-2.7	-6.5	declining
Eastern Phoebe (2,N)		NS	NS	NS	stable
Great Crested Flycatcher (2,C)	BCR	NS	NS	1.5	stable
Eastern Kingbird (2,S)	BCR	-4.1	-1.4	-3.6	declining
Purple Martin (1,S)	NH-SC	dec	-12.1	4.1	uncertain
Tree Swallow (1,N)		-2.9	-3.3	2.2	uncertain
N. Rough-winged Swallow (1,C)		inc	NS	NS	stable
Bank Swallow (1,S)	NH-SC,BCR	-3.8	-8.0	-8.7	declining
Cliff Swallow (1,S)	NH-SC	-9.6	dec	dec	declining
Barn Swallow (1,S)	BCR	-5.2	-6.5	[-1.0]	declining
Cedar Waxwing (2,N)		-2.3	-1.2	2.1	declining



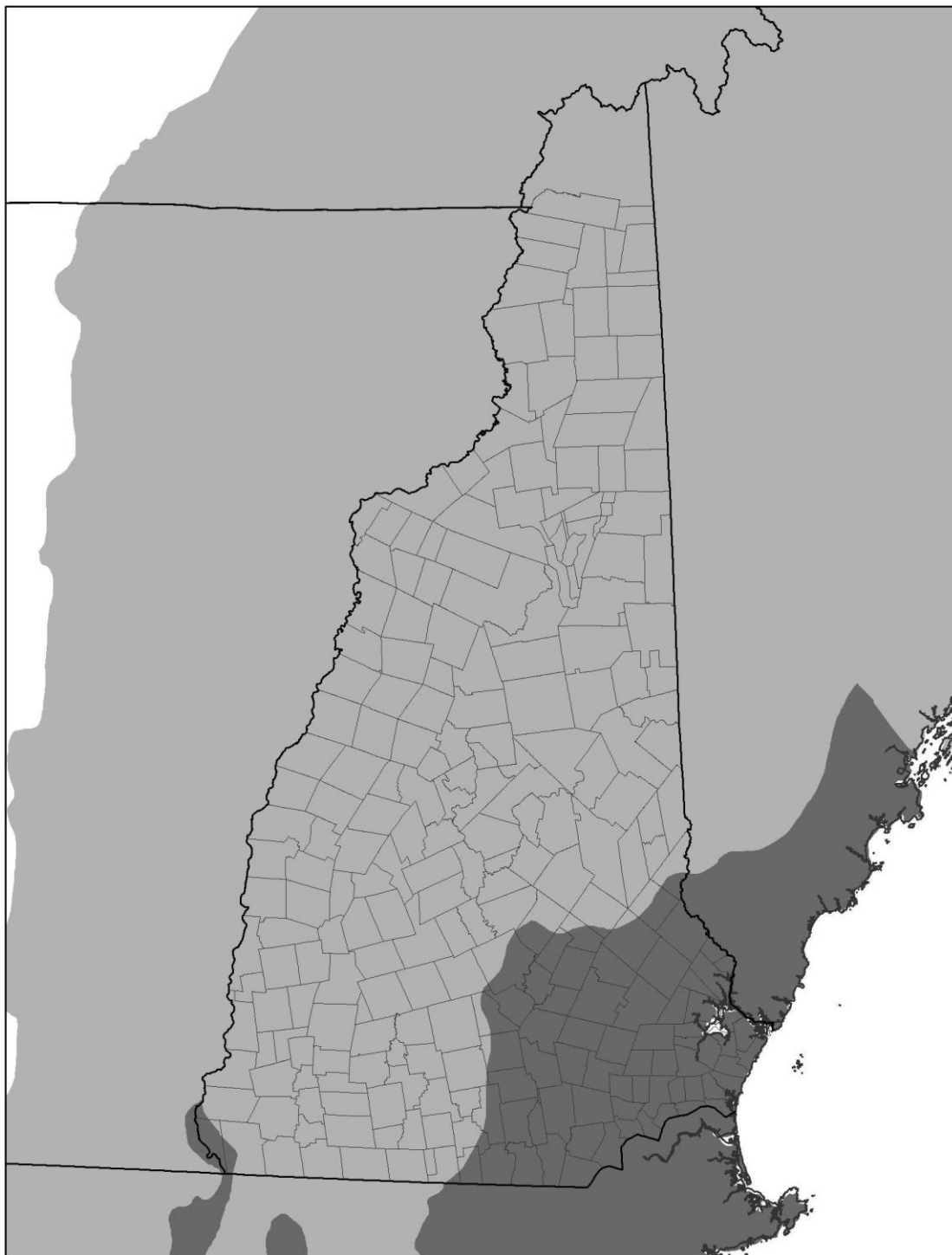
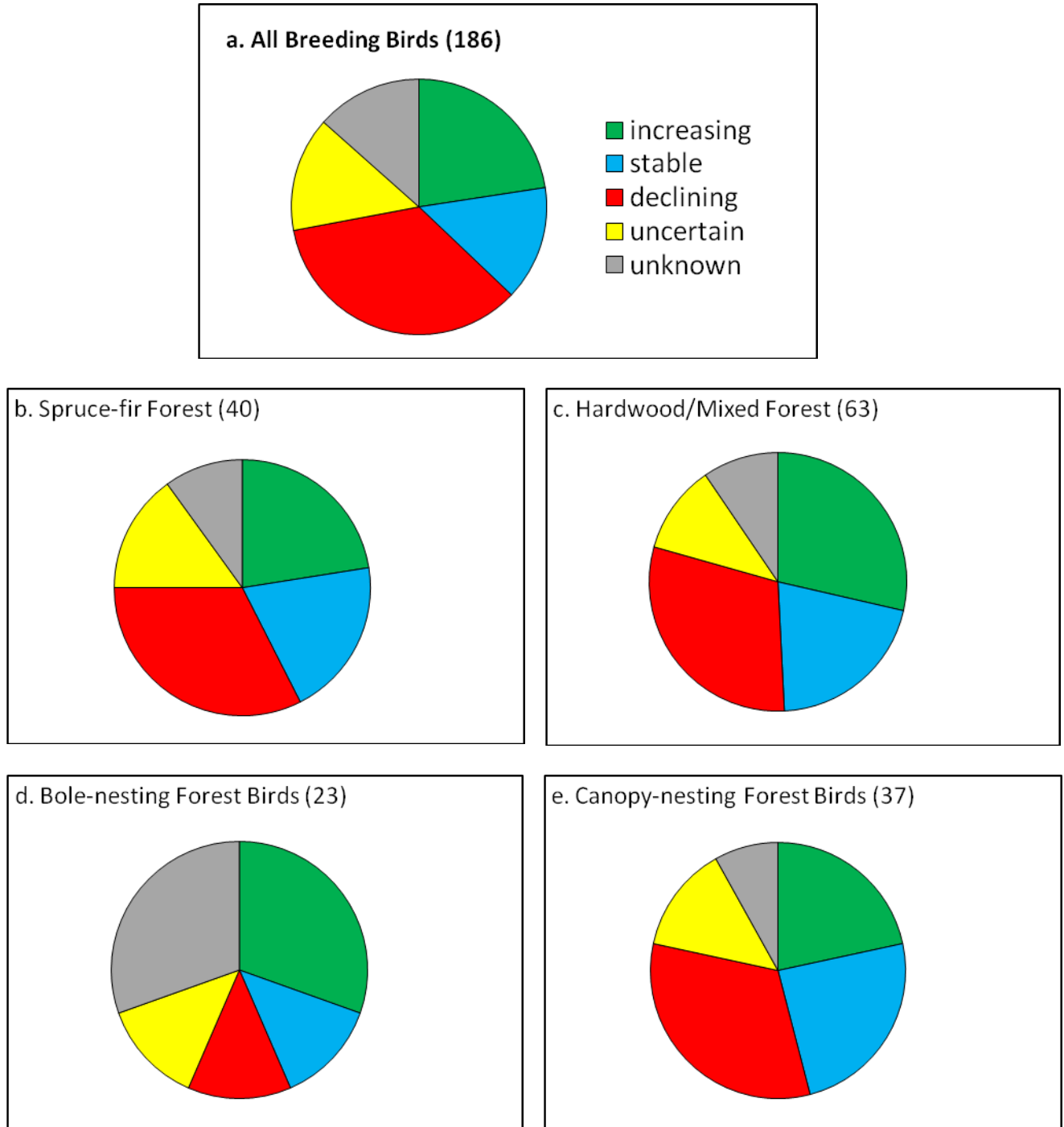
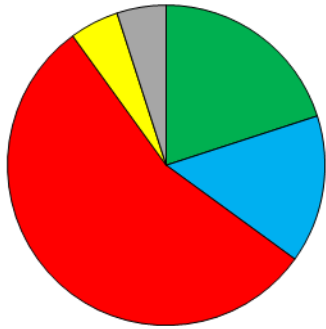


Figure 1. Locations of Bird Conservation Regions in New Hampshire: BCR 14 (Atlantic Northern Forest) in light gray and BCR 30 (New England/Mid-Atlantic Coast) in dark gray.

Figure 2. Population trends for New Hampshire breeding birds by habitat type. This figure is a visualization of the raw data presented in Table 1. The legend for each pie chart follows that shown for Figure 2a. For each habitat, the number of species included is given in parentheses after the habitat name.



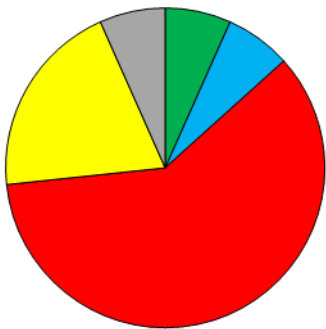
f. Ground-nesting Forest Birds (20)



g. Shrublands (28)



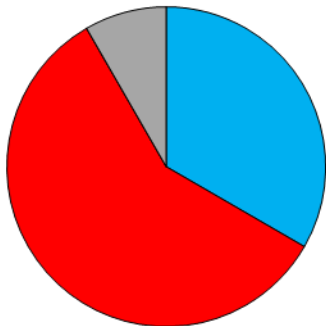
h. Grasslands (15)



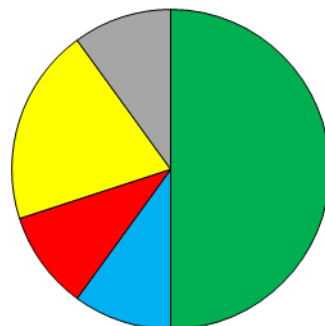
i. Marsh and Shrub Wetlands (33)



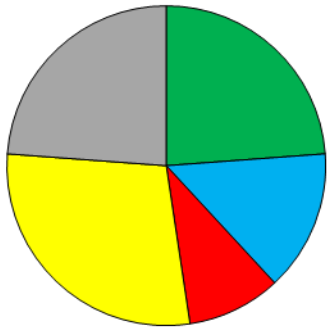
j. Riparian Edge (12)



k. Lakes and Rivers (10)



l. Coastal Habitats (21)



m. Developed Areas (46)



n. Aerial Insectivores (19)

