Background

Birds are useful indicators of ecological change because they are highly mobile and generally conspicuous. As climate in a particular place changes, suitability may worsen for some species and improve for others. These changes in climate may create the potential for local extirpation or new colonization. This brief summarizes projected changes in climate suitability by mid-century for birds at Cape Cod National Seashore (hereafter, the Seashore) under two climate change scenarios (see Wu et al. 2018 for full results, and Langham et al. 2015 for more information regarding how climate suitability is characterized). The high-emissions pathway (RCP8.5) represents a future in which little action is taken to reduce global emissions of greenhouse gases. The low-emissions pathway (RCP2.6) is a best-case scenario of aggressive efforts to reduce emissions. These emissions pathways are globally standardized and established by the Intergovernmental Panel on Climate Change for projecting future climate change. The findings below are model-based projections of how species distributions may change in response to climate change. A 10-km buffer was applied to each park to match the spatial resolution of the species distribution models (10 x 10 km), and climate suitability was taken as the average of all cells encompassed by the park and buffer.

Results

Climate change is expected to alter the bird community at the Seashore, with greater impacts under the high-emissions pathway than under the low-emissions pathway (Figure 1). Among the species likely to be found at the Seashore today, climate suitability in summer under the high-emissions pathway is projected to improve for 45, remain stable for 48 (e.g., Figure 2), and worsen for 15 species. Suitable climate ceases to occur for 40 species in summer, potentially resulting in extirpation of those species from the Seashore. Climate is projected to become suitable in summer for 7 species not found at the Seashore today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 81, remain stable for 34, and worsen for 20 species. Suitable climate ceases to occur for 23 species in winter, potentially resulting in extirpation from the Seashore. Climate is projected to become suitable in winter for 17 species not found at the Seashore today, potentially resulting in local colonization.
Results (continued)

Potential Turnover Index

Potential bird species turnover for the Seashore between the present and 2050 is 0.27 in summer (46th percentile across all national parks) and 0.22 in winter (30th percentile) under the high-emissions pathway. Potential species turnover declines to 0.18 in summer and 0.15 in winter under the low-emissions pathway. Turnover index was calculated based on the theoretical proportions of potential extirpations and potential colonizations by 2050 relative to today (as reported in Wu et al. 2018), and therefore assumes that all potential extirpations and colonizations are realized. According to this index, no change would be represented as 0, whereas a complete change in the bird community would be represented as 1.

Climate Sensitive Species

The Seashore is or may become home to 36 species that are highly sensitive to climate change across their range (i.e., they are projected to lose climate suitability in over 50% of their current range in North America in summer and/or winter by 2050; Table 1; Langham et al. 2015). While the Seashore may serve as an important refuge for 32 of these climate-sensitive species, 4 might be extirpated from the Seashore in at least one season by 2050.

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. Under the high-emissions pathway, Cape Cod National Seashore falls within the high turnover group. Parks anticipating high turnover can focus on actions that increase species' ability to respond to environmental change, such as increasing the amount of potential habitat, working with cooperating agencies and landowners to improve habitat connectivity for birds across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 32 species that are highly sensitive to climate change across their range (Table 1; Langham et al. 2015) but for which the park is a potential refuge. Monitoring to identify changes in bird communities will inform the selection of appropriate management responses.

Caveats

The species distribution models included in this study are based solely on climate variables (i.e., a combination of annual and seasonal measures of temperature and precipitation), which means there are limits on their interpretation. Significant changes in climate suitability, as measured here, will not always result in a species response, and all projections should be interpreted as potential trends. Multiple other factors mediate responses to climate change, including habitat availability, ecological processes that affect demography, biotic interactions that inhibit and facilitate species' colonization or extirpation, dispersal capacity, species' evolutionary adaptive capacity, and phenotypic plasticity (e.g., behavioral adjustments). Ultimately, models can tell us where to focus our concern and which species are most likely to be affected, but monitoring is the only way to validate these projections and should inform any on-the-ground conservation action.
More Information

For more information, including details on the methods, please see the scientific publication (Wu et al. 2018) and the project overview brief, and visit the NPS Climate Change Response Program website.

References


Wu et al. (2018) Projected avifaunal responses to climate change across the U.S. National Park System. PLOS ONE.

Contacts

Gregor Schuurman, Ph.D.
Ecologist, NPS Climate Change Response Program
970-267-7211, gregor_schuurman@nps.gov

Joanna Wu
Biologist, National Audubon Society
415-644-4610, science@audubon.org

Species Projections

Table 1. Climate suitability projections by 2050 under the high-emissions pathway for all birds currently present at the Seashore based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Seashore is projected to become suitable in the future. "Potential colonization" indicates that climate is projected to become suitable for the species, whereas "potential extirpation" indicates that climate is suitable today but projected to become unsuitable. Omitted species were either not modeled due to data deficiency or were absent from the I&M and eBird datasets. Observations of late-season migrants may result in these species appearing as present in the park when they may only migrate through. Species are ordered according to taxonomic groups, denoted by alternating background shading.

* Species in top and bottom 10th percentile of absolute change

Species that are highly climate sensitive

- Species not found or found only occasionally, and not projected to colonize by 2050

x Species not modeled in this season

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Summer Trend</th>
<th>Winter Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brant</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Cackling/Canada Goose</td>
<td>x</td>
<td>Worsening</td>
</tr>
<tr>
<td>Mute Swan</td>
<td>x</td>
<td>Worsening*</td>
</tr>
<tr>
<td>Wood Duck</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Gadwall</td>
<td>Stable*</td>
<td>Improving</td>
</tr>
<tr>
<td>Eurasian Wigeon</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>American Wigeon</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>American Black Duck</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Mallard</td>
<td>Potential extirpation*</td>
<td>Worsening</td>
</tr>
<tr>
<td>Blue-winged Teal</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Northern Shoveler</td>
<td>-</td>
<td>Improving*</td>
</tr>
<tr>
<td>Green-winged Teal</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Canvasback</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Ring-necked Duck</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Greater Scaup</td>
<td>Potential colonization</td>
<td>Improving*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Summer Trend</th>
<th>Winter Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesser Scaup</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Common Eider</td>
<td>x</td>
<td>Worsening*</td>
</tr>
<tr>
<td>Harlequin Duck</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Surf Scoter</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>White-winged Scoter</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Black Scoter</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Long-tailed Duck</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Bufflehead</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Common Goldeneye</td>
<td>-</td>
<td>Worsening</td>
</tr>
<tr>
<td>Barrow’s Goldeneye</td>
<td>-</td>
<td>Stable*</td>
</tr>
<tr>
<td>Hooded Merganser</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Common Merganser</td>
<td>-</td>
<td>Worsening*</td>
</tr>
<tr>
<td>Red-breasted Merganser</td>
<td>Improving</td>
<td>Improving*</td>
</tr>
<tr>
<td>Ruddy Duck</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Northern Bobwhite</td>
<td>Improving*</td>
<td>Improving</td>
</tr>
<tr>
<td>Common Name</td>
<td>Summer Trend</td>
<td>Winter Trend</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Ring-necked Pheasant</td>
<td>Potential extirpation</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Wild Turkey</td>
<td>x</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Red-throated Loon</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Pacific Loon</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Common Loon</td>
<td>Potential extirpation</td>
<td>Improving*</td>
</tr>
<tr>
<td>Pied-billed Grebe</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Horned Grebe</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Red-necked Grebe</td>
<td>Potential extirpation</td>
<td>Worsening*</td>
</tr>
<tr>
<td>Northern Fulmar</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Northern Gannet</td>
<td>Improving*</td>
<td>Improving*</td>
</tr>
<tr>
<td>Double-crested Cormorant</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Great Cormorant</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Brown Pelican</td>
<td>-</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>American Bittern</td>
<td>Potential extirpation</td>
<td>Improving*</td>
</tr>
<tr>
<td>Great Blue Heron</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Great Egret</td>
<td>Improving*</td>
<td>Improving*</td>
</tr>
<tr>
<td>Snowy Egret</td>
<td>x</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Little Blue Heron</td>
<td>Improving</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Tricolored Heron</td>
<td>Improving*</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Green Heron</td>
<td>Improving*</td>
<td>-</td>
</tr>
<tr>
<td>Black-crowned Night-Heron</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Yellow-crowned Night-Heron</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Black Vulture</td>
<td>Improving</td>
<td>Improving</td>
</tr>
<tr>
<td>Turkey Vulture</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Swallow-tailed Kite</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Mississippi Kite</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Northern Harrier</td>
<td>Stable*</td>
<td>Stable</td>
</tr>
<tr>
<td>Sharp-shinned Hawk</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Cooper's Hawk</td>
<td>x</td>
<td>Worsening</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Summer Trend</th>
<th>Winter Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Goshawk</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Bald Eagle</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Red-shouldered Hawk</td>
<td>Improving</td>
<td>Stable</td>
</tr>
<tr>
<td>Red-tailed Hawk</td>
<td>Improving</td>
<td>Worsening</td>
</tr>
<tr>
<td>Rough-legged Hawk</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Clapper Rail</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Virginia Rail</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>American Coot</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>American Oystercatcher</td>
<td>x</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Black-bellied Plover</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>American Golden-Plover</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Semipalmated Plover</td>
<td>Improving</td>
<td>Improving*</td>
</tr>
<tr>
<td>Killdeer</td>
<td>Improving</td>
<td>Improving*</td>
</tr>
<tr>
<td>Greater Yellowlegs</td>
<td>Stable</td>
<td>Improving*</td>
</tr>
<tr>
<td>Willet</td>
<td>Improving*</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Lesser Yellowlegs</td>
<td>Stable*</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Long-billed Curlew</td>
<td>Stable*</td>
<td>-</td>
</tr>
<tr>
<td>Marbled Godwit</td>
<td>Potential extirpation</td>
<td>Improving</td>
</tr>
<tr>
<td>Ruddy Turnstone</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Red Knot</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Sanderling</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Dunlin</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Purple Sandpiper</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Western Sandpiper</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Short-billed Dowitcher</td>
<td>x</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Long-billed Dowitcher</td>
<td>-</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Wilson's Snipe</td>
<td>-</td>
<td>Worsening</td>
</tr>
<tr>
<td>American Woodcock</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Wilson's Phalarope</td>
<td>Stable*</td>
<td>-</td>
</tr>
<tr>
<td>Red-necked Phalarope</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Common Name</td>
<td>Summer Trend</td>
<td>Winter Trend</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Pomarine Jaeger</td>
<td>x</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Parasitic Jaeger</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Long-tailed Jaeger</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Common Murre</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Black Guillemot</td>
<td>x</td>
<td>Worsening*</td>
</tr>
<tr>
<td>Bonaparte's Gull</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Laughing Gull</td>
<td>Improving*</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Ring-billed Gull</td>
<td>Stable*</td>
<td>Stable</td>
</tr>
<tr>
<td>Herring Gull</td>
<td>Improving</td>
<td>Stable*</td>
</tr>
<tr>
<td>Iceland Gull (Thayer's)</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Glaucous Gull</td>
<td>Stable</td>
<td>x</td>
</tr>
<tr>
<td>Great Black-backed Gull</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Black Tern</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Arctic Tern</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Forster's Tern</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Rock Pigeon</td>
<td>Worsening</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>White-winged Dove</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Mourning Dove</td>
<td>Worsening</td>
<td>Worsening</td>
</tr>
<tr>
<td>Yellow-billed Cuckoo</td>
<td>Improving*</td>
<td>-</td>
</tr>
<tr>
<td>Black-billed Cuckoo</td>
<td>Worsening</td>
<td>-</td>
</tr>
<tr>
<td>Barn Owl</td>
<td>-</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Eastern Screech-Owl</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Great Horned Owl</td>
<td>x</td>
<td>Stable</td>
</tr>
<tr>
<td>Snowy Owl</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Common Nighthawk</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Chuck-will's-widow</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Chimney Swift</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Ruby-throated Hummingbird</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Belted Kingfish</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Red-headed Woodpecker</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Red-bellied Woodpecker</td>
<td>Improving*</td>
<td>Stable</td>
</tr>
<tr>
<td>Yellow-bellied Sapsucker</td>
<td>-</td>
<td>Improving*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Summer Trend</th>
<th>Winter Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downy Woodpecker</td>
<td>Stable</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Hairy Woodpecker</td>
<td>Potential extirpation</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Northern Flicker</td>
<td>Potential extirpation</td>
<td>Stable</td>
</tr>
<tr>
<td>American Kestrel</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Merlin</td>
<td>x</td>
<td>Improving*</td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Eastern Wood-Pewee</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Yellow-bellied Flycatcher</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Acadian Flycatcher</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Alder Flycatcher</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Willow Flycatcher</td>
<td>Worsening*</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Phoebe</td>
<td>Potential extirpation</td>
<td>Improving*</td>
</tr>
<tr>
<td>Great Crested Flycatcher</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Kingbird</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Northern Shrike</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>White-eyed Vireo</td>
<td>Improving*</td>
<td>-</td>
</tr>
<tr>
<td>Yellow-throated Vireo</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Warbling Vireo</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Red-eyed Vireo</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Blue Jay</td>
<td>Worsening</td>
<td>Worsening</td>
</tr>
<tr>
<td>American Crow</td>
<td>Worsening</td>
<td>Worsening</td>
</tr>
<tr>
<td>Fish Crow</td>
<td>Improving</td>
<td>Improving</td>
</tr>
<tr>
<td>Common Raven</td>
<td>Potential extirpation</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Horned Lark</td>
<td>Stable</td>
<td>Worsening</td>
</tr>
<tr>
<td>Northern Rough-winged Swallow</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Purple Martin</td>
<td>Improving*</td>
<td>-</td>
</tr>
<tr>
<td>Tree Swallow</td>
<td>Potential extirpation</td>
<td>Improving</td>
</tr>
<tr>
<td>Barn Swallow</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Cliff Swallow</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Common Name</td>
<td>Summer Trend</td>
<td>Winter Trend</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Carolina Chickadee</td>
<td>Potential colonization</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Black-capped Chickadee</td>
<td>Potential extirpation</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Tufted Titmouse</td>
<td>Improving</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Red-breasted Nuthatch</td>
<td>Potential extirpation</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>White-breasted Nuthatch</td>
<td>Potential extirpation</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Brown Creeper</td>
<td>Potential extirpation*</td>
<td>Stable</td>
</tr>
<tr>
<td>House Wren</td>
<td>Potential extirpation</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Pacific/Winter Wren</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Marsh Wren</td>
<td>-</td>
<td>Potential colonization</td>
</tr>
<tr>
<td>Carolina Wren</td>
<td>x</td>
<td>Improving</td>
</tr>
<tr>
<td>Blue-gray Gnatcatcher</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Golden-crowned Kinglet</td>
<td>-</td>
<td>Worsening</td>
</tr>
<tr>
<td>Ruby-crowned Kinglet</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Eastern Bluebird</td>
<td>Stable</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Hermit Thrush</td>
<td>Potential extirpation</td>
<td>Improving</td>
</tr>
<tr>
<td>Wood Thrush</td>
<td>Worsening*</td>
<td>-</td>
</tr>
<tr>
<td>American Robin</td>
<td>Worsening</td>
<td>Improving</td>
</tr>
<tr>
<td>Varied Thrush</td>
<td>-</td>
<td>Stable</td>
</tr>
<tr>
<td>Gray Catbird</td>
<td>Worsening*</td>
<td>Improving</td>
</tr>
<tr>
<td>Brown Thrasher</td>
<td>Stable</td>
<td>Improving*</td>
</tr>
<tr>
<td>Northern Mockingbird</td>
<td>Improving*</td>
<td>Improving</td>
</tr>
<tr>
<td>European Starling</td>
<td>Worsening</td>
<td>Worsening</td>
</tr>
<tr>
<td>American Pipit</td>
<td>Improving</td>
<td>Improving</td>
</tr>
<tr>
<td>Sprague's Pipit</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Bohemian Waxwing</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Cedar Waxwing</td>
<td>Worsening</td>
<td>Stable</td>
</tr>
<tr>
<td>Snow Bunting</td>
<td>-</td>
<td>Worsening*</td>
</tr>
<tr>
<td>Ovenbird</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Northern Waterthrush</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Black-and-white Warbler</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Prothonotary Warbler</td>
<td>Potential colonization</td>
<td>-</td>
</tr>
<tr>
<td>Swainson's Warbler</td>
<td>Potential colonization</td>
<td>-</td>
</tr>
<tr>
<td>Tennessee Warbler</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Orange-crowned Warbler</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Nashville Warbler</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Kentucky Warbler</td>
<td>Potential colonization</td>
<td>-</td>
</tr>
<tr>
<td>Common Yellowthroat</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>American Redstart</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Northern Parula</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Magnolia Warbler</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Blackburnian Warbler</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Yellow Warbler</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Chestnut-sided Warbler</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Blackpoll Warbler</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Black-throated Blue Warbler</td>
<td>Stable</td>
<td>x</td>
</tr>
<tr>
<td>Palm Warbler</td>
<td>-</td>
<td>Improving*</td>
</tr>
<tr>
<td>Pine Warbler</td>
<td>Improving*</td>
<td>Stable</td>
</tr>
<tr>
<td>Yellow-rumped Warbler</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Prairie Warbler</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Black-throated Green Warbler</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Canada Warbler</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Wilson's Warbler</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Yellow-breasted Chat</td>
<td>Improving*</td>
<td>x</td>
</tr>
<tr>
<td>Eastern Towhee</td>
<td>Improving</td>
<td>x</td>
</tr>
<tr>
<td>American Tree Sparrow</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Chipping Sparrow</td>
<td>Potential extirpation</td>
<td>Improving</td>
</tr>
<tr>
<td>Common Name</td>
<td>Summer Trend</td>
<td>Winter Trend</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Clay-colored Sparrow</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Field Sparrow</td>
<td>Stable</td>
<td>Stable</td>
</tr>
<tr>
<td>Vesper Sparrow</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Lark Sparrow</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Savannah Sparrow</td>
<td>Potential extirpation</td>
<td>Improving*</td>
</tr>
<tr>
<td>Grasshopper Sparrow</td>
<td>Improving*</td>
<td>-</td>
</tr>
<tr>
<td>Nelson’s/Saltmarsh Sparrow (Sharp-tailed Sparrow)</td>
<td>x</td>
<td>Improving**</td>
</tr>
<tr>
<td>Seaside Sparrow</td>
<td>Improving*</td>
<td>Improving*</td>
</tr>
<tr>
<td>Fox Sparrow</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Song Sparrow</td>
<td>Worsening</td>
<td>Stable</td>
</tr>
<tr>
<td>Swamp Sparrow</td>
<td>Potential extirpation</td>
<td>Improving</td>
</tr>
<tr>
<td>White-throated Sparrow</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>White-crowned Sparrow</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Dark-eyed Junco</td>
<td>-</td>
<td>Worsening</td>
</tr>
<tr>
<td>Summer Tanager</td>
<td>Improving</td>
<td>-</td>
</tr>
<tr>
<td>Scarlet Tanager</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Western Tanager</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Northern Cardinal</td>
<td>Improving</td>
<td>Stable</td>
</tr>
<tr>
<td>Rose-breasted Grosbeak</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Blue Grosbeak</td>
<td>Potential colonization</td>
<td>-</td>
</tr>
<tr>
<td>Indigo Bunting</td>
<td>Stable</td>
<td>-</td>
</tr>
<tr>
<td>Painted Bunting</td>
<td>-</td>
<td>Improving</td>
</tr>
<tr>
<td>Dickcissel</td>
<td>Improving*</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Summer Trend</th>
<th>Winter Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bobolink</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Red-winged Blackbird</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Eastern Meadowlark</td>
<td>Stable</td>
<td>Improving*</td>
</tr>
<tr>
<td>Yellow-headed Blackbird</td>
<td>Potential extirpation</td>
<td>-</td>
</tr>
<tr>
<td>Common Grackle</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Boat-tailed Grackle</td>
<td>Potential colonization*</td>
<td>Potential colonization*</td>
</tr>
<tr>
<td>Brown-headed Cowbird</td>
<td>Stable</td>
<td>Improving</td>
</tr>
<tr>
<td>Orchard Oriole</td>
<td>Improving*</td>
<td>-</td>
</tr>
<tr>
<td>Baltimore Oriole</td>
<td>Worsening*</td>
<td>x</td>
</tr>
<tr>
<td>Pine Grosbeak</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>House Finch</td>
<td>Worsening*</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Purple Finch</td>
<td>Potential extirpation</td>
<td>Stable</td>
</tr>
<tr>
<td>Red Crossbill</td>
<td>Potential extirpation*</td>
<td>x</td>
</tr>
<tr>
<td>White-winged Crossbill</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Common Redpoll</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Pine Siskin</td>
<td>Potential extirpation</td>
<td>Stable</td>
</tr>
<tr>
<td>American Goldfinch</td>
<td>Worsening</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>Evening Grosbeak</td>
<td>-</td>
<td>Potential extirpation</td>
</tr>
<tr>
<td>House Sparrow</td>
<td>x</td>
<td>Worsening</td>
</tr>
<tr>
<td>Eurasian Tree Sparrow</td>
<td>-</td>
<td>Potential colonization</td>
</tr>
</tbody>
</table>