The Partners in Flight

Avian Conservation Assessment Database Handbook

Version 2021

Partners in Flight Science Committee

Partners in Flight Technical Series No. 8.2

Revised May 2021

The Partners in Flight

Avian Conservation Assessment Database Handbook

Version 2021
May 2021

Arvind O. Panjabi[1] – Bird Conservancy of the Rockies
Wendy E. Easton – Canadian Wildlife Service, Environment and Climate Change Canada
Peter J. Blancher – Emeritus, Environment and Climate Change Canada
Allison E. Shaw – Bird Conservancy of the Rockies
Brad Andres – U.S. Fish and Wildlife Service
Carol J. Beardmore – Emerita, U.S. Fish and Wildlife Service
Alaine F. Camfield – Canadian Wildlife Service, Environment and Climate Change Canada
Dean W. Demarest – U.S. Fish and Wildlife Service
Randy Dettmers – U.S. Fish and Wildlife Service
Marcel A. Gahbauer – Canadian Wildlife Service, Environment and Climate Change Canada
Rebecca H. Keller – Appalachian Mountains Joint Venture`
Kenneth V. Rosenberg – Cornell Laboratory of Ornithology
Tom Will – U.S. Fish and Wildlife Service

and the Partners in Flight Science Committee

Suggested citation:

Panjabi[1], A.O., W.E. Easton, P.J. Blancher, A.E. Shaw, B.A. Andres, C.J. Beardmore, A.F. Camfield, D.W. Demarest, R. Dettmers, M.A. Gahbauer, R.H. Keller, K.V. Rosenberg, and T. Will. 2021. Avian Conservation Assessment Database Handbook, Version 2021. Partners in Flight Technical Series No. 8.2. http://pif.birdconservancy.org/acad.handbook.pdf.

[1] primary contact: arvind.panjabi@birdconservancy.org

Table of Contents

Background ... 4

Scope of ACAD ... 5

PART I. PIF ASSESSMENT FACTORS ... 8

Vulnerability Factors ... 8

Population Size (PS-g) ... *8*

Breeding and Non-breeding Distributions (BD-g and ND-g) ... *9*

Threats to Breeding (TB-c, TB-r) and Non-breeding (TN-c, TN-r) ... *10*

Population Trend (PT-c, PT-r) ... *15*

Area Importance Factors ... 17

Relative Density (RD) ... *17*

Percent of Population (%Pop) ... *19*

PART II. USING ASSESSMENT SCORES TO IDENTIFY SPECIES OF CONSERVATION IMPORTANCE ... 21

Species of Continental Importance ... 21

Watch List Species ... *21*

Common Birds in Steep Decline (CBSD) ... *22*

Species of Regional Importance ... 22

Designated due to Continental Importance in Region –2 Categories ... *23*

Designated due to Regional Importance – 3 Categories ... *23*

Using Species Assessment Data to Set Priorities for Action ... 24

Action Codes ... *25*

Conservation Urgency Metric ... *26*

Habitat and Geography ... 26

Avifaunal Biomes ... *27*

Habitats ... *32*

LITERATURE CITED ... 38

Appendix A. **Database Dictionary** ... 42

Appendix B: **Key to Data Sources** ... 48

Appendix C: **Changes Since Recent Versions of the Database** ... 74

Appendix D: **Assessment Regions** ... 77

Background

Partners in Flight (PIF) is a cooperative venture of federal, state, provincial and territorial agencies, industry, non-governmental organizations, researchers, and many others whose common goal is the conservation of North American birds. While PIF has traditionally focused primarily on landbirds, it works in conjunction with other bird partners to promote coordinated conservation of all birds, and now includes all North American bird species in its conservation status assessment database.

PIF follows an iterative, adaptive planning approach that develops a sound scientific basis for decision-making and a logical process for setting, implementing, and evaluating conservation objectives (Pashley et al. 2000, Rich et al. 2004, Berlanga et al. 2010). The steps include:

1. Assessing conservation vulnerability of all bird species;
2. Identifying species most in need of conservation attention at continental and regional scales;
3. Setting of numerical population objectives for species of continental and regional importance;
4. Identifying conservation needs and recommended actions for species and habitats of importance;
5. Implementing strategies for meeting species and habitat objectives at continental and regional scales; and
6. Evaluating success, making revisions, and setting new objectives for the future.

One of the principal tools supporting this approach is the Avian Conservation Assessment Database (ACAD). ACAD represents a compendium of raw data and derived scores intended to permit a consistent, transparent, and credible evaluation of the relative vulnerability of all North American birds—i.e., species assessment. Based on thresholds representing unique individual or aggregate vulnerabilities, information from ACAD is used to identify species most in need of conservation attention—i.e., species prioritization. ACAD supports these types of evaluations at regional (e.g., Bird Conservation Region, Joint Venture) as well as larger (e.g. continental) levels. ACAD is a joint product of PIF and other major North American bird initiatives including the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan.

The 2020 *Avian Conservation Assessment Database Handbook* documents the rationale, rules and scores underlying the species assessment and species prioritization processes that ACAD captures. As described herein, these processes were instrumental in supporting the *Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States* (Rosenberg et al. 2016) and *The State of North America's Birds 2016* (NABCI 2016). Previous versions of the handbook (Panjabi et al. 2001, 2005, 2012, 2017, 2019, 2020) document past iterations of ACAD, which supported other PIF applications including *Saving Our Shared Birds: Partners in Flight Tri-National Vision for Landbird Conservation* (Berlanga et al. 2010), and the *North American Landbird Conservation Plan* (Rich et al. 2004). All current and past ACAD scores, data sources, handbook versions, and other related information are maintained or archived by the Bird Conservancy of the Rockies. ACAD scores and data can be viewed online and downloaded as Excel files.

The handbook is presented in two principal sections. Part I details species assessment, the factors and scoring used by PIF to assess the vulnerability of species at continental and regional scales (i.e., step 1 of the planning approach above). Each assessment factor is based on biological criteria intended to evaluate distinct components of vulnerability throughout the annual cycle of each species. Part II describes species prioritization, the use of the factors and corresponding scores to highlight conservation importance (i.e., step 2 of the planning approach above). Both the scores and the process have evolved over time (Hunter et al. 1993; Carter et al. 2000; Panjabi et al. 2001, 2005, 2012, 2017) and have been updated in response to external review (Beissinger et al. 2000), broad partner expertise, and the emergence of new data and analytical tools (e.g. Rosenberg et al. 2019, Stanton et al. 2019).

Scope of ACAD

ACAD comprises assessment scores and associated data for nearly 1600 native and 20 entirely non-native bird species occurring in North America, defined as mainland, islands and waters of Canada south through Panama (excluding Greenland, the West Indies and Hawaii). Presence, taxonomy and nomenclature follow the American Ornithological Society (AOS) Checklist of North and Middle American Birds, 7th Edition, 60th supplement (Chesser et al. 2019).

ACAD treats only those species believed to be extant in the wild in North America. Likewise, for regional level assessments, ACAD only treats species determined to be extant within a given Bird Conservation Region (BCR). Because the underlying vulnerability assessment is rooted in characteristics (e.g. relative abundance, threats) that require a species be present to be evaluated, ACAD is not readily applicable to extinct or extirpated species. So, for example, ACAD does not treat Heath Hen (extinct), nor does it include Swallow-tailed Kite within the regional assessment for BCR 22 (where it is extirpated). However, it remains within PIF's general interests to recognize components of the historical North American avifauna that have been lost (regionally, or entirely) so as to not forget what is ultimately at stake as we work to conserve birds going forward. The following list comprises those native species omitted from ACAD on the basis of scientific consensus regarding their status as extinct or extirpated from the wild in North America:

Labrador Duck
Heath Hen
Atitlan Grebe
Passenger Pigeon
Great Auk
Guadalupe Storm-Petrel
Guadalupe Caracara
Carolina Parakeet
Slender-billed Grackle
Bachman's Warbler

We consulted AOS (Chesser et al. 2019; http://checklist.aou.org/taxa/) as the primary source for the above determinations, but other sources were consulted or a cumulative assessment of evidence was made in a few instances. For species where status remains somewhat equivocal, or where conservation programs continue to treat them as potentially extant, we erred on the side of caution, continuing to include them within ACAD (e.g. Socorro Dove, Eskimo Curlew).

In the regional ACAD assessments, determining whether to omit species from a given BCR on the basis of regional extirpation required a degree of judgement that a species was no longer present and that its exclusion would not jeopardize attention where it was truly warranted. In certain instances, this resulted in regional ACAD assessments retaining species that otherwise would not be considered extant. For example, although Swallow-tailed Kite is no longer believed to be a breeding species in BCR 24, it is included in the regional assessment for this BCR due to general conservation concern in the U.S. and recent prospects for breeding expansion into this portion of the former range. We do not provide here a summary of species determined to be regionally extirpated from specific BCRs, and instead refer users directly to ACAD.

Although ACAD has traditionally included approximately 20 Old World species that are clearly established as introduced (non-native) in North America (e.g. Ring-necked Pheasant), its emphasis is on the status of taxa native to North America. Assessment of native status can be confounded, however, in species that are native to a part of North America yet also are known or present potential to exist elsewhere on the continent as non-native "populations" resulting from human intervention (e.g. Muscovy Duck, Red-crowned Parrot). We did not attempt to decipher all such cases, but rather prioritized making appropriate distinctions where conservation implications seemed to clearly exist and warrant. For example, we did not address Muscovy Duck as a feral entity except to help ascertain the true status of native populations in regions where believed to be extant, and we treated Red-crowned Parrot as a native species in the U.S. due to uncertainty regarding origins of populations in Texas, which may include native birds from neighboring Tamaulipas.

Overview of the Species Assessment Process

Each species is assigned scores for 6 factors, assessing largely independent aspects of vulnerability: Population Size (PS), Breeding (BD) and Non-breeding Distribution (ND), Threats during Breeding (TB) and Non-breeding (TN) seasons, and Population Trend (PT). Each score reflects the degree of vulnerability for the species (i.e., risk of significant population decline, major extirpation or extinction) due to that factor, ranging from "1" for low to "5" for high vulnerability. Scores are combined in various ways to produce an overall assessment of vulnerability, determine Watch List status and identify other categories of concern.

PS, BD and ND are always scored at the global scale, as these vulnerabilities are defined by and inherent to the population as a whole. However, PT, TB and TN are scored at the continental scale and at regional scales (i.e. PT-r, TB-r, TN-r) to reflect "local" variability in trends and threats within a species' range. All regional scores in the USA and Canada presently use Bird Conservation Regions (BCRs) as the scoring unit. In Mexico and Central America, regional scores have been assigned at biome or country levels. See Appendix D for more information on assessment regions and recent changes to them.

To further depict local or regional conservation importance in the context of sustaining global/continental populations, PIF also provides two measures of "area importance" for each species in each region: 1) the density of the species relative to other regions, and 2) the percent of the species global population encompassed. This information helps emphasize the importance of local or regional conservation attention in core population areas and highlights regions with high *stewardship responsibility* for characteristic species. Area importance measures are currently only available for breeding-season avifaunas in each region, but these measures will be added for non-breeding avifaunas in the future.

PIF Vulnerability Factors:

Population Size (PS) assesses vulnerability due to the total number of adult individuals in the global population.

Distribution (BD/ND) assesses vulnerability due to the geographic extent of a species' range on a global scale, in breeding (BD) and non-breeding (ND) seasons.

Threats (TB/TN) assess vulnerability due to the effects of *current and probable future* extrinsic conditions that threaten the ability of North American populations to survive and successfully reproduce in breeding (TB) and to survive over the non-breeding season (TN).

Population Trend (PT) indicates vulnerability as reflected by the direction and magnitude of changes in North American population size since 1970.

PIF Area Importance Factors:

Relative Density (RD or RF) compares the relative density or frequency of reporting of a species amongst regions to highlight regions of highest numbers. It is independent of region size or absolute species abundance.

Percent of Population (%Pop) indicates the proportion of the global population of a species in the region and is influenced by the size of the region.

Steps 1 and 2 of the PIF planning approach encompass separate but related elements for identifying bird conservation needs at regional, continental and greater scales: status assessment and determining relative conservation importance. *Assessment* refers to the process of compiling and evaluating data on the biological vulnerability of each species using a standardized approach, whereas *determining level of conservation importance* describes the process for using these data to determine which individual species, species guilds, and habitats warrant attention, and at what level, in order to support PIF goals to maintain native birds in their natural numbers, natural habitats, and natural geographic ranges (Rich et al. 2004).

'*Prioritization*' is often mistakenly used as short-hand for step 2, but it is a more appropriate term applied to step 4 in the PIF planning process where action plans outline priorities for intervention based on biological criteria and may incorporate factors such as feasibility, cost-effectiveness, and political considerations along with the interests and capabilities of partners. Species are assessed for continental or regional conservation importance due to multiple biologically-based criteria, not all of which require immediate intervention. Although it is not the focus of the PIF Species Assessment Process and ACAD, they are valuable tools for setting conservation priorities based on sound, biologically-based information where all bird species are considered using equal and standardized criteria.

PART I. PIF ASSESSMENT FACTORS

Vulnerability Factors

Population Size (PS-g)

Population Size (PS-g) indicates vulnerability due to the total number of breeding-aged adult individuals in the global population. Evaluation of population size is based on the assumption that species with small breeding populations are more vulnerable to extirpation or extinction than species with large breeding populations.

PS-g Score	Criterion
1	Global breeding population ≥50,000,000
2	Global breeding population <50,000,000 and ≥5,000,000
3	Global breeding population <5,000,000 and ≥500,000
4	Global breeding population <500,000 and ≥50,000
5	Global breeding population <50,000

For landbird species occurring in Canada and the continental U.S., scores were assigned using population estimates derived primarily from count data collected by the North American Breeding Bird Survey (BBS) with adjustments for species detectability, then extrapolated to range size outside of BBS coverage (per Rosenberg and Blancher 2005); other data were used when appropriate (Rosenberg et al. 2016) with details in the *Handbook to the PIF Landbird Population Estimates Database* (Will et al. 2019). For the first time, these updated BBS-derived estimates include measures of uncertainty, as estimated by Stanton et al. (2019). For shorebirds, population estimates are mostly from the U.S. Shorebird Conservation Plan (2016), which is not limited to U.S. populations. Estimates for waterfowl are primarily from the *North American Waterfowl Management Plan* (NAWMP 2012, 2018), Wetlands International (2017), Conservation of Arctic Flora and Fauna International Secretariat (2018), or Birdlife International's Data Zone. Estimates for waterbird species are primarily from Birdlife International (2016), IUCN (IUCN 2016), Partners in Flight 2016 Central America Workshop, Rosenberg et al. 2019, Birds of North America (now integrated into Birds of the World), or Wetlands International (2017). For waterbirds and waterfowl, we multiplied estimates by 2/3 where it was likely they were based on non-breeding season surveys and thus represented total population (including adults and juveniles), as per instructions in the *Waterbird Population Estimates Database v.5* (Wetlands International 2017) to approximate breeding population size.

For species in Mexico and Central America where no population data were available, we assigned species to PS categories by converting the PS criteria in the table above into range-wide density criteria unique to each species based on the extent of its breeding distribution:

$$\text{PS-g criterion}_{\text{Density}} = \text{PS-g criterion / Area (km}^2\text{) of species' breeding range}$$

and then selected the most appropriate order-of magnitude PS-density category for each species, considering published estimates or expert knowledge of the species' density within suitable habitat, availability of habitat across the range and habitat plasticity within the species. (In some cases the geometric midpoint (2×10^x) of the range of population size within a PS category was assigned as the global population estimate, in which case the suffix "–PS-g midpoint" was added to the source field PS-g_s.) This process was also applied to familiar species with independent population estimates in order to compare PS-density categories among better-known species to the PS-density categories of the lesser known species.

Breeding and Non-breeding Distributions (BD-g and ND-g)

The breeding distribution (BD-g) and non-breeding distribution (ND-g) scores indicate a species' vulnerability due to the geographic extent of its range in either the breeding or non-breeding seasons separately. The underlying assumption is that species with narrowly distributed populations are more vulnerable to individual risks and threats than species with widely distributed populations, and that this vulnerability can vary seasonally as migratory populations re-distribute. Distribution scores are assessed at a global scale.

BD-g or ND-g Score	Criterion (Extent of Occurrence)
1	≥4,000,000 km^2
2	≥1,000,000 and <4,000,000 km^2
3	≥300,000 and <1,000,000 km^2
4	≥80,000 and <300,000 km^2
5	<80,000 km^2

Distribution scores reflect the areal extent of occurrence (km^2) of adult individuals during the breeding season (BD-g), and the analogous extent of occurrence of all individuals during the portion of the non-breeding season when birds are relatively sedentary (ND-g). For resident species with largely sedentary, year-round populations, BD and ND are the same and scored identically. BD-g and ND-g are calculated using digital range maps available from NatureServe (Ridgely et al. 2007) and Birdlife International (year specified in data source). Range maps were reviewed for accuracy by the international PIF Science Committee and other taxonomic experts, and adjusted based on other data sources or expert knowledge concerning species distributions. The scoring criteria for BD-g and ND-g are complementary to Extent of Occurrence (EOO) criteria applied by the IUCN

(2016) in their assessment of extinction risk for the IUCN Red List; the threshold for a PIF score of 5 (<80,000 km^2) is purposely set larger than the IUCN EOO threshold for 'Vulnerable' species (<20,000 km^2) in order to include a slightly broader suite of species in the top tier.

Both the breeding and non-breeding distribution scoring categories were developed primarily with landbirds in mind, but have been applied equally to all species distributed across the continental land masses of the planet. Seabirds nesting primarily on widespread oceanic islands require a slightly different approach due to the small areas occupied during the breeding season relative to their overall range extent including foraging areas. Although BD-g and ND-g do not attempt to measure habitat or portion of range occupied (they are coarse measures of range extent during the respective seasons), additional consideration can be given to the number and geographic distribution of nesting sites with the breeding ranges of island nesting seabirds when assigning BD scores. More work is needed in this area to refine rulesets.

Threats to Breeding (TB-c, TB-r) and Non-breeding (TN-c, TN-r)

Threats to breeding and non-breeding are scored separately and assess vulnerability due to the effects of current and probable future extrinsic conditions that threaten the ability of populations to survive and successfully reproduce during the breeding season (TB) or to survive over the non-breeding season (TN). The "continental" (in lieu of global) frame of reference for TB-c and TN-c reflects the intent to consider threats faced by populations relevant to North America only (i.e. Panama and north). Thus, for the majority of species, TB-c considers threats occurring to populations within their breeding range in North America, and TN-c considers threats faced by these same populations throughout their entire non-breeding range. For oceanic seabirds, the relationship gets complicated, but the intent is to emphasize threats (breeding and non-breeding seasons) to the population segments that spend time in North America.

Threats are also scored regionally for species breeding (TB-r) or remaining in North America between breeding seasons (TN-r). Here the logic is similar to that described above for TB-c and TN-c, but the frame of reference for evaluating threats becomes those populations relevant to the regional unit (e.g. BCR, biome). We used the same criteria and thresholds to score continental and regional threats. Absent any evidence that regional threats differ from those evaluated continentally, the continental scores were adopted.

Evaluation of TB includes threats to breeding habitats, as well as other factors that interfere with reproduction (e.g., competition with exotic species) or survival (e.g., predators). Evaluation of TN includes threats to habitat as well as other factors affecting survival outside the breeding season. Migration season threats are included, especially for birds facing significant known threats at critical migration concentration sites (e.g., many shorebirds). For most birds and especially landbirds, TN largely considers threats faced during the portion of the non-breeding season where birds are relatively sedentary (i.e. "temperate winter").

To score threats, an assessment is made regarding the expected change in the suitability of breeding or non-breeding conditions necessary for maintaining healthy populations of a species over the next 30 years. Threats are defined as any extrinsic factor that reduces the likelihood of the persistence of a population, and can include predation, poaching, parasitism, poisoning from pesticides or other environmental contaminants, habitat fragmentation/deterioration/loss, hybridization, collisions with power lines or other hazards, predicted impacts of climate change or any other factor that reduces the suitability of breeding or non-breeding conditions.

Threats scores for U.S. and Canadian birds were assigned by members of the PIF Science Committee, with review and input from other formal and informal regional or taxonomic working groups, such as the (Trial) Unified Science Team of the U.S. Joint Ventures, the NAWMP National Science Support Team, the Sea Duck Joint Venture, the Waterbird Working Group, and the U.S. Shorebird Conservation Partnership. Sources of all data and scores are maintained in the database. In Mexico and Central America, threat scores for all birds were assigning by taxonomic experts in various national and regional workshops with a facilitator trained in PIF assessment to ensure calibration and consistency in scoring. Although threat scores are the most subjective of the species assessment criteria, the scoring thresholds are robust, and individual scores are calibrated among taxa and across geographic scales within species to promote consistency among species and regions facing similar threats. In practice, PIF has found close agreement among experts on the most appropriate threat scores.

The categorical variables TB-c and TN-c were assigned by placing each species into one of the broad, relative threats categories in the table below. For a species to be given a particular score, it must meet the relevant definition and at least one of the associated scenarios. Although not quantified explicitly, the scope (i.e., proportion of population affected), severity, and timing of threats are implicit considerations in evaluation of threats and assignment of scores. For a species to be assigned a given score, one or more of the example conditions listed *must actually be significantly affecting a majority of the species' population at present, or be expected to do so within the next 30 years*. In other words, simply being *susceptible* to threats, without actually being affected by such threats in the foreseeable future, is not enough to warrant a high threat score.

TB or TN Score	Definition	Scenarios	Examples
1	Future conditions for breeding (TB) or non-breeding (TN) populations are expected to significantly improve for the majority of the population.	Species that benefit substantially from human activity such as habitat fragmentation, urbanization, bird-feeding, etc.	Canada Goose (*Branta canadensis*), American Crow (*Corvus brachyrhynchos*), American Robin (*Turdus migratorius*), European Starling (*Sturnus vulgaris*), American Goldfinch (*Spinus tristis*).

TB or TN Score	Definition	Scenarios	Examples
2	Future conditions for breeding (TB) or non-breeding (TN) populations are expected to remain stable; no significant threats.	a) no known threats of major significance to population or habitats b) species relatively tolerant of future changes likely to result from human activities or land-use trends (i.e., breeds or survives in altered landscapes, c) potential threats exist, but management or conservation activities have stabilized or increased populations d) threats are assumed to be low	a) Spruce Grouse (*Falcipennis canadensis*), Common Merganser (*Mergus merganser*), Greater Roadrunner (*Geococcyx californianus*), Ruddy Turnstone (*Arenaria intepris*). b) Mallard (*Anas platyrhychos*), Gambel's Quail (*Callipela gambelli*), Song Sparrow (*Melospiza melodia*). c) Wood Duck (*Aix sponsa*), Osprey (*Pandion haliaetus*), Great Blue Heron (*Ardea herodias*), Eastern Bluebird (*Sialia sialia*). d) Ruby-throated Hummingbird (*Archilochus colubris*)

3	Slight to moderate decline in the future suitability of breeding (TB) or non-breeding (TN) conditions is expected for the majority of the population. This is a broad category that implies anything amounting to "moderate threats."	a) Moderately vulnerable to human activities and land-use trends, with increased human activity expected b) does not occur in highly altered landscapes, with some expectation of increased landscape alteration within breeding or non-breeding range c) area-sensitive species, or sensitive to habitat fragmentation (with fragmentation expected to increase within the area for which scores are being assigned) d) relatively specialized on sensitive habitats (e.g., native grasslands) or successional stages that are limiting populations, or expected to become limiting, due to human activity or natural changes e) requires relatively specialized conditions within habitats that are limiting populations, or expected to become limiting, due to human activity or natural changes f) relatively sensitive to biotic factors that are being exacerbated by human activities, such as cowbird parasitism, predation, overgrazing, climate change, and other phenomena that are limiting populations g) demographic factors (low productivity, single-brooded) may contribute to limiting populations, especially when combined with other threats h) concentration or coloniality increases vulnerability to otherwise minor threats i) threats potentially increasing if present trends/conditions continue	a) American Avocet (*Recurvirostra americana*), Common Tern (*Sterna hirundo*), American Kestrel (*Falco sparverius*), Brown-headed Nuthatch (*Sitta pusilla*). b) Blue-winged Teal (*Spatula discors*), Eastern Whip-poor-will (*Antrostomus vociferous*). c) White-tailed Ptarmigan (*Lagopus leucura*), Audubon's Oriole (*Icterus graduacauda*). d) Eastern Meadowlark (*Sturnella magna*), American Woodcock (*Scolopax minor*), Blue-winged Warbler (*Vermivora cyanoptera*). e) Vaux's Swift (*Chaetura vauxi*). f) Lazuli Bunting (*Passerina amoena*), Wood Thrush (*Hylocichla mustelina*), Brewer's Sparrow (*Spizella breweri*), Verdin (*Auriparus flaviceps*). g) Some seabirds (e.g. Short-tailed Albatross [*Phoebastria albatrus*]). h) Aleutian Tern (*Onychoprion aleuticus*). i) Clark's Nutcracker (*Nucifraga columbiana*).

TB or TN Score	Definition	Scenarios	Examples
4	Severe deterioration in the future suitability of breeding (TB) or non-breeding (TN) conditions is expected to significantly affect a majority of the population. This is essentially a "high threats" category, with basically more severe versions of the above list for TB =3, but for species that are not quite in danger of extinction or extirpation from significant portions of range (TB =5).	a) highly vulnerable to human activities and land-use trends, with increased human activity expected b) highly area sensitive or intolerant of fragmentation (with fragmentation a significant factor within the area for which scores are being assigned) c) highly specialized/dependent on sensitive or undisturbed habitats (e.g., old-growth forest, upper margins of saltmarsh, etc.) that are in short supply, are under threat, or expected to come under threat d) extremely specialized on specific conditions within a habitat (e.g., requires large snags or specific water conditions) that are in short supply, under threat, or expected to decrease in availability e) biotic factors (parasitism, hybridization) currently are having or are expected to have a strong adverse effect on a majority of the breeding population f) concentration or coloniality leads to high vulnerability g) population highly likely to decline and may be in danger of major range contraction if threats continue	a) Grasshopper Sparrow (*Ammodramus savannarum*). b) Swallow-tailed Kite (*Elanoides forficatus*). c) Bachman's Sparrow (*Peucaea aestivalis*), Seaside Sparrow (*Ammospiza maritima*). d) Spotted Owl (*Strix occidentalis*), American Flamingo (*Phoenicopterus ruber*). e) Mottled Duck (*Anas fulvigula*). f) Red Knot (*Calidris canutus*). g) Bell's Vireo (*Vireo bellii]*).

TB or TN Score	Definition	Scenarios	Examples
5	Extreme deterioration in the future suitability of breeding (TB-c) or non-breeding (TN-c) conditions is expected.	a) Species that are in danger of extinction b) Species that are at risk of extirpation from substantial portions of range within the area for which scores are being assigned c) Species with a low probability of successful reintroduction across a substantial former range.	a) Saltmarsh Sparrow (*Ammospiza caudacuta*). b) Black Rail (*Laterallus jamaicensis*). c) Aplomado Falcon (*Falco femoralis*) in the Chihuahuan Desert region.

Note: derivation of threat scores differs from that described in Carter et al. (2000) in that past conditions are no longer considered and a semi-quantitative matrix of conditions has been abandoned in favor of the more descriptive list of scenarios shown above.

Population Trend (PT-c, PT-r)

Population trend indicates vulnerability due to the direction and magnitude of recent changes in population size. Like the threat scores, population trend scores reflect trends for North American populations only, even for species with ranges that extend beyond the continent. We scored median population trend for a species across the North American continent (PT-c) and within each region (PT-r). Species declining by 50% or more since 1970 are considered most vulnerable, whereas species with increasing trends over this period are least vulnerable. In contrast to previous PIF assessments, historical trends are no longer considered.

For U.S. and Canadian landbirds, we used the BBS as the primary source of trends. However, we also used Christmas Bird Count (CBC) or other specialized data sources where these are the best available breeding or non-breeding data for North American bird population trends. For shorebirds and waterbirds, taxonomic experts considered a variety of surveys and analyses, ranging from BBS and CBC to the International Shorebird Survey (https://www.manomet.org/iss-focal-site-prism-background-information) and others. For waterfowl, experts evaluated trends from several surveys including the U.S. Fish and Wildlife Service (USFWS) mid-continent waterfowl survey (USFWS 2016), BBS and CBC, and selected the most suitable survey for each species. In Mexico and Central America, where population trend data are lacking for nearly all species, scores for PT were assigned by consensus during workshops involving dozens of ornithologists and other wildlife experts using surrogate data on land cover trends combined with expert knowledge of the species' affinity for certain land cover types and conditions in order to assess population trends. This process included land cover trend data from CONAFOR in Mexico (www.cnf.gob.mx:8090/snif/portal/infys), and from CATHALAC in Central America (www.cathalac.int/) and forest cover data from Global Forest Watch (2016) (www.globalforestwatch.org/), combined with expert knowledge of the birds and lands in question. Where empirical data did not exist, population trends scores were assigned by expert opinion, using the qualitative definitions below as guidelines.

In this update, we considered BBS trends from a special analysis provided by John Sauer of USGS (personal communication, 2018) that differs from that presented on the BBS website (https://www.mbr-pwrc.usgs.gov/bbs/). Whereas the published BBS analysis uses the end points of the trend period to determine the overall trend, the PIF analysis applies a linear fit to the log-scale annual abundance indices, thus diminishing the influence of the end points and providing greater stability in trend scores across updates.

A similar custom linear fit CBC analysis (Meehan et al. 2018) was utilized where abundance trend is calculated for each species as the geometric-mean rate of change in the abundance index between two time points, 1970 and 2017. Calculation methods for a PIF trend are different from those described in Soykan et al. (2016) in that, in the latter case, start and end abundance indices are the actual hierarchical model predictions, whereas in the former case, start and end abundance indices are fitted values from a linear regression of the full time series of hierarchical model predictions.

We analyzed a linear fit analysis of the period of BBS data of 1970-2015 for the regional trend score (PT-r) of most birds where the BBS survey covered their core distribution. However for a handful of species in BCRs 2 and 4, we used the expanded BBS dataset spanning 1993-2017 to take advantage of the BBS expansion in Alaska, Yukon Territory, Northwest Territories, Newfoundland and Labrador. Here we used the endpoint analysis, as a linear fit analysis was not available.

For the continental trend score (PT-c), linear fit BBS trends from 1970-2017 were analyzed for most birds. We chose 1970 as the starting date over 1966 used in previous PIF population trend assessments due to relatively poor geographic coverage of BBS data collected during the first few years of the survey. Expanded BBS from 1993-2017 was used for several northern breeders, and at this continental scale, a linear fit analysis was used. CBC continental trends were calculated over the period 1970-2017. USFWS waterfowl trends were estimated from 1970-2016. International Shorebird Survey trends were estimated from 1974-2014. Other trend sources varied in the years of data available but the years used are specified in the trend source field (e.g. CAFF6116 spans from 1961 to 2016).

To standardize species' comparisons, we converted annual rates of population change to total change over the period of 1970 to the most recent year available, by extrapolating the annual rate to all years (ΔN= (1+AnnTr)^nYrs-1). PT scores were determined based on total population size change since 1970, and the precision and reliability of the annual trend estimate as presented in the table below.

PT Scores and Criteria					
% total population change	90% CI excludes 0 (P ≤ 0.1) and df ≥ 14	67% CI excludes 0 (P ≤ 0.33) and df = 6-13	67% CI excludes 0, 90% CI includes 0 (0.1 < P ≤ 0.33) and df ≥ 14	67% CI includes 0 (P > 0.33) and Trend is Reliable	67% CI includes 0 (P > 0.33) and Trend is Not Reliable
≤ -50%	5	4	4	3	3
-50% to -15%	4	4	4	3	3
-15% to 0%	3	3	3	2	3
0% to +50%	2	3	2	2	3
≥ +50%	1	2	2	2	3

Details on PT Scores. CI = credible interval for annual trend estimate used to calculate % total population change over the period of consideration. Criteria for degrees of freedom (df) were defined for BBS and CBC analyses and may differ for other data sources.

All of the following criteria must be met for a trend to be considered "Reliable" in the 2 columns at right:
1. Trend Precision: 90% Credible Interval ≤ 3%/yr above or below trend
2. Sample size: degrees of freedom ≥ 14 (for BBS and CBC, df = # of Routes/Circles – # of Strata – 1)
3. Count Abundance: Average count ≥ 0.1

Species for which trend direction and magnitude are both uncertain, either because of highly variable data or poor sample size (df < 6), receive a score of 3 and the source "insufficient data." This intermediate score is assigned on the reasoning that uncertain trends should invoke more concern than stable trends (for which PT = 2). Any species with a PT score of 3 because of an uncertain trend is reviewed by experts to determine if a more appropriate score can be assigned.

In the absence of long-term, quantitative, species-specific trend data, PT scores can be assigned using the qualitative descriptions provided below using the same timeframe (1970-present).

PT score	Qualitative description
1	Significant large increase
2	Significant small increase Possible increase Stable
3	Uncertain population change Possible small decrease Significant small decrease
4	Moderate decrease Possible large decrease
5	Significant large decrease

Area Importance Factors

The assessment factors described above are all indicators of a species' *vulnerability*. However, species are not distributed evenly over the continent, and using vulnerability alone to identify species of conservation interest will produce regional lists that include many species at the periphery of their range. Given the limited resources for conservation, the large number of competing needs among species, and the need to coordinate actions across broad scales, the PIF regional assessment process gives additional weight to species in areas supporting core populations, where the ecological importance and likelihood of success are greatest. PIF includes two additional criteria in the regional assessment process, which reflect the importance of the area of interest to each species.

Relative Density (RD)

Relative density (RD) scores reflect the mean density of a species within a given region (e.g., a BCR) relative to density in the single region in which the species occurs in its highest density. The underlying assumption of this score is that conservation action taken in regions where the species occurs in highest density will affect the largest number of birds per unit area. Because the score is one of *relative* density, it is unaffected by the size of the region or the absolute density of the species. For species that are extirpated (ER) or nearing extirpation (NE) from a region, letter codes may be assigned in lieu of an RD score to ensure they are not overlooked in conservation planning. Species that occur in the region outside of the breeding season receive a non-breeding code (NB).

Scores in the current database are for the breeding season only (RD-b), but non-breeding scores (RD-n) will be added soon. RD-b scores for most species were derived from BBS raw data from the period 2005-2014 (Pardieck et al. 2015), based on the mean birds/route/year within the region vs. the same measure in other comparable regions. Other sources of data and expert opinion were used for species with few range-wide abundance data. In particular, eBird relative frequency data for the month of June & 1st week of July period (eBird 2017) were used to estimate relative density for many species with poor abundance data. A comparison of BBS relative density vs. eBird relative frequency for birds with at least 90% of population covered well by both BBS and eBird found very good correspondence and was used to estimate equivalent criteria for RD scores based on eBird frequencies (see table below). eBird relative frequency data were also used to adjust RD values where the region with maximum eBird frequency for the species was outside of BBS coverage, e.g., for a species with highest density outside of North America. In those cases, BBS-based relative abundances within continental U.S. and Canada were adjusted downward by the ratio of eBird maximum frequency in all regions versus eBird maximum frequency in continental U.S. and Canada.

Scoring by expert opinion was also an option for species judged to be poorly sampled by both BBS and eBird – this scoring was based on estimation of mean density across entire BCRs (including both suitable and unsuitable areas), to make scores comparable to those based on BBS and eBird data.

RD-b score	Quantitative definitions		Equivalent qualitative definition
	Relative abundance data (BBS etc)	**Relative frequency data** (eBird)*	
P/0		BCR relative frequency < 1.5% of the maximum relative frequency	Peripheral: has bred only irregularly, or strong evidence of regular breeding is lacking
1	BCR relative abundance < 1% of the maximum relative abundance	BCR relative frequency 1.5-3.6% of maximum relative frequency	Breeds regularly but in very small numbers or in only a very small part of the region in question
2	BCR relative abundance 1-10% of maximum relative abundance	BCR relative frequency 3.6-21.7% of maximum relative frequency	Breeds in low mean abundance relative to the region(s) in which the species occurs in maximum density
3	BCR relative abundance 10-25% of maximum relative abundance	BCR relative frequency 21.7-44.6% of maximum relative frequency	Breeds in moderate mean abundance relative to the region(s) in which the species occurs in maximum density
4	BCR relative abundance 25-50% of maximum relative abundance	BCR relative frequency 44.6-68.1% of maximum relative frequency	Breeds in moderately high mean abundance relative to the region(s) in which the species occurs in maximum density
5	BCR relative abundance > 50% of maximum relative abundance	BCR relative frequency > 68.1% of maximum relative frequency	Breeds in high mean abundance, similar to the region(s) in which the species occurs in maximum density

* relative frequency criteria are those that best mirrored relative abundance criteria, based on a comparison of BBS relative abundance (2005-2014 data) vs eBird relative frequency (1970-2016 data) for 224 landbirds with at least 90% of global population in U.S./Canada excluding poorly covered regions (BCRs 1, 2, 3 and 7); Maximum relative frequencies included regions outside of North America, with regions typically being countries, sometimes split into groups of BCRs (Mexico) or states (Brazil, Australia) within a country, sometimes amalgamations of countries when country sample sizes were small (e.g., Lesser Antilles in Caribbean was treated as a single region).

Percent of Population (%Pop)

Percent of Population (%Pop) values reflect the proportion of the global population of a species that is contained within a region during a given season. Currently, %Pop values are available only for species breeding in Canada and the continental USA. Values for the non-breeding season will be added later. The underlying assumption of this value (a continuous variable, unlike the scores discussed thus far) is that regions with high proportions of a species' global population have a high responsibility for the species as a whole, and actions taken in those regions will affect the largest number of that species. Unlike RD, %Pop is influenced by the size of a region (e.g. BCR). Thus, large regions may have high population percentages but relatively low densities, or vice versa. Percent of population complements the relative density score[1].

For species with regional and global population estimates calculated in the same way, %Pop is simply the regional population estimate divided by the global population estimate. Since this is a relative measure, relative abundances can also be used if population estimates are not available. For example, for a species sampled by the BBS, relative abundance (mean birds/route/year) is calculated for each BCR. This value is multiplied by the size of the BCR (km^2), and the area-weighted value is then divided by the sum of area-weighted values from all the BCRs in which the species occurs. The concept is as follows:

$$\text{Pct\_POP}_{(\text{Region})} = \frac{\text{Relative Abundance}_{(\text{Region})} \times \text{Region Area (km}^2)}{\sum_{(\text{All regions})} (\text{Relative Abundance}_{(\text{Region})} \times \text{Region Area})}$$

BCRs are broken down into individual state, province, and territory portions of BCRs before applying the above formula, and results from these geo-political regions are then summed up to full BCR %Pop.

Additional sources of population data beyond the data source cited for RD-b were used to estimate %Pop when this data source did not provide sufficient geographic coverage for the full range of the species. For example, checklist counts were combined with Breeding Bird Census data in arctic Canada, Rich et al. 2004. eBird frequencies per region were weighted by region size to approximate %Pops per Region (%Frequencies) for species with poor BBS data or for regions without BBS data. Note that eBird proportions outside the Western Hemisphere were replaced with other values, such as percent of range as a surrogate for %Pop, where the geographic area had poor eBird coverage (e.g. Asia).

Even if BBS greatly underestimates the absolute abundance of a species, relative abundance values and %Pop estimates should be valid as long as the detectability of a species on BBS routes is reasonably constant across the species' range. The percentage of population based on BBS is more questionable for species occupying very patchy habitats (e.g., wetlands) in regions where BBS routes do not adequately sample these habitats, or where BBS sampling is limited to only a small part of the area of interest, or for species not well detected by the BBS protocol, e.g. nocturnal species. However, compared with trend estimates, relative abundance (and subsequent %Pop) estimates are not as sensitive to problems of low detection rate along routes.

Estimates of %Pop may differ between the ACAD and PIF Population Estimates Database (PED). The main reason for this discrepancy is that in the ACAD Regionals, we relied more on eBird frequencies within USA/Canada for species poorly detected by BBS surveys, thereby providing data in many more regions than was possible using only BBS in the PED. We also used the decade 2005–2014 to calculate %Pop in the Regional ACAD vs. 2006–2015 for Version 3.0 of the PED. In the ACAD, %Population and Relative Density (RD) are used at the Regional scale to indicate conservation responsibility. When the source in the ACAD for RD and %Pop in a BCR was BBS, differences in %Pop

[1] If an RD score disagrees with a %Pop (e.g., where there is an RD value but no %Pop), users should rely on the RD score (the latter were reviewed by regional experts and sometimes revised, whereas %Pop scores have not been thoroughly reviewed).

between ACAD and PED are minor; when the source in ACAD was eBird, then the differences in % values may be more substantial.

For a few poorly surveyed species (e.g., some seabirds) in remote regions lacking quantitative %Pop estimates, PIF has assigned a %Pop of >25% where additional information suggests the species may have at least 25% of its global population in that region. These instances have no %Pop value displayed, but include a source of "PIFSC-19-%Pop".

PART II. USING THE ASSESSMENT SCORES TO IDENTIFY SPECIES OF CONSERVATION IMPORTANCE

Since its inception, PIF has explored various means of combining assessment scores to highlight the current vulnerability and stewardship responsibility of species and their habitats. It is a pro-active approach to bird conservation where we move to highlight and address the threats and needs of both well-dispersed species and those with limited, smaller populations across their full life-cycle and before they become endangered or species at risk.

Species of Continental Importance

PIF recognizes several categories of species of continental conservation importance. The U.S.-Canada 'Watch List' was established in the North American Landbird Conservation Plan (Rich et al. 2004. Panjabi et al. 2005). 'Common Birds in Steep Decline' was established in *Saving Our Shared Birds: a Tri-National Vision for Landbird Conservation* (Berlanga et al. 2010). Both of these categories are retained in the current ACAD, whereas the 'U.S.-Canada Continental Stewardship' species (Rich et al. 2004) and 'Tri-National Concern' species (Berlanga et al. 2010) are archived. Here we update the Watch List and the list of Common Birds in Steep Decline, expand their scope to encompass all North and Central American birds, and differentiate between causes of concern among species. Together the species on these two lists reflect a diversity of reasons for recognizing continental importance, including high vulnerability, high stewardship responsibility, steep declines and high threats. This diversity of reasons for conservation importance reflects the large shared avifauna across a large continent and Partners in Flight's mission of helping species at risk, keeping common birds common, and engaging in voluntary partnerships to implement bird conservation.

Watch List Species

The Watch List comprises extant species of greatest conservation concern and includes those most vulnerable due to a combination of small and declining populations, limited distributions, and high threats throughout their ranges. Some of these species are already recognized as Threatened or Endangered at federal levels.

To determine which species are most vulnerable, we summed global scores pertinent to each season to arrive at Combined Scores for breeding (CCS-b) and non-breeding (CCS-n) seasons, as follows:

Combined Score for breeding (CCS-b) = TB-c + BD-g + PT-c + PS-g

Combined Score for non-breeding (CCS-n) = TN-c + ND-g + PT-c + PS-g

The overall Maximum Combined Score (CCS-max) for each species is simply the larger of the two seasonal combined scores:

Maximum Combined Score (CCS-max) = maximum of CCS-b or CCS-n

The Maximum Combined Score can range from 4 for a widespread, numerous, and increasing species which is expected to face even more favorable conditions in the future to 20 for a species of the very highest conservation concern. Species were included in the Watch List if they had a Maximum Combined Score ≥ 14, or 13 in combination with PT-c = 5. Species that meet these thresholds are considered to exhibit high vulnerability across multiple factors. We categorized species on the Watch List into three groups to help provide some understanding regarding why they are species of conservation concern:

Red Watch List: *Highly vulnerable and in urgent need of special attention.*
Maximum Combined Score > 16 OR
Maximum Combined Score = 16 AND [PT-c + (Maximum of TB-c or TN-c) = 9 or 10]

Yellow Watch List "R": *Range restricted and small populations in need of constant care.*
On Watch List but not considered Red AND have either:
[PS-g + (Maximum of BD-g or ND-g) > PT-c + (Maximum of TB-c or TN-c)] OR
[PS-g + (Maximum of BD-g or ND-g) = PT-c + (Maximum of TB-c or TN-c) AND PT-c <5]

Yellow Watch List "D": *Steep declines and major threats.*
On Watch List but not considered Red AND have either:
[PT-c + (Maximum of TB-c or TN-c) > PS-g + (Maximum of BD-g or ND-g)] OR
[PT-c + (Maximum of TB-c or TN-c) = PS-g + (Maximum of BD-g or ND-g) AND PT-c = 5]

Common Birds in Steep Decline (CBSD)

PIF also highlights a list of Common Birds in Steep Decline. While these birds do not exhibit broad levels of vulnerability warranting Watch List designation, their populations have declined continentally by an estimated 50% or more since 1970. Together these Common Birds in Steep Decline have lost roughly a billion or more breeding birds during this period, raising concern for the vital ecosystem services that they provide. Species in this category are native species not on the Watch List, but with PT-c = 5.

Species of Regional Importance

Species of Continental Importance should receive appropriate conservation attention within regions where significant populations occur, but these are not the only species that regional planners should consider. Many species that have moderate or even low Combined Scores may be declining steeply within certain regions, or face higher threats than elsewhere. Species that are concentrated within a region also merit stewardship, even if they are not Watch List Species. Here we describe the categories of species that PIF considers to be important at the regional scale and how those are determined. Note that the area importance criteria, RD and %Pop, are used in various ways to help define these groups.

Designated due to Continental Importance in Region –2 Categories

A) Watch List: Species must meet all of the following criteria:

- Meet criteria for PIF Watch List (see above)
- Occur regularly in the region, i.e., RD > 0
- Future conditions are not expected to improve, i.e., Threat Score > 1

B) Common Birds in Steep Decline (CBSD): species must meet all of the following criteria:

- Meet criteria for Common Bird in Steep Decline (see above, also Rosenberg et al. 2016)
- Occur regularly in significant numbers in the BCR, i.e., RD > 1

Designated due to Regional Importance – 3 Categories

Regional Combined Scores (RCS) are calculated for each species according to which season(s) they are present in the region with RD>0. The formulae include a mix of global and regional scores pertinent to each season. The Regional Combined Score for the breeding season (RCS-b) is a simple total of 5 scores:

RCS-b = BD-g + PS-g + PT-r + TB-r + RD-b

Note that RD-b has not yet been scored within Central America and therefore RCS-b has not been calculated for Central American regions.

Regional Combined Scores for non-breeding residents (RCS-n, soon to be added to the database) are calculated by replacing breeding season values with non-breeding values:

RCS-n = ND-g + PS-g + PT-c + TN-r + RD-n

An exception is made for permanent, non-migratory residents in the region; breeding season trends and RD scores are retained in the calculation of the Regional Combined Scores for the non-breeding season for these species, as their scores should not change seasonally:

RCS-n (for permanent residents) = ND-g + PS-g + PT-r + TN-r + RD-b

Future versions of the database will include a column indicating seasonal residency status. As more non-breeding information becomes available, for instance where regional trends from Christmas Bird Counts are available, or where RD values are calculated for migratory periods, these will be used to refine non-breeding Regional Combined Scores.

Regional Combined Scores for each season can range from 5 to 25. Note that the Regional Combined Scores differ from the Continental Combined Scores in that they incorporate an area importance score (RD). Regional scores therefore include an element of stewardship responsibility, giving greater weight to those species in a group of equal vulnerability that are also concentrated in the planning region.

The three categories of Regional Importance are:

C) Regional Concern (RC): Species must meet all criteria in the seasons for which they are listed:

- Regional Combined Score > 13
- High Regional Threats (> 3), or Moderate Regional Threats (3) combined with moderate or large regional population declines (PT-r > 3)
- Occur regularly in significant numbers in the BCR, i.e., RD > 0
- Native to North America (not "Introduced" as listed in AOS checklist)

D) Regional Stewardship (RS) – species must meet all criteria in the season(s) for which they are listed:

- High importance of the BCR to the species; %Pop> 25%
- Future conditions are not expected to improve, i.e., TB-r or TN-r > 1
- Native to North America (not "Introduced" as listed in AOS checklist)

E) Near Extirpated (NE) or Extirpated (ER) – assigned by regional reviewers

- Native species assigned 'NE' or 'ER' instead of a numeric RD score

Note that Continental Importance in Region, Regional Concern, Regional Stewardship, and Near Extirpated/Extirpated designations have not been applied to Central American regions because RD-b scores, %Pop estimates, and NE/ER designations are not available yet.

For Mexican regions, %Pop estimates are not yet available so species have not been assigned Regional Stewardship designations. The option of scoring RD as NE/ER was not considered during the 2005 Mexican Regional Assessment, so species do not qualify for Regional Importance via category E.

For USA/Mexico cross-border BCRs, the assignment of Regional Stewardship status is likely inaccurate because Mexico-only species lack the %Pop estimates needed to assess Regional Stewardship so can't qualify (so false negatives), and the %Pop estimates for species present in the USA are only based only on the US side of the border which may be different from the %Pop of the BCR as a whole (so false negatives or positives).

It is critical to note that while many species of conservation importance require immediate conservation effort, not every species highlighted from the assessment process should receive the same level of management attention or conservation action in every region. A few species are highlighted, at least in part, because of their relatively high concentration in a region and may be quite common and abundant. These species of "stewardship responsibility" are often missed when assessments consider only local conditions without the context of the global criteria. Partners in Flight identifies these species to support these birds, characteristic of a region, staying common.

Using Species Assessment Data to Set Priorities for Action

While conservation assessment and planning happens at international, national and ecoregional scales, action is best taken locally by those who know how the lands, water, human, and natural communities will respond. The PIF Avian Conservation Assessment Database (https://pif.birdconservancy.org/avian-conservation-assessment-database) contains all BCR scores for categories A-E above and can be used to generate a pool of regionally important species based on uniformly applied biological criteria. Regional planners may wish to add certain species to the pool, such as listed species at risk, species of cultural significance or economically important species (such as hunted species or targets of eco-tourism and birders) that do not meet the PIF criteria for a particular region. While these additional species should not be the main targets of regional conservation plans, their needs may often be addressed simultaneously with those of the regionally important species if all are considered together during conservation planning.

Action Codes

Additional information derived from biologically based criteria can be used to provide some guidance on priorities for taking action. For example, the PIF tables for preliminary BCR pools of important species also include codes for general categories of action most needed for improving or maintaining current population status of each species, defined from the PIF scores as described below.

CR (Critical Recovery)	Regional Concern species[2] subject to very high regional threats (TB-r or TN-r=5). Critical recovery actions are needed to prevent likely extirpation or to reintroduce a species that has been extirpated.
IM (Immediate Management)	Regional Concern species[2] subject to high regional threats (TB-r or TN-r =4) combined with a large population decline (PT-r=5). Conservation action is needed to reverse or stabilize significant, long-term population declines in species where lack of action may put species at risk of extirpation.
MA (Management Attention)	Regional Concern species[2] with moderate threats (TB-r or TN-r =3) and undergoing moderate to large declines (PT-r=4 or 5), OR has high regional threats (TB-r or TN-r =4) but no large decline (PT-r<5). Management or other on-the-ground conservation actions are needed to reverse or stabilize significant, long-term population declines where threats are moderate, or to reverse high threats in species that are not currently experiencing steep long-term declines.
PR (Planning and Responsibility)	Species of Continental Importance but not Regional Concern[2], OR Regional Stewardship[3] species that are neither of Continental Importance nor Regional Concern. Long-term planning actions are needed to ensure that sustainable populations are maintained in regions with high responsibility for these species. Actions often target many species at once, for example long-term multi-species monitoring programs, or broad plans/programs targeting suites of species sharing a habitat.

[2] Many species of Continental Importance that occur in a BCR may also qualify as species of regional concern.

[3] Species may not qualify for the PR action code via Regional Stewardship designation in Mexican regions, qualifying only through Continental Importance status, because of the present lack of %Pop data to designate regions for Regional Stewardship of a species.

These codes indicate that not all species require immediate conservation attention, even though they may appear high on the BCR list, and for some species it may be sufficient to continue monitoring or periodic assessment to ensure that populations remain stable. Other species require more direct conservation action to identify and remedy factors causing population declines or limiting population growth. Sorting the pool of species by action codes can help planners identify groups of species with similar needs, promoting comprehensive planning to address many needs simultaneously.

Conservation Urgency Metric

Central to maintaining a healthy avifauna is maintaining the abundance of birds fundamental for healthy habitats and functioning ecosystems in all regions and terrestrial habitats. As birds are excellent indicators of overall environmental health and their loss signals danger, we developed a new *Conservation Urgency Metric, a species' 'half-life'*, for U.S. and Canadian landbirds to reflect the urgency for species predicted to experience rapid declines in the near future if current trends continue. The overall assessment process identifies species and habitats in greatest conservation need. While it includes a population trend score that reflects population trends observed over the past several decades (PT-c and PT-r) to highlight species with long-term declines, it does not necessarily capture species that may be experiencing more recent rapid declines. This new urgency metric is expressed as the number of years until a population size that is half of the current abundance is likely to be observed (i.e. a species' 'half-life'). These predictions are based on the assumption that recent population trends observed over the past decade will continue and thus is an indication of the size of the window of opportunity for which to take conservation action. Data used for this estimation are from North American Breeding bird survey time series' of indices of abundance (Sauer et al. 2014). These data were used to fit a multivariate state-space model for each species. Future population trajectories are forecast based on estimates of the population trend and year-to-year variability. Additional details are available in Stanton et al. (2016).

Habitat and Geography

Because loss, degradation, and threats to habitat are likely the biggest factors resulting in population declines and high concern for bird species, the ability to group species by habitat and geography is an important component of conservation planning at continental and regional scales. Although information on habitat associations and other ecological requirements (e.g., food supply, nest site) can be compiled from the literature for each species (e.g., accounts in Birds of the World 2020), no standardized terminology exists to describe avian habitats for all species, and classification schemes for describing avian geographical distribution and habitat occurrence vary considerably depending on the intended purpose of the groupings.

In this 2021 version of the ACAD, we attempt to both simplify and standardize the existing habitat and geography fields in the ACAD; each existing field was intended to meet a different objective, and most were incompletely populated, particularly for non-landbird species. Our goal was to create easily sortable groupings at a very broad scale, at the same time respecting the many hours of thought and deliberation that went into classifications of biomes in the 2004 *North American Landbird Conservation Plan* (Rich et al. 2004); analyses in *Saving Our Shared Birds* (Berlanga et al.

2010); habitats in the 2016 *Landbird Conservation Plan Revision* (Rosenberg et al. 2016); the *State of North America's Birds* report that included major habitats for all species in Canada, U.S., and Mexico (NABCI 2016); habitat classification conducted in association with the Central American Species Assessment process, which relied heavily on Stotz et al. (1996); and the habitat groupings underlying the analyses presented in the recent *Science* paper documenting the loss of abundance in the North American avifauna (Rosenberg et al. 2019).

As anyone who has tried to categorize bird species by either habitat or geography can attest, birds—by the very nature of their spectacular ecological diversity and omnipresence—are experts at thwarting human efforts to pigeon-hole [sic] them into neatly mutually exclusive bins. No system works perfectly, and human experts will go back and forth for hours over which categories make the most sense. The deeper we dove into systematic specificity (at least with the objective of finding mutually exclusive categories), the more we found that bird distributions and occurrences defied our efforts. So in this current ACAD classification, we attempted to create ***categories that would be useful for comparing levels of concern across groups of species at a broad continental scale.*** Also, recognizing the inevitable relationship between geography and habitat, we tried our best to ***separate geography and habitat*** as much as possible. In this way, by pairing a geography and a primary habitat for a species, it is possible to generate a relatively succinct (albeit simplified) description of its distribution and major habitat association. We provide these categories for both the breeding and non-breeding seasons for all species taxa. For species with global distributions, our **focus is on the North American continent**; for species populations migrating from North America to South American or Old World destinations, we designate the specific regions and habitats to which those North American populations are known to travel—to the extent our present limited knowledge allows.

Avifaunal Biomes

The concept of avifaunal biomes was first introduced by PIF in the 2004 Landbird Conservation Plan (Rich et al. 2004) to organize bird species according to their similar eco-geographic affinities and to assign stewardship responsibility for the conservation of suites of species in broad geographic areas. The original seven Avifaunal Biomes in the U.S. and Canada were derived based on a cluster analysis of the percent of global population for each of 429 landbird species across 37 Bird Conservation Regions (BCRs; see the map on the inside back cover of Rich et al. 2004). These Avifaunal Biomes represent patterns of endemism across geographic regions of North America and include many characteristic species that are restricted to a single biome. Note that the large regions resulting from this cluster analysis are very similar to the CEC Level 1 Ecoregions used to create BCRs (NABCI 2000), but because clusters were defined based on similarities in bird distributions, the boundaries do not exactly align with the CEC regions.

For the current ACAD, we have extended the avifaunal biome concept in several directions, building on the original 2004 presentation. First, we have assigned all breeding non-landbird species, including shorebirds, waterbirds, and waterfowl, to the same original seven avifaunal biomes in the U.S. and Canada. Next, to assign all North American species to avifaunal biomes, we needed to extend the biomes through Mexico, Central, and South America. In Mexico, BCRs have been modified and combined into four regions (PIF Science Committee, unpublished data, see *Fig. 1*) for the purpose of species conservation assessment. For this 2021 biome assessment, we extended three of these four regions south through Central America, essentially representing the Gulf-Caribbean Lowlands, Pacific Lowlands, and Highlands regions. We further extended the biomes to accommodate species occurring largely in marine or oceanic regions, using the previously described Marine Ecoregions of the World (Spalding et al. 2007).

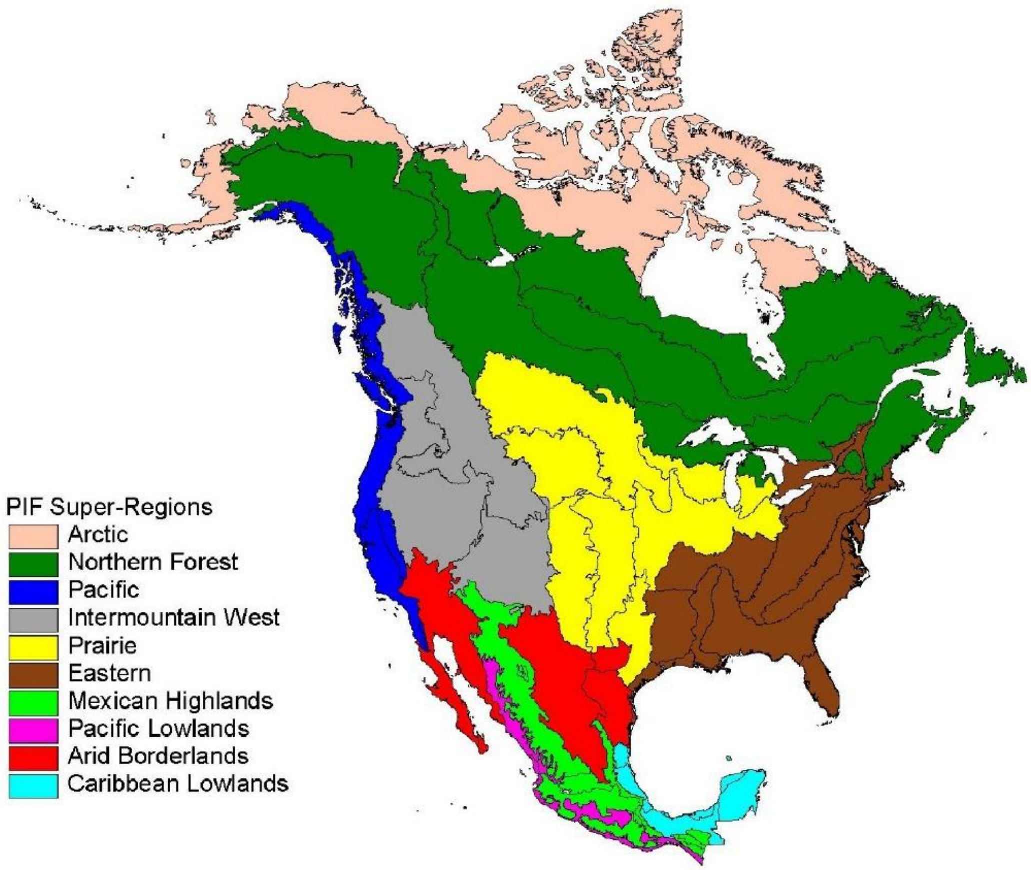

Figure 1. Partners in Flight Avifaunal Biomes for Canada, United States of America, and Mexico.

As part of PIF's emphasis on full annual cycle conservation for migratory species, we previously identified the Primary Winter Region for all species that migrate south of the U.S. and Canada (Rosenberg et al. 2016: Appendix A). Those winter geographies closely match the avifaunal biomes used in this 2021 analysis for Mexico and Central America, and they allow us to extend the biome concept even farther south into South America. To accommodate the hundreds of resident Neotropical species in Mexico and Central America, part of our process was to review the winter geographies used for migratory birds in light of the distributions of Neotropical resident species. This process resulted in a refinement of the Neotropical biomes within Central and South America to better represent the endemism within this diverse avifauna while still grouping important suites of migratory species from the U.S. and Canada. Because many seabird species visit North America only in the nonbreeding season, Wintering Avifaunal Biomes were also established to define the nonbreeding distributions of seabirds.

Our process resulted in 24 unique terrestrial and marine Avifaunal Biomes from the Arctic to Temperate South America and the Southern Ocean and including regions outside the Western Hemisphere to which species migrate in the breeding or nonbreeding seasons (see Definitions below). We also used several composite biome regions to represent combinations of biomes within a larger region (e.g., Nearctic, Mesoamerican). Species that occur in multiple biomes across regions or are especially difficult to assign to a single biome are designated as Widespread. Species introduced in North America are not considered as part of any native avifaunal assemblage and are not assigned to an Avifaunal Biome.

Although we were not able to repeat a cluster analysis for all species throughout North America, we did use a summary of eBird frequency and abundance data (Blancher, unpublished analysis) to help assign species to a primary Avifaunal Breeding and Nonbreeding Biome. We also consulted range maps and descriptions in Birds of the World (2020) accounts as well as eBird distribution maps and models (Fink et al. 2020). We did not follow strict quantitative rule sets in assigning species to Avifaunal Biomes, because available data varied greatly among taxonomic groups and because avifaunal affinities were not always represented in regions with greatest abundance. Many species with broad ranges were difficult to assign to a single Avifaunal Biome and were assigned to either larger composite biomes (e.g. Neotropical) or were considered Widespread, even if a majority of the species' population occurred in a single region. In the end our goal remained to identify groupings or affinities of species that represent patterns of endemism across the full North American avifauna. Assignment of avian species to biomes using a data-driven approach and quantitative rule set is a potential future task, although similar results are already available since the Regional ACAD database presents RD scores and %Pop at the finer BCR scale.

Avifaunal Biome Definitions

Arctic Same as CEC Level 1 and PIF 2004 Avifaunal Biome; includes BCR 1, 2, 3. Most bird species in this group are Holarctic in distribution, and we do not distinguish a separate North American Arctic biome; includes coastal and marine portions of Greenland, Labrador, Arctic Canada, Alaska, and the Bering Sea.

Caribbean Includes the entire West Indies plus Bermuda; some species also occur along the immediate Caribbean coast of Central or South America but often on offshore cays or islands. Includes marine portions of Caribbean Basin.

Central and South American Highlands Defined originally as a Winter Geography (PIF 2016); includes mountain cordilleras from Costa Rica and Panama south through the South American Andes and other mountainous areas of northern South America.

Eastern Indo-Pacific (Marine) Defined by Spalding et al. (2007), Marine Ecoregions of the World; includes Hawaiian Islands, Marshall Islands, and Polynesian chains.

Eastern Temperate Eastern United States and southeastern Canada, south of the Northern Forest; corresponds with Eastern Avifaunal Biome of PIF 2004 (BCRs: 13, 24–31, 37).

Great Plains Central U.S. and Canada as defined by the Prairie Avifaunal Biome of PIF 2004 (BCRs 11, 17–23).

Gulf-Caribbean Lowlands Defined originally as a Winter Geography (PIF 2016); includes the Mexican species assessment region, MX-CarLo, extending from NE Mexico (south of Tamaulipan Brushlands) south through eastern Mexico, including the Yucatan Peninsula; extends south along the Caribbean slope of Central America to the northern Caribbean lowlands of Colombia. Note that for many Caribbean Slope species that extend into the Pacific lowlands of Costa Rica and Panama, we use the broader biome Mesoamerican; for species largely restricted to the southern Central American lowlands in southwestern Costa Rica, Panama, and the lowlands of South America north and west of the Andes, we use the biome Trans-Andean Lowlands.

Intermountain West Interior western U.S. and Canada; corresponds with Intermountain West Avifaunal Biome of PIF 2004 (BCRs 9, 19, 16).

Introduced Species not native to North America and therefore not associated with any native avifaunal grouping. Note that these species, although not assigned to biomes, are assigned to habitats.

Mesoamerican Refers to Mexico plus Central America; assigned to species that occur in more than one biome within this broader region (e.g., many species that occur on both Gulf-Caribbean and Pacific slopes).

Mesoamerican Highlands Mountainous areas from northern Mexico (extending into southeastern Arizona and New Mexico) south to northern Nicaragua; an extension of the Mexican Species Assessment region MX-High (Sierra Madre Occidental, Central Mexican Highlands, Northeastern Mexican Highlands, Southeastern Mexican Highlands). Some species extend into Costa Rica and Panama, but if the majority of their range is to the north, we use Mesoamerican Highlands.

Mesoamerican Pacific Lowlands Defined originally as a Winter Geography (PIF 2016), Pacific Lowlands or Pacific Slope; same as Mexican species assessment region MX-PacLo, including Northwestern Mexican Pacific Lowlands and South Central Mexican Pacific Lowlands; extending south along the Pacific Slope of Central America to Costa Rica, including coastal (mangrove) areas and offshore islands. Note that a unique set of species endemic to southwestern CR are also assigned to this biome.

Nearctic As defined elsewhere; refers to broad region of North America north of the Tropic of Cancer in Mexico; used for species that occur in multiple biomes of the U.S. and Canada, often in both the East and West or along both Atlantic and Pacific coasts.

Neotropical As defined elsewhere; refers to broad region of Mesoamerica and South America south of the Tropic of Cancer; used for species that occur in multiple biomes across Central and South America and/or the Caribbean.

North American Southwest Arid regions of southwestern U.S. and northern Mexico; roughly the same as the Southwest Avifaunal Biome of PIF 2004 (BCR 33, 35, 36, 20), but BCR 34 is now part of Mesoamerican Highlands; includes much of the CEC Level 1 region North American Deserts.

Northern Forest Corresponds to Northern Forest Avifaunal Biome of PIF 2004 (BCRs 4,6,7,8,12,14); broad region from Newfoundland to western Alaska including boreal and taiga regions as well as northern hardwood and transitional forests of northeastern U.S.

Pacific North America Corresponds to Pacific Avifaunal Biome of PIF 2004 (BCRs 5, 15, 32), including coastal areas.

Pacific Ocean Used for a few species that range widely over the Pacific Ocean, including two or more Marine Ecoregions.

Palearctic As defined elsewhere, referring to the Old World regions including all of Eurasia.

Paleotropics As defined elsewhere, referring to the Old World tropical regions including Southeast Asia and Africa.

Pantropical Marine Used for species that range widely across the tropical Pacific, Atlantic, and Indian Ocean regions.

South American Lowlands Defined originally as a Winter Geography (PIF 2016); includes all tropical lowland areas of South America, primarily east of the Andes, including the Amazon Basin, Llanos, Pantanal, Chaco, and Cerrado bioregions. Note that species occurring only west or north of the Andes in South America are assigned to either Trans-Andean or Gulf-Caribbean Lowlands biomes; species occurring primarily south of the Tropic of Capricorn in the Pampas or Gran Chaco or coastal areas are in Temperate South America.

Southern Ocean Defined by Spalding et al. (2007), Marine Ecoregions of the World; includes Antarctica and adjacent islands and marine waters.

Temperate Australasia Defined by Spalding et al. (2007), Marine Ecoregions of the World; includes marine areas of southern Australia and New Zeeland.

Temperate Northern Atlantic (Marine) Defined by Spalding et al. (2007), Marine Ecoregions of the World; includes marine areas of Atlantic Canada, southern Iceland, western Europe, Mediterranean, and north Africa, including Azores, Canary, and Madeira islands.

Temperate Northern Pacific (Marine) Defined by Spalding et al. (2007), Marine Ecoregions of the World; includes marine waters of Pacific North America, southern Alaska, Aleutians, Japan, and northern China.

Temperate South America Region south of Tropic of Capricorn, including the area referred to as Southern Cone, and also the Gran Chaco of Argentina and Paraguay, and coastal and marine areas of Argentina (including Falklands), Chile, and Peru.

Trans-Andean Lowlands Refers to lowland region north and west of the Andes in northwestern South America (Colombia and Ecuador); the distinct Choco avifauna found here usually extends into Central America, either just into Darien, Panama, to southwestern Costa Rica, or in some cases farther north in Central America. Note that it was often difficult to delimit a boundary with the Gulf-Caribbean Lowlands, as many species occur throughout the entire lowland region; the resident avifauna are fairly distinct, and only a few North American migrants are restricted to this biome in winter (e.g., Bay-breasted Warbler, Acadian Flycatcher).

Tropical Eastern Pacific (Marine) Defined by Spalding et al. (2007), Marine Ecoregions of the World; includes marine waters off northwestern South America (including Galápagos) and Central America to western Mexico (Clipperton, Revillagigedos).

Western Temperate Combines Intermountain West and Pacific North America for species that are found roughly equally in both biomes.

Widespread For species found in many biomes that are difficult to define using a single composite region; includes coastal birds that occur throughout most of the Western Hemisphere and some oceanic birds that occur in several parts of the world.

Habitats

As noted above, the habitat classification in this 2021 version of the ACAD builds on previous efforts in *Saving Our Shared Birds* (Berlanga et al. 2010), the 2016 *Landbird Conservation Plan Revision* (Rosenberg et al. 2016), *State of North America's Birds* (NABCI 2009, 2014, and especially NABCI 2016; NABCI-Canada 2012, 2019), the Central American Species Assessment process, and Rosenberg et al. (2019)—at the same time striving for consistency in category labels using a system applicable across all taxa and throughout the North American continent. A primary goal was a scheme useful for high-level sorting of species into broad categories that is otherwise unavailable in more detailed, species-specific treatments. To achieve this goal, we settled on (1) a **hierarchy with two levels**: a very broad Level 1, Habitat Class (e.g. Forests, Grasslands), and a more descriptive Level 2 sub-category, Habitat (e.g. Forests: Boreal; Grasslands: Chihuahuan) for both breeding and stationary non-breeding seasons; and (2) **two designations for proportional occurrence** across Habitat Classes and Habitats: **Primary and Secondary**, also for both breeding and non-breeding seasons. In addition, we provide two independent columns designating species that are associated with agricultural and urban/suburban habitats, regardless of their Habitat Class or Habitat.

There is little information available at the continental scale for quantitatively assigning species to Habitat Classes or Habitats. For this 2021 version of the ACAD, we relied on the previous efforts mentioned above, reinforced by repeated visits to both distribution maps and habitat descriptions in species accounts in Birds of the World (2020), and expert review by PIF Science Committee members. Short of a complex and costly geospatial analysis, and recognizing that opinions will inevitably vary based on local knowledge, we feel this was a reasonable approach to assigning habitat affinities at broad scales.

For species for which two Habitat Classes or Habitats are *roughly equal* in importance, both are listed, with the Habitat that represents greater proportional occurrence for the species designated as Primary and the other as Secondary. (In some cases, this Primary/Secondary assignment was admittedly an expert opinion that varied among reviewers.) In cases where a species is known to occur in other types of Habitat, but in substantially smaller numbers relative to the Primary Habitat assignment, no Secondary Habitat is listed. Finally, species that are represented in *roughly equal* numbers in *three or more* Habitat categories are designated as Generalists (e.g., Wetland: Generalist).

For reasons of space, only the Primary Breeding Habitat or Primary Nonbreeding Habitat are presented on the web version of the ACAD, depending on whether the Breeding or Nonbreeding filter is active. In the downloadable version of the ACAD, we provide four Habitat columns (Primary and Secondary Breeding, Primary and Secondary Nonbreeding) with the Level 1 (Habitat Class) separated by a colon and two spaces (:) from the Level 2 (Habitat) assignment, as described below.

The ***Hierarchy and Definitions of Habitat Classes and Habitats*** follow, with the Habitat Classes (Level 1) left-justified and the constituent Habitats (Level 2) indented beneath the broader Habitat

Classes:

Tundra Open habitats characterized by sedges, grasses, mosses, lichen, and dwarf shrubs; in general, more xeric than habitat described as *Wetlands: Tundra*.

Tundra: Arctic Tundra in the Arctic biome beyond treeline but not associated with wetlands or coastal tidal influence.

Tundra: Alpine Montane tundra above treeline, often characterized by relatively bare ground and snowfield borders.

Tundra: Páramo High, tropical, montane vegetation above the continuous timberline dominated by grasses, giant rosette plants, and shrubs.

Wetlands Freshwater inland wetlands of all types, excluding coastal marshes.

Wetlands: Tundra Wetlands embedded in tundra habitat; in arctic and northern boreal zones, shallow wetlands characterized by permafrost substrate and vegetation ranging from tundra grasses and forbs to tundra/taiga shrubs.

Wetlands: Boreal Bogs, fens, muskeg, marshes, and other wetlands within the boreal forest zone; species assigned to this habitat category are dependent ecologically on the aquatic resource, although trees may be utilized for nesting, roosting, or perching.

Wetlands: Lakes and Rivers Freshwater lakes, ponds, rivers, and streams, and their immediate shorelines (e.g., alkaline flats); characterized by substantial areas of open water.

Wetlands: Freshwater Marsh Permanent or semi-permanent freshwater wetlands with emergent aquatic vegetation (cattails, rushes, etc.); marsh can be embedded within other habitat types (e.g., grasslands or forests).

Wetlands: Forested Permanent or frequently flooded wetlands in temperate or tropical zones with stunted to mature trees and open water: swamps, bottomland hardwood forests, etc.; species assigned to this habitat category are dependent ecologically on the aquatic resource, although trees may be utilized for nesting, roosting, or perching.

Wetlands: Seasonally Wet Grasslands Ephemeral or seasonal wetlands dominated by grasses or sedges (as opposed to taller emergents like cattails), including temperate Prairie Wetlands.

Wetlands: Generalist Species that use a wide variety of wetland types (three or more categories in roughly equal proportions) for nesting and breeding-season foraging—including, in this case, coastal saltmarsh. Nesting can occur in/on a variety of substrates (trees, rushes, shore, etc.), but species is ecologically dependent on the aquatic resource.

Coasts Interface between continental terrestrial habitats and saltwater oceans, bays, gulfs, and estuaries; all habitats associated with the coastal zone, including mangroves.

Coasts: Tundra Intertidal saline or low-lying tundra immediately bordering the Arctic coastline, distinct from other temperate zone coastlines (including coastal areas of western and southern Alaska, Labrador, etc.) due to the unique scouring effects of sea ice and permafrost substrate.

Coasts: Beach and Estuary Sandy beaches, sandbars, and tidally influenced adjacent shallow waters.

Coasts: Saltmarsh Emergent marsh in the upper coastal intertidal zone dominated by salt-tolerant grasses, herbs, and/or low shrubs; includes brackish marshes.

Coasts: Rocky Intertidal Intertidal zone and rocky beaches dominated by rocks and coarse gravel (including rock jetties) as opposed to sandy beaches or mudflats.

Coasts: Marine Waters Coasts and continental shelf waters (essentially the zone occupied by most gulls), including bays and deep estuaries.

Coasts: Cliffs and Islands Nesting sites on coastal rocky cliffs or on nearshore islands that could include cliffs or flat vegetated areas.

Coasts: Mangroves Coastal mangrove swamps.

Islands Isolated marine islands.

Islands: Terrestrial Habitats Oceanic or nearshore marine island terrestrial habitats; category used primarily for island-restricted species occupying virtually all terrestrial habitats on the island (e.g., Socorro Wren, Cocos Flycatcher).

Islands: Oceanic Isolated oceanic islands beyond the continental shelf or continental coastal marine zone; used primarily for nesting seabirds.

Oceans Open marine habitat beyond continental shelves.

Oceans: Arctic Polynyas Areas of unfrozen seawater within otherwise contiguous pack or sea ice in the Arctic Ocean or Bering Sea.

Oceans: Pelagic Open ocean beyond the continental shelf and/or beyond *Coasts: Marine Waters*.

Grasslands Native and surrogate grasslands (e.g., hayfields and rangeland), but excluding row-crop agricultural systems.

Grasslands: Temperate Shortgrass, tallgrass, and mixed-grass native prairies and rangelands in north temperate latitudes that support grassland birds.

Grasslands: Chihuahuan Arid grasslands of northern Mexico and the southwestern U.S. centered on the Mexican state of Chihuahua.

Grasslands: Tropical Grasslands between the Tropic of Cancer and Capricorn, including high-elevation grasslands in Mesoamerican sierras (excluding páramo), lowland tropical savannas, and the Llanos of South America.

Grasslands: Pampas and Campos Grasslands and rangelands south of the Tropic of Capricorn, including the Pampas, Campos, and Southern Cone grasslands.

Aridlands All arid shrub-dominated communities.

Aridlands: Sagebrush Mostly but not exclusively sagebrush-dominated desert and steppes (shrub-steppe) of the Great Basin of western U.S. and southwestern Canada.

Aridlands: Chaparral Mediterranean forest, woodland, and shrub communities, primarily coastal California and Baja (including coastal sage) and similar shrub habitats in the interior Southwest.

Aridlands: Desert Scrub Broad range of desert shrub communities including Mojave, Sonoran, Chihuahuan, and Mexican Central Plateau deserts.

Aridlands: Desert Riparian Mesic shrub and tree communities along rivers and other wetlands in otherwise predominantly desert ecosystems.

Aridlands: Tropical Arid Scrub Desert shrub communities in tropical arid coastal, lowland, high-elevation montane, and xeric intermontane valleys.

Open Country Broad array of habitat classes dominated by open horizons and non-contiguous patches of landcover types.

Open Country: Habitat Mosaic Predominantly open country characterized by a mosaic of different, mostly native, habitat types; e.g., a combination of forest or woodland patches, gallery forest, brushy edges, regenerating forest, freshwater marsh, and/or pastures; differs from habitat generalist occurrence in that assigned species are dependent on the array of different habitat types rather than simply occurring in different habitats; e.g., Red-tailed Hawk, Roadside Hawk.

Open Country: Developed/Disturbed Similar to *Open Country: Habitat Mosaic*, but dominated by occurrence in human-altered landcover: agriculture (especially row-crop), urban spaces and structures, parks, roadsides, drainage ditches, gardens.

Forests All forest and woodland types, from old-growth conifers and tropical rainforests to arid thorn forest, *including all seral stages* (e.g., early successional, second-growth).

Forests: Boreal Boreal forests of Canada and Alaska and extending into the boreal zone (primarily spruce-fir) of high mountains in the western and northeastern U.S.; also the boreal/hardwood transition of the Upper Midwest and Appalachian and associated mountain ridges (in cases where species occurrence is not more strongly associated with Temperate Eastern Forest types). Species assigned to this habitat category are ecologically dependent on forest vegetation and associated resources (vs. aquatic resources, as in *Wetlands: Boreal* or *Wetlands: Forested* categories).

Forests: Temperate Eastern All forest types of eastern U.S. and southeastern Canada (south of the Boreal), including northern hardwoods, northern pine, oak-hickory, pine-oak, maple-basswood, southern pine, and bottomland hardwood associations.

Forests: Temperate Western All forest types of western U.S., Canada (south of the Boreal), and extending in high mountains south into northwestern Mexico. Includes Pacific Northwest rainforest; all western conifer, aspen, oak-dominated, and riparian forests; pinyon-juniper; Edward's Plateau juniper-oak woodlands; and high-elevation conifer forests of northwestern Mexico (above the pine-oak zone).

Forests: Temperate Generalist Species occurs in roughly equal abundance in three or more temperate or boreal forest habitat types.

Forests: Mesoamerican Highland High elevation conifer-dominated forests from central Mexico south to Honduras above pine-oak forest zone. Includes some tropical elements (e.g., epiphytes) not present in *Forests: Temperate Western* but lacks broadleaf diversity of *Forests: Tropical Montane Evergreen*.

Forests: Mesoamerican Pine-Oak Distinctive Madrean pine-oak forests from "sky islands" of southeastern Arizona to western Texas, through the Mexican cordilleras, and south through Central America to El Salvador and northern Nicaragua. Ratio of pine/oak may vary from predominantly pine to predominantly oak.

Forests: Tropical Montane Evergreen High elevation tropical broadleaf evergreen forest that is wet throughout the year, with tree branches and trunks typically covered with epiphytes. Includes pre-montane and humid montane forests as well as Cloud Forest.

Forests: Tropical Lowland Evergreen Humid forests ("rainforests") of tropical lowlands and lower montane slopes (i.e., includes upper tropical and/or subtropical zones).

Forests: Tropical Dry Broad array of deciduous and semi-deciduous forests, including arid thorn forest; found primarily on Pacific slope from northwestern Mexico to northwestern Costa Rica, but also including Tamaulipan thorn-scrub and dry forests of Yucatan and other transitional areas.

Forests: Tropical Generalist Species occurs in roughly equal abundance in three or more tropical forest habitat types.

Forests: Generalist Widespread species that occurs in roughly equal abundance in three or more major forest habitat categories (which can include both temperate and tropical forest types).

[xxx] Aerial Denotes the airspace as essential habitat, reserved for non-seabird species that spend the predominant portion of their day in flight; a *Habitat Class* (i.e., Level 1) with prefix denoting a species' primary non-aerial Habitat Class association (e.g., Aridlands Aerial, Forest Aerial, etc.) over which it is most frequently observed.

In addition, we provide two additional columns in the downloadable ACAD. These are not considered habitat classes per se, but are provided for users to sort the avifauna by two human-dominated landscape types:

Urban Species commonly associated with urban/suburban landscapes during the breeding season and generally commensal with people in those landscapes—e.g., birds of developed urban spaces, urban/suburban parks, domestic gardens, etc. Currently no strict criteria for inclusion other than expert opinion, and so subject to further review. Denoted by "yes" in column, with the expectation of upcoming designations for both breeding and nonbreeding seasons.

Agriculture Species that can be found frequently in agricultural systems and landscapes, including row-crop agriculture, pastures, orchards, etc. No strict criteria for inclusion other than being mentioned in composite habitat columns in previous versions of the ACAD. Denoted in database column by "b" for breeding season, "w" for winter (stationary nonbreeding season), and "b,w" for both seasons.

Determining the significant habitats for each species in the pool of regionally important species—and developing specific conservation actions to protect or improve those habitats—are key elements in regional and continental bird conservation plans developed by Partners in Flight, Joint Ventures, and State bird initiatives (http://www.partnersinflight.org/resources). Species can be grouped into suites that share habitats or other ecological needs, either using the broad Biome and Habitat categories assigned to species at range-wide scales or by using locally important habitat designations. These ecological groupings serve to identify habitats that are a priority because conservation actions there can efficiently meet the needs of many species of regional importance at once (Rosenberg 2016). Nonetheless, the broad groupings presented in the ACAD are not intended to be a substitute for the much finer habitat designations useful for specific management actions at local scales. These more local designations and accompanying management guidelines, often dependent on species-specific habitat suitability models, are the purview of Joint Ventures or similar planning efforts that depend on consideration of unique local vegetation structure and ecological processes.

LITERATURE CITED

Arizmendi, M.C. and L. Márquez-Valdelamar. 2000. Áreas de importancia para la conservación de las aves en México. CIPAMEX.

Beissinger, S. R., J. M. Reed, J. M. Wunderle, Jr., S. K. Robinson, and D. M Finch. 2000. Report of the AOU conservation committee on the Partners in Flight species prioritization plan. Auk 117:549- 561.

Berlanga, H., J.A. Kennedy, T.D. Rich, M.C. Arizmendi, C.J. Beardmore, P.J. Blancher, G.S. Butcher, A.R. Couturier, A.A. Dayer, D.W. Demarest, W.E. Easton, M. Gustafson, E. Iñigo-Elias, E.A. Krebs, A.O. Panjabi, V. Rodriguez Contreras, K.V. Rosenberg, J.M. Ruth, E. Santana Castellón, R. Ma Vidal, and T. Will. 2010. Saving Our Shared Birds: Partners in Flight Tri-National Vision for Landbird Conservation. Cornell Lab of Ornithology: Ithaca, NY. Retrieved from http://www.savingoursharedbirds.org/

BirdLife International 2016. Data Zone. from http://datazone.birdlife.org/home

Birds of the World (S. M. Billerman, B. K. Keeney, P. G. Rodewald, and T. S. Schulenberg, Editors). 2020. Cornell Laboratory of Ornithology, Ithaca, NY, USA. https://birdsoftheworld.org/bow/home

Carter, M. F., W. C. Hunter, D. N. Pashley, and K. V. Rosenberg. 2000. Setting conservation priorities for landbirds in the United States: the Partners in Flight approach. Auk 117:541-548.

Chesser, R.T., K.J. Burns, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, P.C. Rasmussen, J.V. Remsen Jr., D.F. Stotz, and K. Winker. 2019. Sixtieth Supplement to the American Ornithological Society's Check-list of North American Birds. Auk 136: 1-23.

Conservation of Arctic Flora and Fauna International Secretariat. 2018. A Global audit of the status and trends of Arctic and Northern Hemisphere goose population. Conservation of Arctic Flora and Fauna International Secretariat, Akureyri, Iceland.

eBird. 2017. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Retrieved from http://www.ebird.org. (Accessed: January 25-27, 2017).

Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, O. Robinson, S. Ligocki, W. Hochachka, C. Wood, I. Davies, M. Iliff, L. Seitz. 2020. eBird Status and Trends, Data Version: 2019; Released: 2020. Cornell Lab of Ornithology, Ithaca, New York. https://doi.org/10.2173/ebirdst.2019

Global Forest Watch. Retrieved February, 2016. http://www.globalforestwatch.org

Hunter, W. C., M. F. Carter, D. N. Pashley, and K. Barker. 1993. Partners in Flight Species Prioritization Scheme. Pages 109-119 in Finch, D. M., and P. W. Stangel (eds.), Status and management of Neotropical migratory birds. USDA For. Ser. Gen. Tech. Rep. RM-229. Fort Collins, Colorado.

IUCN. 2016. The IUCN Red List of Threatened Species. Version 2016-3. Retrieved from http://www.iucnredlist.org.

Meehan, T.D., G.S. LeBaron, K. Dale, N.L. Michel, G. Verutes, and G.M. Langham. 2018. Population trends for North American winter birds from Audubon Christmas Bird Counts, 1966-2017, version 2.1_1966-2017_2018. National Audubon Society, New York, New York, USA. Available upon request.

NABCI. 2000. North American Bird Conservation Initiative: Bird Conservation Region Descriptions. U. S. Fish and Wildlife Service, Washington D.C.

NABCI. 2009. The State of the Birds, United States of America, 2009. U.S. Department of Interior: Washington, DC. 36 pages.

NABCI. 2014. The State of the Birds 2014 Report. U.S. Department of Interior, Washington, D.C. 16 pages.

NABCI. 2016. The State of North America's Birds 2016. Environment and Climate Change Canada: Ottawa, Ontario. 8 pages. Retrieved from http://www.stateofthebirds.org

NABCI--Canada. 2012. The State of Canada's Birds, 2012. Environment Canada, Ottawa, Canada. 36 pages.

NABCI--Canada. 2019. The State of Canada's Birds, 2019. Environment and Climate Change Canada, Ottawa, Canada. 12 pages. http://www.stateofcanadasbirds.org.

NAWMP. 2012. North American Waterfowl Management Plan 2012: People Conserving Waterfowl and Wetlands. 70 pages. Available from https://nawmp.org/

NAWMP. 2018. NAWMP 2018 Update: Connecting People, Waterfowl and Wetlands. 32 pp. https://nawmp.org/timeline/2018-update

Panjabi, A., C. Beardmore, P. Blancher, G. Butcher, M. Carter, D. Demarest, E. Dunn, C. Hunter, D. Pashley, K. Rosenberg, T. Rich and T. Will. 2001. The Partners in Flight handbook on species assessment and prioritization. Version 1.1. Rocky Mountain Bird Observatory. Brighton, Colorado. Available from https://pif.birdconservancy.org/avian-conservation-assessment-database-archives/.

Panjabi, A. O., E. H. Dunn, P. J. Blancher, W. C. Hunter, B. Altman, J. Bart, C. J. Beardmore, H. Berlanga, G. S. Butcher, S. K. Davis, D. W. Demarest, R. Dettmers, W. Easton, H. Gomez de Silva Garza, E. E. Iñigo-Elias, D. N. Pashley, C. J. Ralph, T. D. Rich, K. V. Rosenberg, C. M. Rustay, J. M. Ruth, J. S. Wendt, and T. C. Will. 2005. The Partners in Flight handbook on species assessment. Version 2005. Partners in Flight Technical Series No. 3. Available from https://pif.birdconservancy.org/avian-conservation-assessment-database-archives/.

Panjabi, A. O., P. J. Blancher, R. Dettmers, and K. V. Rosenberg, 2012. The Partners in Flight handbook on species assessment. Version 2012. Partners in Flight Technical Series No. 3. Available from https://pif.birdconservancy.org/avian-conservation-assessment-database-archives/.

Panjabi, A. O., P. J. Blancher, W. E. Easton, J. C. Stanton, D. W. Demarest, R. Dettmers, K. V. Rosenberg. 2017. The Partners In Flight Handbook on Species Assessment. Version 2017. Partners in Flight Technical Series No. 3. Bird Conservancy of the Rockies. Available from https://pif.birdconservancy.org/avian-conservation-assessment-database-archives/.

Panjabi, A.O., W.E. Easton, P.J. Blancher, A.E. Shaw, B.A. Andres, C.J. Beardmore, A.F. Camfield, D.W. Demarest, R. Dettmers, R.H. Keller, K.V. Rosenberg, and T. Will. 2019. Avian Conservation Assessment Database Handbook, Version 2019. Partners in Flight Technical Series No. 8. Available from https://pif.birdconservancy.org/avian-conservation-assessment-database-archives/.

Panjabi, A.O., W.E. Easton, P.J. Blancher, A.E. Shaw, B.A. Andres, C.J. Beardmore, A.F. Camfield, D.W. Demarest, R. Dettmers, R.H. Keller, K.V. Rosenberg, T. Will, and M.A. Gahbauer. 2020. Avian Conservation Assessment Database Handbook, Version 2020.Partners in Flight Technical Series No. 8.1. Available from https://pif.birdconservancy.org/avian-conservation-assessment-database-archives/.

Pardieck, K.L., D.J. Ziolkowski Jr., M.-A.R. Hudson. 2015. North American Breeding Bird Survey Dataset 1966 - 2014, version 2014.0. U.S. Geological Survey, Patuxent Wildlife Research Center. Available from http://www.pwrc.usgs.gov/BBS/RawData/.

Pashley, D.N., C.J. Beardmore, J.A. Fitzgerald, R.P. Ford, W.C. Hunter, M.S. Morrison, and K.V.

Rosenberg. 2000. Partners in Flight: Conservation of the land birds of the United States. American Bird Conservancy. The Plains, Virginia. 92 pp.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, and T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Retrieved from http://www.partnersinflight.org/resources/north-american-landbird-conservation-plan/.

Ridgely, R. S., T. F. Allnutt, T. Brooks, D. K. McNicol, D. W. Mehlman, B. E. Young, and J. R. Zook. 2007. Digital Distribution Maps of the Birds of the Western Hemisphere, version 3.0. NatureServe, Arlington, Virginia, USA.

Rosenberg, K. V. and P. J. Blancher. 2005. Setting numerical population objectives for priority landbird species. Pp. 57-67 in Bird Conservation and Implementation in the Americas: Proceedings of the Third International Partners in Flight Conference, Vol. 1. C. J. Ralph and T. D. Rich, eds. USDA For. Ser. Gen. Tech. Rep. PSW-GTR-191. Pacific Southwest Research Station. Albany, California. 651 pp.

Rosenberg, K.V., A.M. Dokter, P.J. Blancher, J.R. Sauer, A.C. Smith, P.A. Smith, J.C. Stanton, A. Panjabi, L. Helft, M. Parr, and P.P. Mara. 2019. Decline of the North American Avifauna. Science 10.1126/science.aaw1313.

Rosenberg, K.V., J.A. Kennedy, R. Dettmers, R.P. Ford, D. Reynolds, C.J. Beardmore, P.J. Blancher, R.E. Bogart, G.S. Butcher, A. Camfield, D.W. Demarest, W.E. Easton, B. Keller, A. Mini, A.O, Panjabi, D.N. Pashley, T.D. Rich, J.M. Ruth, H. Stabins, J. Stanton, T. Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. Retrieved from http://www.partnersinflight.org.

Rosenberg, K.V., A.M. Dokter, P.J. Blancher, J.R. Sauer, A.C. Smith, P.A. Smith, J.C. Stanton, A. Panjabi, L. Helft, M. Parr, and P.P. Marra. 2019. Decline of the North American Avifauna. Science 366: 120-124.

Sauer J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2014. The North American Breeding Bird Survey, results and analysis 1966–2012: version 02.19.2014. USGS Patuxent Wildlife Research Center, Laurel, MD. Retrieved from http://www.mbr-pwrc.usgs.gov/bbs/bbs.html.

Soykan, C.U., J. Sauer, J.G. Schuetz, G.S. LeBaron, K. Dale, G.M. Langham. 2016. Population trends for North American winter birds based on hierarchical models. *Ecosphere* 7:5, e01351. Online publication date: 24-May-2016.Stanton J.C., B.X. Semmens, P.C. McKann, T. Will, and W.E. Thogmartin. 2016. Flexible risk metrics for identifying and monitoring conservation-priority species. Ecological Indicators 61, Part 2:683–692.

Spalding, M.D., Helen E. Fox, Gerald R. Allen, Nick Davidson, Zach A. Ferdaña, Max Finlayson, Benjamin S. Halpern, Miguel A. Jorge, Al Lombana, Sara A. Lourie, Kirsten D. Martin, Edmund McManus, Jennifer Molnar, Cheri A. Recchia, James Robertson, Marine Ecoregions of the World: A Bioregionalization of Coastal and Shelf Areas, *BioScience*, Volume 57, Issue 7, July 2007, Pages 573–583, https://doi.org/10.1641/B570707

Stanton, J.C., P. Blancher, K.V. Rosenberg, A.O. Panjabi, and W.E. Thogmartin. 2019. Estimating Uncertainty of North American Landbird Population Sizes. *Avian Conservation and Ecology* 14(1):4. https://doi.org/10.5751/ACE-01331-140104.

Stotz, D.F., J.W. Fitzpatrick, T.A. Parker III, and D.K. Moskovits. 1996. Neotropical birds: ecology and conservation; with ecological and distributional databases by T.A. Parker III, D.F. Stotz, and J.

Fitzpatrick. University of Chicago Press.

U.S. Fish and Wildlife Service. 2016. Waterfowl Population Status, 2016. U.S. Department of the Interior, Washington, D.C. USA. https://www.fws.gov/migratorybirds/pdf/surveys-and- data/Population-status/Waterfowl/WaterfowlPopulationStatusReport16.pdf

U.S. Shorebird Conservation Plan. 2016. https://www.shorebirdplan.org/wp-content/uploads/2016/08/Shorebirds-Conservation-Concern-2016.pdf

Wetlands International 2017. Waterbird Population Estimates: Versions 4 and 5. Retrieved Jan 2016–Mar 2017 from http://www.wpe.wetlands.org

Will, T., J.C. Stanton, K.V. Rosenberg, A.O. Panjabi, A.F. Camfield, A.E. Shaw, W.E. Thogmartin, and P.J. Blancher. 2020. Handbook to the Partners in Flight Population Estimates Database, Version 3.1. PIF Technical Series No 7.1. http://pif.birdconservancy.org/popest.handbook.pdf.

Appendix A. Database Dictionary

The following list explains the field headings (in alphabetical order) in the Partners in Flight Avian Conservation Assessment Database (https://pif.birdconservancy.org/avian-conservation-assessment-database/), including fields found only in the downloadable table. The database should be used in consultation with this Handbook, which further defines the terms listed below.

Field	Definition
%Breeding Pop in US & Canada	% of global breeding population found in continental U.S. and Canada in text format to include </> signs. Note that eBird coverage is spotty in Asia, so estimates for any species listing "eBrd17" as the "Glob" source should be used cautiously if the species occurs in Asia. We did not calculate this value for species whose breeding phenology was not effectively captured by the breeding season window applied to eBird data (June 1 - July 7), or where global and North American estimates were deemed incompatible, including several wide-ranging waterfowl species like mallard, gadwall, etc.
%Breeding Pop in US & Canada#	% of global breeding population found in continental U.S. and Canada in numeric format to allow sorting. Note that eBird coverage is spotty in Asia, so estimates for any species listing "eBrd17" as the "Glob" source should be used cautiously if the species occurs in Asia. We did not calculate this value for species whose breeding phenology was not effectively captured by the breeding season window applied to eBird data (June 1 - July 7), or where global and North American estimates were deemed incompatible, including several wide-ranging waterfowl species like Mallard, Gadwall, etc.
%GL_WH-b	Percent of global population breeding in Western Hemisphere. Note that eBird coverage is spotty in Asia, so estimates for any species listing "eBrd17" as the "Glob" source should be used cautiously if the species occurs in Asia.
%Pop	Estimate of percent of species' global breeding population in region

%Pop_s	In case of BCR Breeding Scores/Regional ACAD: data sources for %Pop. In case of Global ACAD Scores: population estimate sources for continental USA/Canada ("UsCa"), for the Western Hemisphere ("WHem"), and globally ("Glob") used to calculate the fields: (1) %GL_WH-b (2) %WH_US-Ca-b (3) % Breeding Pop in US/Canada More than one source was often used for different parts of range, as follows: 1. bbs0514(UsCa) - BBS counts from 2005-2014 were averaged across routes within BCRs (weighted by size of provinces/states in BCRs), for the continental US & Canada, including some extrapolations to range uncovered by BBS, and some other data sources in the north (atlases, NWT checklists & censuses); this source for landbirds only 2. bbs0514(BBS) - non-landbirds; as above, BBS counts from 2005-2014 were averaged / weighted, but did not include non-BBS sources; %Pops for species in BCRs 1, 3 and 7 were based on eBird frequencies due to sparse BBS coverage 3. eBrd17(UsCa or WHem or Glob) - eBird frequencies per region were weighted by region size to approximate %Pops per Region (%Freqs), generally for species with poor BBS data, or for regions without BBS data; UsCa indicates BCRs 1 to 37 without Mexican portions of border BCRs, WHem indicates regions outside of BBS coverage in the Western Hemisphere, Glob indicates parts of range outside the Western Hemisphere - note that eBird proportions outside the Western Hemisphere were often replaced with other values - see next 3 entries 4. eBrd18modl(UsCa,WHem) - eBird abundance model was used as source (so far just for Cerulean Warbler) 5. PIF(Glob) - proportion of global range outside of the Western Hemisphere was estimated by the PIF Science Committee (most done in 2007, with some updates when taxonomy changed) 6. WI(Glob) - proportion of global range outside of the Western Hemisphere for shorebirds estimated from Global population (Wetlands International) vs Western Hemisphere (North American) populations, from Brad Andres spreadsheet (March 2016) 7. SGS-17 - proportion of population estimated from AMWO relative abundance on SGS (singing ground survey), 1970 to 2017, from trend analysis provided by John Sauer (2017) and proportion of BCR within AMWO breeding range (NatureServe 3.0 maps) 8. PIF18 - PIF Science Committee, Feb 2018 Note that eBird coverage is spotty in Asia, so any species listing "eBrd17" as the "Glob" source should be used cautiously if the species occurs in Asia.
%WH_US-Ca-b	% of Western Hemisphere population breeding in continental U.S. and Canada
Action Code	The type of conservation action most needed for improving or maintaining current population status of each species of Regional Concern: CR=Critical Recovery; IM=Immediate Management; MA=Management Attention; PR=Planning and Responsibility

Agriculture	Species that can be found frequently in agricultural systems and landscapes, including row-crop agriculture, pastures, orchards, etc. during the breeding season (indicated by "b"), stationary nonbreeding season (indicated by "w" for winter), or both (indicated by "b,w").
AOS 60	Taxonomic order according to the American Ornithological Society (AOS) 7th edition checklist, 60th supplement
Half-Life	Projected timeframe (in years) until 50% of remaining population is lost, as published in PIF North American Landbird Plan 2016
BCR	Bird Conservation Region, with map available at http://nabci-us.org/resources/bird-conservation-regions-map/. For US/Mexico border BCRs, check the Region field to see if an asterisk follows the BCR number there. An asterisk indicates that the species is only found on the Mexican side of the USA/Mexico border. USA/Mexico border BCRs without an asterisk in the Region field only reflect the US side of the border pending future integration of the two countries' scores. Note the following discrepancies between BCR number listed and actual content. Region "BCR32*" may include species limited to BCR 39 because the regions are lumped due to insufficient sample size for estimating RD-b in BCR 39. "BCR33*" may include species limited to BCRs 40, 41, 42, 62, and 63 for the same reason. "BCR34*" excludes BCR 34 in Jalisco, Aguascalientes, Guanajuato and San Luis Potosí and includes the part of BCR 46 in Zacatecas.
BD area	Area estimate (in km^2) of global breeding distribution
BD-g	Assessment score for global breeding distribution
BD-g_com	Comments for global breeding distribution score
BD-g_s	Source for global breeding distribution score
Breeding Biome	For each species, one of 24 primary geographic regions in which it occurs during its breeding season and in which it shares ecological affinities with other species also occupying the same region. See *ACAD Handbook* pp. 26-30 for definitions.
C America	Occurs in Central America
Canada	Occurs in Canada
CCS-b	Continental combined score for breeding season (PS-g + BD-g + TB-c + PT-c)
CCS-max	The higher of CCS-b and CCS-n
CCS-n	Continental combined score for non-breeding season (PS-g + ND-g + TN-c + PT-c)
CI	Category of Continental Importance: Watch List (Red, Yel-d, Yel-r) or CBSD (Common Bird in Steep Decline). See handbook for more detailed definitions.
CIR	Continental Importance in Region: (Watch List AND RD-b > 0 AND TB-r > 1) OR (CBSD AND RD-b > 1)
Common Name	Common English name according to AOS 7th edition checklist, 60th supplement
DF	degrees of freedom: (# of BBS routes - # of strata - 1) OR (# of CBC circles - # of strata - 1)
family	Family according to AOS 7th edition checklist, 60th supplement
Global Pop Size	Estimate of global population size (breeding-aged individuals) in text format to include </> signs
Global Pop Size#	Estimate of global population size (breeding-aged individuals) in numeric format to allow sorting
group	Type of bird (waterbird, waterfowl, shorebird, landbird)

Introduced	1=Introduced species in North America, according to AOS 7th edition checklist, 60th supplement
IUCN Red List 2018	Conservation status according to the International Union for the Conservation of Nature's (IUCN) Red List of Threatened Species (2018)
lcl_67%CI	Lower Confidence Limit, 67% Credible Interval
lcl_90%CI	Lower Confidence Limit, 90% Credible Interval
Mexico	Occurs in Mexico
Mig Status	Migratory status in North America (R=resident, M=migratory, PM=partial migrant)
ND area	Area estimate (in sq. km) of global non-breeding distribution
ND-g	Assessment score for global non-breeding distribution
ND-g_com	Comments for global non-breeding distribution score
ND-g_s	Source for global non-breeding distribution score
Nonbreeding Biome	For each species, one of 24 primary geographic regions in which it occurs during its stationary nonbreeding season and in which it shares ecological affinities with other species also occupying the same region. See *ACAD Handbook* pp. 26-30 for more detailed explanation and definitions.
Nonbreeding only	Occurs only as a non-breeder (N) in North America, according to AOS 7th edition checklist, 60th supplement
order	Order according to AOU 7th edition checklist, 60th supplement
pop change	Cumulative % change in population size over the trend period listed in trend source. **Note that this metric is not comparable between trend sources spanning different lengths of time**, e.g. BBS9317 only spans 24 years, vs. BBS7017 spans 46 years, so more change would occur over the longer period given identical trends.
pop change 90% lcl	90% lower credible limit for cumulative % change in population size, available for species where the trend source is the same source used by Rosenberg et al. 2019
pop change 90% ucl	90% upper credible limit for cumulative % change in population size, available for species where the trend source is the same source used by Rosenberg et al. 2019
Pop Size_US-Ca	Current population size estimate (breeding-aged individuals) for continental U.S. and Canada in text format to include </> signs. Note that occasionally other geographies are included in the estimate due to the lack of a U.S./Canada-only estimate or due to populations breeding elsewhere that winter in the U.S. or Canada, in which case this will be noted in the field "Pop Size_US-Ca_com."
Pop Size_US-Ca#	Current population size estimate (breeding-aged individuals) for continental U.S. and Canada in numeric format to allow sorting. Note that occasionally other geographies are included in the estimate due to the lack of a U.S./Canada-only estimate or due to populations breeding elsewhere that winter in the U.S. or Canada, in which case this will be noted in the field "Pop Size_US-Ca_com."
Pop Size_US-Ca_com	Comments regarding continental U.S. and Canada population size
Pop Size_US-Ca_s	Source for continental U.S. and Canada population estimate
PopYr	Year associated with Pop Size_US-Ca population size estimates, or primary year or average year if many years involved; note that in most cases this indicates the year(s) the survey was conducted, but in some cases (e.g. USSCP 2016) it indicates the year of publication of estimates (e.g. Andres et al. 2012).

Primary Breeding Habitat	The broad Habitat Class (level 1, e.g. *Forests*) which a species is most likely to occupy during its breeding season; separated by ": " from a more detailed description of its primary Habitat (level 2, e.g., *Mesoamerican Pine-Oak*). See *ACAD Handbook* pp. 31-35 for more detailed explanation and definitions.
Primary Nonbreeding Habitat	The broad Habitat Class (level 1, e.g. *Grasslands*) which a species is most likely to occupy during its stationary nonbreeding season; separated by ": " from a more detailed description of its primary Habitat (level 2, e.g., *Chihuahuan*). See *ACAD Handbook* pp. 31-35 for more detailed explanation and definitions.
PS-g	Assessment score for global population size (breeding-aged individuals)
PS-g_com	Comments regarding global population size and score
PS-g_s	Source of global population size estimate (breeding-aged individuals)
PT-c	Assessment score for continental population trend
PT-c_com	Comments for continental population trend score
PT-c_s	Source for continental population trend score
PT-r#	Assessment score for regional population trend
PT-r_com	Comments for current regional population trend score
PT-r_latest_review	Year in which PT-r was last reviewed (if reviewed)
PT-r_s	Source for current regional population trend score and trend
RA	This value is the annual index for the region from mid-year of the interval represented by the trend estimate. The Relative Abundance estimate is model-based, produced as part of the hierarchical model analysis, and is adjusted for observer and other effects.
RCS-b	Regional Combined Score for breeding season = BD-g + PS-g + PT-r + TB-r + RD-b
RD-b	Assessment score for Relative Density of breeding population in region in text format to include the codes for Perpheral (P), Extirpated Regionally (ER), Nearing Extirpation (NE) or non-breeding (NB).
RD-b#	Assessment score for Relative Density of breeding population in region in numeric format, where Peripheral is represented as a 0 and other non-numeric codes appear blank
RD-b_com	Comments for Relative Density breeding score
RD-b_latest_review	Year in which RD-b was last reviewed
RD-b_s	Source for Relative Density score in region
Region	Geographic scope of regional conservation assessment. See Appendix D for details.
RC	Regional Concern designation (1=yes)
RI	Species of Regional Importance (1=yes)
RS	Regional Stewardship designation (1=yes)
Scientific Name	Scientific name according to AOS 7th edition checklist, 60th supplement
Secondary Breeding Habitat	In cases in which a species occurs in almost equal or in smaller but still significant numbers in a second Habitat Class *or* Habitat (compared to its Primary Breeding Habitat), the additional broad Habitat Class (level 1, e.g. *Aridlands*) which it is likely to occupy during its breeding season; separated by ": " from a more detailed description of its secondary Habitat (level 2, e.g., *Desert Scrub*). See *ACAD Handbook* pp. 31-35 for more detailed explanation and definitions.

Secondary Nonbreeding Habitat	In cases in which a species occurs in almost equal or in smaller but still significant numbers in a second Habitat Class *or* Habitat (compared to its Primary Nonbreeding Habitat), the additional broad Habitat Class (level 1, e.g. *Coasts*) which it is likely to occupy during its stationary nonbreeding season; separated by ": " from a more detailed description of its secondary Habitat (level 2, e.g., *Marine Waters*). See *ACAD Handbook* pp. 31-35 for more detailed explanation and definitions.
taxonomic notes	Annotations on taxonomy and recent changes from AOU 7th edition checklist, 60th supplement, with additions
TB-c	Assessment score for continental threats-breeding
TB-c_com	Comments for continental threats-breeding score
TB-c_s	Source for continental threats-breeding score
TB-r	Assessment score for regional threats-breeding
TB-r_com	Comments for regional threats-breeding score
TB-r_latest_review	Year in which TB-r was last reviewed (if reviewed)
TB-r_s	Source for regional threats-breeding score
TN-c	Assessment score for continental threats-non-breeding
TN-c_com	Comments for continental threats-non-breeding score
TN-c_s	Source for current continental threats-non-breeding score
TN-r	Assessment score for regional threats-non-breeding
TN-r_com	Comments for regional threats-non-breeding score
TN-r_latest_review	Year in which TN-r was last reviewed (if reviewed)
TN-r_s	Source for current regional threats-non-breeding score
trend source	Data source for "trend (%/yr)", associated metadata fields (CI's, df, RA), and pop change fields. **Trend sources marked with an asterisk were rejected as a valid source to assign PT-c**, but are still included here for reference. For those species included in Rosenberg et al. 2019, the trend source is that used in that publication except for a handful of species where CBC was selected as the population trend score source due to better survey coverage for that species than the BBS used by Rosenberg et al. 2019.
trend (%/yr)	Annual trend estimate from long-term survey data, if available. This data is limited to the continental USA and Canada, due to a lack of comparable surveys in other geographies, such that the rangewide trend for a species may differ from that presented here. See trend source (above) for the trend data source displayed in the Global ACAD. In the Regional ACAD, the trend source is the same as PT-r_s.
ucl_67%CI	Upper Confidence Limit, 67% Credible Interval
ucl_90%CI	Upper Confidence Limit, 90% Credible Interval
Urban	"yes" indicates that a species is commonly associated with urban and suburban habitat and landcover during the breeding season—e.g., birds of developed urban spaces, urban/suburban parks, domestic gardens, etc.
USA	Occurs in continental USA

Appendix B: Key to Data Sources

2017 PIPL Regional Summary for Eastern Canada	2017 Piping Plover Regional Summary for Eastern Canada
2018 PF Databook	Olson, S. M. Compiler. 2018. Pacific Flyway Data Book, 2018. U.S. Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Vancouver, Washington.
AFWA Sage- and Columbian Sharp-tailed Grouse Tech Cmte, 2008	Association of Fish and Wildlife Agencies, Sage and Columbian Sharp-tailed Grouse Technical Committee, 2008
Alaska seabird information series 2006	Denlinger, L.M. 2006. Alaska Seabird Information Series. Unpubl. Rept., U.S. Fish and Wildl. Serv., Migr. Bird Manage., Nongame Program, Anchorage, AK. Available at https://www.fws.gov/alaska/mbsp/mbm/seabirds/pdf/asis_complete.pdf
Alaska shorebird conservation plan 2018	Alaska Shorebird Group. 2019. Alaska Shorebird Conservation Plan. Version III. Alaska Shorebird Group, Anchorage, AK.
Alisauskas et al. 2011 (1971-06)	Alisauskas RT, Rockwell RF, Dufour KW, Cooch EG, Zimmerman G, Drake KL, et al. Harvest, survival and abundance of midcontinent lesser snow geese relative to population. Wildlife Monogr. 2011;179:1–42. http://canuck.dnr.cornell.edu/research/pubs/pdf/lsgo-survival.pdf.
Altman	Bob Altman, American Bird Conservancy
AMG	Allisyn Gillet, Indiana Department of Natural Resources
AMJV 2018	Appalachian Mountain Joint Venture, 2018
Ammon 2018	Elisabeth Ammon, Great Basin Bird Observatory, 2018
AMOY Working Group 2018	American Oystercatcher Working Group (amoywg.org)
Andres	Brad Andres, U.S. Fish and Wildlife Service
Andres et al. 1999	Andres, B.A., D.L. Brann, and B.T. Browne. 1999. Inventory of breeding birds on Local Training Areas of the Alaska Army National Guard. Unpublished report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 104 pp.
Andres et al. 2012	Andres, B.A., P.A. Smith, R.I.G. Morrison, C.L. Gratto-Trevor, S.C. Brown, and C.A. Friis. 2012. Population estimates of North American shorebirds, 2012. Wader Study Group Bulletin 119: 178–194. http://www.shorebirdplan.org/wp-content/uploads/2013/03/ShorePopulationAndresEtAl2012.pdf
AOU	American Ornithologists' Union (AOU). 1998. Check-list of North American Birds, 7th ed. American Ornithologists' Union, Washington, D.C.
AOU Checklist 57th Suppl.	Chesser, R.T., K.J. Burns, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, P.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising, D.F. Stotz, and K. Winker. 2016. Fifty-seventh Supplement to the American Ornithologists' Union Check-list of North American Birds. Auk 133: 544–560.
Atlantic Coast shorebird experts 2018	David Mizrahi, Caleb Spiegel, Dan Catlan

AWCP-08	American Woodcock Conservation Plan. 2008. A summary of and recommendations for woodcock conservation in North America. J.R. Kelley and S.J. Williamson, editors. Compiled by woodcock task force, migratory shore and upland game bird working group, Association of Fish and Wildlife Agencies. Wildlife Management Institute, Washington, D. C., USA.
AZ Game & Fish	Arizona Department of Game and Fish
AZBBA	Corman, T. E., & Wise-Gervais, C. 2005. The Arizona breeding bird atlas. Albuquerque: University of New Mexico Press.
AZ-PIF	Arizona Partners in Flight
Baldassarre 2014	Baldassarre, G. 2014. Ducks, geese, and swans of North America (4th edition). John Hopkins University Press, Baltimore, MD.
Ball et al. 2016	Ball, J. R., P. Sólymos, F. K. A. Schmiegelow, S. Hache, J. Schieck, and E. Bayne. 2016. Regional habitat needs of a nationally listed species, Canada Warbler (*Cardellina canadensis*), in Alberta, Canada. Avian Conservation and Ecology 11(2):10. http://dx.doi.org/10.5751/ACE-00916-110210.
Ballou 2015	Ballou, B. (2015, June 6.) Feed 'em or fight 'em: the Muscovy duck wars rage on. Sun Sentinel. Retrieved from https://www.sun-sentinel.com/local/broward/fl-pines-muscovy-ducks-20150604-story.html.
Balshi et al. 2009	Balshi MS, et al. (2009) Assessing the response of area burned to changing climate in western boreal North America using a Multivariate Adaptive Regression Splines (MARS) approach. Glob Change Biol 15(3):578–600.
Bank Swallow Tech. Advisory Comm. 2013	Bank Swallow Technical Advisory Committee. 2013. Bank Swallow (*Riparia riparia*) Conservation Strategy for the Sacramento River Watershed, California. Version 1.0. www.sacramentoriver.org/bans
Barrett et al. 2011	Barrett, K., McGuire, A. D., Hoy, E. E. & Kasischke, E. S. (2011). Ecological Applications 21, 2380–2396;
Bart and Johnston 2012	Bart, J. & V. Johnston, Eds. 2012. Arctic shorebirds in North America: A decade of monitoring. Studies in Avian Biology 44.
bbs0514(BBS)	BBS counts from 2005-2014 were averaged across routes within BCRs (weighted by size of provinces/states in BCRs), for the continental US & Canada, including some extrapolations to range uncovered by BBS, but did not include non-BBS sources; %Pops for species in BCRs 1, 3 and 7 were based on eBird frequencies due to sparse BBS coverage; this source for non-landbirds only
bbs0514(UsCa)	BBS counts from 2005-2014 were averaged across routes within BCRs (weighted by size of provinces/states in BCRs), for the continental US & Canada, including some extrapolations to range uncovered by BBS, and some other data sources in the north (atlases, NWT checklists & censuses); this source for landbirds only
BBS-08	Hierarchical linear regression analysis of Breeding Bird Survey data (1966-2008) provided by John Sauer to Partners In Flight, BCR-level results
bbs14	RD-b score based on BBS average counts from 2005 to 2014, standardized to BCR with highest average count. RD=5 if relative density ("rdens14" below) was 50% or more, else RD=4 if rdens14 > 25%, else RD=3 if rdens14 > 10%, else RD=2 if rdens14 > 1.0%, else RD=1 if rdens14 > 0

bbs14adj	When eBird indicated that a commonly encountered species was found more frequently in region(s) outside continental US/Canada, adjusted BBS values (rdens14 times max eBird frequency in continental US/Canada divided by max eBird frequency in any region) were used to account for lower global importance of regions within continental US/Canada (Area Importance measures such as RD and %Pop are assessed globally)
BBS7015	Hierarchical linear regression analysis of Breeding Bird Survey data (1970-2015) provided by John Sauer to Partners In Flight, BCR-level results
BBS7017	Hierarchical linear regression analysis of Breeding Bird Survey data (1970-2017) provided by John Sauer to Partners In Flight, BBS core survey area-wide results
BBS9317	Hierarchical linear regression analysis of Breeding Bird Survey data (1993-2017) provided by John Sauer to Partners In Flight, expanded BBS coverage area-wide results. Includes BBS routes added in Alaska, Yukon Territory, Northwest Territory, and Newfoundland in 1993 as well as the core BBS area of southern Canada and lower 48 United States.
BBS9317-endpt	Endpoint analysis (based on start year and end year) of Breeding Bird Survey data from the expanded BBS coverage area (see BBS9317 above), BCR-level results. Only the 95% CI was provided, so we used these to calculate LCL and UCL-specific Standard Deviation using the equations: $LCL = trend – (critical\ value \times SD_{LCL})$ $UCL = trend + (critical\ value \times SD_{UCL})$ and used these SD's to estimate the 90% and 67% CI's using appropriate critical values for the purpose of scoring TB-r, but they are not reported since rough estimates. For this reason and because endpoint analysis is more susceptible to annual population fluctuations than hierarchical linear regression, TB-r scores with this source should be taken with a grain of salt.
BC BBA	Davidson, P.J.A., R.J. Cannings, A.R. Couturier, D. Lepage, and C.M. Di Corrado (eds.). 2015. The Atlas of the Breeding Birds of British Columbia, 2008-2012. Bird Studies Canada, Delta, B.C. Available at http://www.birdatlas.bc.ca.
BCR 11 review team 2018	Scott Somershoe, Sean Fields, Alaine Camfield with additional CWS staff input
BCR 13 Review Team 2018	Canadian experts: Mike Cadman, Christian Roy, François Shaffer, Josée Tardif, Bruno Drolet, Christine Lepage, Josée Lefebvre, Jean-François Rail, Yves Aubry. US experts: Randy Dettmers, Ken Rosenberg, Doug Gross, Caleb Spiegel.
BCR 1-3 Review Team 2018	Brad Andres and Natalie Savoie
BCR 14 Review Team 2018	Canadian experts: Christian Roy, Sabine Whilhelm, Greg Campbell, Julie Paquet, François Shaffer and Josée Tardif, Bruno Drolet, Christine Lepage, Josée Lefebvre, Jean-François Rail, Yves Aubry. US experts: Randy Dettmers, Pam Hunt, Danielle D'Auria, Linda Welch, Lindsay Tudor, Caleb Spiegel, Ken Rosenberg, Adrienne Leppold, Jenny Dickson.
BCR 16 Review Team 2018	Edwin Juarez, Troy Corman, Carol Beardmore, Russell Norvell, Adam Brewerton, Christopher Rustay, Corrie Borgman, Arvind Panjabi

BCR 24 Review Team 2018	Kate Slankard, Sarah Kendrick, David Hanni, Doreen Mengel, Heath Hagy, Chuck Hunter, Dean Demarest, Tom Will, Allisyn Gillet, John Brunjes, Jane Fitzgerald, Allison Fowler
BCR 25 review team 2018	Anne Mini, Dean Demarest, Bill Holliman, Mark Howery, Chuck Hunter, Dale James, Karen Rowe, Cliff Shackelford, and Michael Seymour
BCR 26 Review Team 2018	Anne Mini, Dean Demarest, Chuck Hunter, Dale James, Mark Woodrey
BCR 27 Review Team 2018	Dean Demarest, Chuck Hunter
BCR 28 Review Team 2018	Dean Demarest, Randy Dettmers, Becky Keller, Rich Bailey, Sergio Harding, Dan Brauning, Chris Kelly, David Hanni, Sharon Petzinger, Carol Croy, Suzanne Treyger, Gwen Brewer, Laura Kearns, Petra Wood, Kate Slankard
BCR 29 Review Team 2018	Dean Demarest, Chuck Hunter, Randy Dettmers
BCR 31 Review Team 2018	Dean Demarest, Chuck Hunter
BCR 37 Review Team 2017	Brent Ortego; Michael Seymour; Cliff Shackelford; Clay Green; Erik Johnson; Paul Leberg; David Newstead; Susan Heath; Donna Dittmann; Steven W Cardiff; Mary Gustafson; Matt Brady; Jesús Franco; Jim Giocomo; Barry Wilson; Anne Mini; Mike Brasher; Dean Demarest
BCR 4 Review Team 2018	Pam Sinclair
BCR 6 Review Team 2018	Steve Van Wilgenburg, Samuel Hache, Christian Roy
BCR 8 Review Team 2018	Christian Friis, Steve Van Wilgenburg, Christian Roy, François Shaffer and Josée Tardif, Bruno Drolet, Christine Lepage, Josée Lefebvre, Jean-François Rail, Yves Aubry
Beardmore	Carol Beardmore, retired from Sonoran Joint Venture
Beedy et al. 2013	Beedy, E. C., and E. R. Pandolfino; illustrated by K. Hansen. 2013. Birds of the Sierra Nevada. University of California Press, Berkeley, California, USA.
Bellrose 1980	Bellrose, F.C. 1980. Ducks, geese and swans of North America. Third edition. Stackpole Books. Harrisburg, Pennsylvania. 540 pp.
Benkman 2018	Craig Benkman, University of Wyoming
Bergeron et al. 2010	Bergeron Y, Cyr D, Girardin MP, Carcaillet C (2010) Will climate change drive 21st century burn rates in Canadian boreal forest outside of its natural variability: Collating global climate model experiments with sedimentary charcoal data. Int J Wildland Fire 19(8):1127–1139.
Bird Conservancy of the Rockies 2018	Bird Conservancy of the Rockies, unpublished data, 2018. For Black Rosy-Finch, mean abundance estimate (note high variance: 83% mean CV) from within IMBCR (https://birdconservancy.org/what-we-do/science/monitoring/imbcr-program/) 2017-2018 survey area of WY, MT, UT, and USFS land + some BLM land in S. ID, but no surveys in OR, NV, or rest of ID, so a min. estimate. For Brown-capped Rosy-Finch, estimate is mean from RMBO's Monitoring Colorado's Birds surveys of alpine habitat from 1999-2005.
Bird Conservancy of the Rockies 2019	Custom calculations to adjust prior scores to taxonomic changes based on geographic range of split taxa

BirdLife	If BirdLife 2000: BirdLife International. 2000. Threatened birds of the world. Barcelona and Cambridge, UK: Lynx Edicions and BirdLife International. All other years: BirdLife International IUCN Red List for birds. Downloaded from http://www.birdlife.org.
Birds of Trans Pecos checklist	Peterson, J., & Zimmer, B. (1998). Birds of the Trans-Pecos. Austin, Tex: University of Texas Press.
Bishop et al. 2018	Bishop, C.A., Moran, A.J., Toshack, M.C., Elle, E., Maisonneuve, F. and Elliott, J.E., 2018. Hummingbirds and bumble bees exposed to neonicotinoid and organophosphate insecticides in the Fraser Valley, British Columbia, Canada. Environmental toxicology and chemistry, 37(8), pp.2143-2152.
Blancher	Peter Blancher, retired from Environment and Climate Change Canada
BNA Ainley et al. 2002	Ainley, D. G., D. N. Nettleship, H. R. Carter, and A. E. Storey. 2002. Common Murre (*Uria aalge*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.666
BNA Ainley et al. 2011	Ainley, D. G., D. A. Manuwal, J. Adams, and A. C. Thoresen (2011). Cassin's Auklet (*Ptychoramphus aleuticus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.50
BNA Atwood & Bontrager 2001	Atwood & Bontrager. 2001. California Gnatcatcher. In BNA No. 574, Poole & Gill, eds., BNA, Philadelphia.
BNA Avery 2013	Avery, M. L. 2013. Rusty Blackbird (*Euphagus carolinus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.200
BNA Bond et al. 2013	Bond, A. L., I. L. Jones, S. Seneviratne, and S. Bin Muzaffar (2013). Least Auklet (*Aethia pusilla*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.69
BNA Briskie 1993	Briskie. 1993. Smith's Longspur. In BNA No. 34. Poole, Stettenheim, & Gill, eds., Acad. Natl. Sci., Phil., & AOU, D.C.
BNA Bryan 2002	Bryan, D. C. (2002). Limpkin (*Aramus guarauna*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.627
BNA Bull & Duncan 1993	Bull & Duncan. 1993. Great Gray Owl. In BNA No. 41, Poole & Gill, eds., BNA Philadelphia.
BNA Butler and Buckley 2002	Butler, Ronald G. and Daniel E. Buckley. (2002). Black Guillemot (*Cepphus grylle*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/blkgui
BNA Causey 2002	Causey, D. (2002). Red-faced Cormorant (*Phalacrocorax urile*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.617
BNA Chardine & Morris 1996	Chardine, John W. and Ralph D. Morris. (1996). Brown Noddy (*Anous stolidus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/brnnod

BNA Ciaranca et al. 1997	Ciaranca, M. A., C. C. Allin, and G. S. Jones (1997). Mute Swan (*Cygnus olor*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.273
BNA Coulter et al. 1999	Coulter, M. C., J. A. Rodgers Jr., J. C. Ogden, and F. C. Depkin (1999). Wood Stork (*Mycteria americana*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.409
BNA Diamond & Schreiber 2002	Diamond, Anthony W. and Elizabeth A. Schreiber. (2002). Magnificent Frigatebird (*Fregata magnificens*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna-org.prxy4.ursus.maine.edu/Species-Account/bna/species/magfri
BNA Dumas 2000	Dumas, J. V. (2000). Roseate Spoonbill (*Platalea ajaja*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.490
BNA Evers et al. 2010	Evers, David C., James D. Paruk, Judith W. McIntyre and Jack F. Barr. (2010). Common Loon (*Gavia immer*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/comloo
BNA Ewins 1993	Ewins, P. J. (1993). Pigeon Guillemot (*Cepphus columba*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.49
BNA Frederick & Siegel-Causey 2000	Frederick, P. C. and D. Siegel-Causey (2000). Anhinga (*Anhinga anhinga*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.522
BNA Gaston & Dechesne 1996	Gaston, Anthony J. and S. B. Dechesne.(1996).Rhinoceros Auklet (*Cerorhinca monocerata*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/rhiauk
BNA Gaston & Hipfner 2000	Gaston, A. J. and J. M. Hipfner (2000). Thick-billed Murre (*Uria lomvia*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.497
BNA Gaston and Shoji 2010	Gaston, A. J. and A. Shoji (2010). Ancient Murrelet (*Synthliboramphus antiquus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.132
BNA Gauger 1999	Gauger, Vanessa H.(1999).Black Noddy (*Anous minutus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/blknod

BNA Gerber et al. 2014	Gerber, Brian D., James F. Dwyer, Stephen A. Nesbitt, Rod C. Drewien, Carol D. Littlefield, T. C. Tacha and P. A. Vohs. (2014). Sandhill Crane (*Antigone canadensis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/sancra
BNA Gochfeld & Burger 1994	Gochfeld, M. and J. Burger (1994). Black Skimmer (*Rynchops niger*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.108
BNA Hatch 2002	Hatch, Jeremy J.(2002).Arctic Tern (*Sterna paradisaea*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/arcter
BNA Hatch et al. 2009	Hatch, S. A., G. J. Robertson, and P. H. Baird (2009). Black-legged Kittiwake (*Rissa tridactyla*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.92
BNA Hobson 2013	Hobson, K. A. (2013). Pelagic Cormorant (*Phalacrocorax pelagicus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.282
BNA Hohman & Lee 2001	Hohman, W. L. and S. A. Lee (2001). Fulvous Whistling-Duck (*Dendrocygna bicolor*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.562
BNA Johnson et al. 2011	Johnson, Jeff A., Michael A. Schroeder and Leslie A. Robb.(2011). Greater Prairie-Chicken (*Tympanuchus cupido*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America:https://birdsna.org/Species-Account/bna/species/grpchi
BNA Jones et al. 2001	Jones, Ian L., Nikolai B. Konyukhov, Jeffrey C. Williams and G. Vernon Byrd.(2001).Parakeet Auklet (*Aethia psittacula*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America:https://birdsna.org/Species-Account/bna/species/parauk
BNA Kessel et al. 2002	Kessel, B., D. A. Rocque, and J. S. Barclay. 2002. Greater Scaup (*Aythya marila*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.650
BNA Koenig & Reynolds 2009	Koenig, W. D. and M. D. Reynolds (2009). Yellow-billed Magpie (Pica *nuttalli*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.180
BNA Knopf and Evans 2004	Knopf, F. L. and R. M. Evans (2004). American White Pelican (*Pelecanus erythrorhynchos*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.57

BNA Lavers et al. 2009	Lavers, Jennifer, J. Mark Hipfner and Gilles Chapdelaine.(2009). Razorbill (*Alca torda*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/razorb
BNA, Lee & Walsh-McGee 1998, White-tailed Tropicbird	Lee, David S. and Martha Walsh-McGee. (1998). White-tailed Tropicbird (*Phaethon lepturus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/whttro
BNA Lowther et al. 2002	Lowther, P. E., A. W. Diamond, S. W. Kress, G. J. Robertson, and K. Russell (2002). Atlantic Puffin (*Fratercula arctica*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.709
BNA Mallory et al. 2012	Mallory, M. L., S. A. Hatch, and D. N. Nettleship (2012). Northern Fulmar (*Fulmarus glacialis*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.361
BNA Molina et al. 2014	Molina, K. C., J. F. Parnell, and R. M. Erwin (2014). Gull-billed Tern (*Gelochelidon nilotica*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.140
BNA Montevecchi & Stenhouse 2002	Montevecchi, W. A. and I. J. Stenhouse (2002). Dovekie (*Alle alle*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.701
BNA Mowbray 2002a	Mowbray, T. B. 2002. Canvasback (*Aythya valisineria*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.659
BNA Mowbray 2002b	Mowbray, T. B. (2002). Northern Gannet (*Morus bassanus*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.693
BNA Nisbet et al. 2014	Nisbet, Ian C., Michael Gochfeld and Joanna Burger. (2014). Roseate Tern (*Sterna dougallii*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/roster
BNA Nisbet et al. 2017	Nisbet, I. C. T., D. V. Weseloh, C. E. Hebert, M. L. Mallory, A. F. Poole, J. C. Ellis, P. Pyle, and M. A. Patten (2017). Herring Gull (*Larus argentatus*), version 3.0. In The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.hergul.03
BNA North 2013	North, M. R. 2013. Aleutian Tern (*Onychoprion aleuticus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.291
BNA Powell & Suydam 2012	Powell, A. N. and R. S. Suydam (2012). King Eider (*Somateria spectabilis*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.491
BNA Robertson & Savard 2002	Robertson, G. J. and J. L. Savard. 2002. Long-tailed Duck (*Clangula hyemalis*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.651

BNA Schreiber and Norton, 2002	Schreiber, Elizabeth A. and R. L. Norton.(2002).Brown Booby (*Sula leucogaster*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/brnboo
BNA Schreiber and Schreiber 2009	Schreiber, Betty A. and R. W. Schreiber. (2009). Red-tailed Tropicbird (*Phaethon rubricauda*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/rettro
BNA Schreiber et al. 2002	Schreiber, Elizabeth A. and R. L. Norton.(2002).Brown Booby (*Sula leucogaster*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/brnboo
BNA Shealer et al. 2016	Shealer, D., J. S. Liechty, A. R. Pierce, P. Pyle, and M. A. Patten (2016). Sandwich Tern (*Thalasseus sandvicensis*), version 3.0. In The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.santer1.03
BNA Shields 2014	Shields, M. (2014). Brown Pelican (*Pelecanus occidentalis*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.609
BNA Urbanek & Lewis 2015	Urbanek, Richard P. and James C. Lewis.(2015). Whooping Crane (Grus *americana*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/whocra
BNA Wallace & Wallace 1998	Wallace, E. A. and G. E. Wallace (1998). Brandt's Cormorant (*Phalacrocorax penicillatus*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.362
BNA Weiser & Gilchrist 2012	Weiser, E. and H. G. Gilchrist (2012). Glaucous Gull (*Larus hyperboreus*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.573
BNA White et al. 2002	White, C. M., N. J. Clum, T. J. Cade, and W. G. Hunt (2002). Peregrine Falcon (*Falco peregrinus*), version 2.0. In The Birds of North America (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.660
BNA Woolfenden & Fitzpatrick 1996	Woolfenden, Glen E. and John W. Fitzpatrick. (1996). Florida Scrub-Jay (*Aphelocoma coerulescens*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/flsjay
Boettcher 2018	Ruth Boettcher, Virginia Department of Game and Inland Fisheries 2018
Bond et al. 2015	Bond, A. L., Hobson, K. A., & Branfireun, B. A. (2015). Proceedings of the Royal Society of London B: Biological Sciences, 282(1805), 20150032.
Boulanger et al. 2014	Boulanger Y, Gauthier S, Burton PJ (2014) A refinement of models projecting future Canadian fire regimes using homogeneous fire regime zones. Can J Res 44(4):365–376.

Bowman et al. 2015	Bowman, T. D., Silverman, E. D., Gilliland, S. G., and Leirness, J. B. (2015). Status and trends of North American sea ducks: reinforcing the need for better monitoring. Pp. 1-28 in Savard et al., eds. Ecology and Conservation of North American Sea Ducks. Studies in Avian Biology 46.
Braun 1998	Braun, C.E. 1998. Sage grouse declines in western North America: what are the problems? Proc. West. Assoc. State Fish and Wildl. Agencies 78:139-156.
Brown et al. 2001	Brown, S., Hickey, C., Harrington, B., and Gill, R. (eds.) 2001. The U. S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.
Butler & Harrell 2019	Butler, M.J. and W. Harrell. 2019. Whooping Crane Survey Results: Winter 2017–2018. U.S. Fish and Wildlife Service, Albuquerque, NM.
C. Dwyer 2018	Chris Dwyer, US Fish and Wildlife Service
C. Friis 2018	Christian Friis, Canadian Wildlife Service
C. Roy 2018	Christian Roy, Canadian Wildlife Service
CAFF[year(s)]	CAFF18: population estimate from the following publication. CAFF6116, CAFF7514, CAFF8515: population trend over the years 1961-2016, 1975-2014, 1985-2015 respectively, from the following publication. CAFF. 2018. A Global audit of the status and trends of Arctic and Northern Hemisphere goose population. Conservation of Arctic Flora and Fauna International Secretariat, Akureyri, Iceland.
California Condor Recovery Team 2017	U.S. Fish and Wildlife Service. 2017. California Condor Recovery Program 2017 Annual Condor Population Status. https://www.fws.gov/cno/es/CalCondor/PDF_files/2017-CA-condor-population-status.pdf
Camfield-17	Alaine Camfield, Canadian Wildlife Service, 2017
Camill 2005	Camill, P. (2005). Permafrost thaw accelerates in boreal peatlands during late-20th century climate warming. Climatic Change, 68(1), 135-152.
Carter	Michael Carter, Playa Lakes Joint Venture
Casey	Daniel Casey, Northern Great Plains Joint Venture
CBC	Audubon Christmas Bird Count
CBC7017	Meehan, T.D., LeBaron, G.S., Dale, K., Michel, N.L., Verutes, G., and Langham, G.M. 2018. Population trends for North American winter birds from Audubon Christmas Bird Counts, 1966-2017, version 2.1_1966-2017_2018. National Audubon Society, New York, New York, USA.
CBO	Colorado Bird Observatory (now Bird Conservancy of the Rockies)
CDTT	Chihuahuan Desert Technical Team of the Rio Grande Joint Venture
Chardine et al. 2013	Chardine, J., J. Rail, and S. Wilhelm. 2013. Population dynamics of Northern Gannets in North America, 1984–2009. Journal of Field Ornithology. 84. 10.1111/jofo.12017.
Chasmer & Hopkinson 2017	Chasmer, L., & Hopkinson, C. (2017). Threshold loss of discontinuous permafrost and landscape evolution. Global change biology, 23(7), 2672-2686.

Clay et al. 2014	Clay, R.P., A.J. Lesterhuis, S. Schulte, S. Brown, D. Reynolds and T.R. Simons. 2014. A global assessment of the conservation status of the American Oystercatcher *Haematopus palliatus*. International Wader Studies 20: 62–82.
Clements checklist (taxonomic reference)	see http://www.birds.cornell.edu/clementschecklist/
Colonial Seabird Monitoring Program 2018	Colonial Seabird Monitoring Program, Canadian Wildlife Service, 2018
Conklin et al. 2016	Conklin, Jesse & Lok, Tamar & Melville, David & C Riegen, Adrian & Schuckard, Rob & Piersma, Theunis & Battley, Phil. (2016). Declining adult survival of New Zealand Bar-tailed Godwits during 2005–2012 despite apparent population stability. The Emu: official organ of the Australasian Ornithologists' Union. 116. 147-157. 10.1071/MU15058.
Coops & Warning 2011	Coops, N.C. and Waring, R.H. (2011) A Process-Based Approach to Estimate Lodgepole Pine (*Pinus contorta* Dougl.) Distribution in the Pacific Northwest under Climate Change. Climate Change, 105, 313-328.
CO-PIF	Colorado Partners in Flight
Corman 2018	Troy Corman, Arizona Department of Game and Fish, 2018
Corner Brook 2008	Newfoundland landbird conservation plan meeting, at which scores were reviewed by experts
Correll et al. 2017	Correll, M. D., W. A. Wiest, T. P. Hodgman, W. G. Shriver, C. S. Elphick, B. J. McGill, K. M. O'Brien, and B. J. Olsen. 2017. Predictors of specialist avifaunal decline in coastal marshes. Conservation Biology 31: 172– 182.
COSEWIC 2008	The Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2008. COSEWIC Annual Report 2007-2008. Retrieved from http://publications.gc.ca/collections/collection_2013/ec/CW70-18-2008-eng.pdf.
COSEWIC 2012	COSEWIC. 2012. COSEWIC assessment and status report on the Marbled Murrelet Brachyramphus marmoratus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 82 pp.
COSEWIC 2014a	COSEWIC. 2014. COSEWIC assessment and status report on the Cassin's Auklet Ptychoramphus aleuticus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 69 pp. (Species at Risk Public Registry).
COSEWIC 2014b	COSEWIC. 2014. COSEWIC assessment and status report on the Western Grebe (Aechmophorus occidentalis) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 55 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).
COSEWIC 2017	COSEWIC. 2017. COSEWIC assessment and status report on the Peregrine Falcon Falco peregrinus (pealei subspecies – Falco peregrinus pealei and anatum/tundrius – Falco peregrinus anatum/tundrius) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xviii + 108 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

Cumming & Diamond 2002	Cumming, E. E., & Diamond, A. W. (2002). Songbird community composition versus forest rotation age in Saskatchewan boreal mixedwood forest. Canadian Field-Naturalist, 116(1), 69-75.
CWS - QC reviewers 2018	Canadian Wildlife Service, Quebec Regional Office
CWS BCR database	Canadian Wildlife Service. 2014. National Database to Support Bird Conservation Region Planning in Canada. Request data or information: ec.oiseauxmigrateurs-migratorybirds.ec@canada.ca
CWS review team 2018	Canadian Wildlife Service review team 2018
CWS reviewers 2018	Canadian Wildlife Service review team 2018
CWS waterfowl biologists 2018	Canadian Wildlife Service waterfowl biologists 2018
CWS-ATL 2018	Canadian Wildlife Service, Atlantic Regional Office
CWS-ON 2018	Canadian Wildlife Service, Ontario Regional Office
CWS-ON waterfowl biologists 2018	Canadian Wildlife Service Ontario Regional Office waterfowl biologists 2018
D Haukos, pers. comm. 2015	Dave Haukos, Kansas Cooperative Fish and Wildlife Research Unit Leader, US Geological Survey/Kansas State University
Dale	Brenda Dale, Canadian Wildlife Service
Danielle D'Auria, Maine DIFW 2018	Danielle D'Auria, Maine Department of Inland Fisheries and Wildlife, 2018
Dave Moore CWS 2018	Dave Moore, Canadian Wildlife Service, 2018
David Mizrahi (NJ Audubon) 2018	David Mizrahi, New Jersey Audubon, 2018
Defenders of Wildlife 2007	Defenders of Wildlife. 2007. Navigating the Arctic Meltdown: Ivory Gulls. Washington D.C.: Defenders of Wildlife.
DeGroot	Krista DeGroot, Canadian Wildlife Service
Demarest	Dean Demarest, US Fish and Wildlife Service
Derksen et al. 2015	Derksen, D. V., M. R. Petersen, and J-P. L. Savard. 2015. Pp. 469-527 in Savard et al., eds. Ecology and Conservation of North American Sea Ducks. Studies in Avian Biology 46.
Dettling et al. 2014	Dettling, MD, NE Seavy, CA Howell, and T Gardali. (2014.) Current status of Western Yellow-billed Cuckoo along the Sacramento and Feather rivers, California. PLOSOne
Dettmers	Randy Dettmers, U.S. Fish and Wildlife Service
Devers & Collins 2011	Devers, P.K., and B. Collins. 2011. Conservation action plan for the American black duck, First Edition. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, MD, USA.
DiGaudio 2018	Ryan DiGaudio, Point Blue Conservation Science
Dragoo et al. 2019	Dragoo, D. E., H. M. Renner, and R. S. A. Kaler. 2019. Breeding status and population trends of seabirds in Alaska, 2018. U.S. Fish and Wildlife Service Report AMNWR 2019/03. Homer, Alaska.
Dubovsky 2016	Dubovsky, J.A. 2016. Status and harvests of sandhill cranes: Mid-Continent, Rocky Mountain,Lower Colorado River Valley and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Lakewood, Colorado. 15pp.

Dubovsky 2017	Dubovsky, J.A. 2017. Status and harvests of sandhill cranes: Mid-Continent, Rocky Mountain, Lower Colorado River Valley and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Lakewood, Colorado.
Dunn	Erica Dunn, Environment and Climate Change Canada
E Nol, Pers Comm.	Erica Noel, Trent University
Easton	Wendy Easton, Canadian Wildlife Service
eBird	eBird Species Maps from all years filtered by May-July or June-July depending on migration phenology. Cornell Lab of Ornithology, Ithaca, New York. Available at https://ebird.org/map.
eBird17	Relative Frequency (RF) score based on eBird bar chart data, 1970 to mid-January 2017 (downloaded Jan 17, 2017). RF=5 if relative frequency ("rfreq17" below) was 68.1% or more, else RF=4 if rfreq17 > 44.6%, else RF=3 if rfreq17 > 21.7%, else RF=2 if rfreq17 > 3.6%, else RF=1 if rfreq17 > 1.5%. These RF score cutoffs were chosen to maximize relationship between BBS-based relative density and eBird-based relative frequency values across landbirds with 90%+ population in US/Canada.
eBird[year]	ebird Data Explorer from all years (as of the year listed) filtered by May-July or June-July depending on migration phenology
eBrd17(UsCa or WHem or Glob)	eBird frequencies per region were weighted by region size to approximate %Pops per Region (%Freqs), generally for species with poor BBS data, or for regions without BBS data; UsCa indicates BCRs 1 to 37 without Mexican portions of border BCRs, WHem indicates regions outside of BBS coverage in the Western Hemisphere, Glob indicates parts of range outside the Western Hemisphere
eBrd18modl(UsCa,WHem)	Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, M. Iliff, and S. Kelling. eBird Status and Trends. Version: November 2018. https://ebird.org/science/status-and-trends. Cornell Lab of Ornithology, Ithaca, New York.
Environment Canada 2012	Environment Canada. 2012. Bird Conservation Strategy for Bird Conservation Region 11 in the Prairie and Northern Region CWS region: Prairie Potholes. Canadian Wildlife Service, Environment Canada. Saskatoon, SK. 104 pp. + appendices.
Eriksen et al. 2016	Eriksen, R.E., Akridge, M.D., Brown, T.A., Hughes, T.W., Penner, C.A., Scott, K.B. 2016. Status and distribution of wild turkeys in the United States: 2014 status. Proceedings of the National Wild Turkey Symposium 11: 7–18.
EWS-QC	Eastern Waterfowl Survey—Quebec Province, CA
Farrell et al. 2017	Farrell, C. E., Wilson, S., & Mitchell, G. (2017). Assessing the relative use of clearcuts, burned stands, and wetlands as breeding habitat for two declining aerial insectivores in the boreal forest. Forest Ecology and Management, 386, 62-70.
Fitzgerald	Jane Fitzgerald, American Bird Conservancy
FL FWCC 2011	Florida Fish and Wildlife Conservation Commission. 2011. White-crowned Pigeon Biological Status Review.
Flannigan et al. 2005	Flannigan MD, Logan KA, Amiro BD, Skinner WR, Stocks BJ (2005) Future Area Burned in Canada. Clim Change 72(1-2):1–16.

Fletcher et al. 2016	Fletcher et al. 2016. Annual Progress Report on Snail Kite Demography. USGS Florida Cooperative Fish and Wildlife Research Unit, University of Florida, Gainesville.
Franke 2016	Franke, A. 2016. Population Estimates for Northern Juvenile Peregrine Falcons with Implications for Harvest Levels in North America. Journal of Fish and Wildlife Management. 7. 10.3996/062015-JFWM-050.
FWS Mig Birds/ Sea Duck JV 2017	U.S. Fish & Wildlife Service Division of Migratory Bird Management/ Sea Duck Joint Venture expert consensus, 2017
FWS R7	US Fish and Wildlife Service Alaska Region 7 flyway leads, pers. comm.
FWS-16	U.S. Fish and Wildlife Service. 2016. Waterfowl population status, 2016. U.S. Department of the Interior, Washington, D.C. USA.
FWS7017	Original data from U.S. Fish and Wildlife Service. 2017. Waterfowl population status, 2017. U.S. Department of the Interior, Washington, D.C. USA. Trend analysis over 1970-2017 from Rosenberg et al. 2019.
Gauthier et al. 2015	Gauthier, S., Bernier, P., Kuuluvainen, T., Shvidenko, A. Z., & Schepaschenko, D. G. (2015). Boreal forest health and global change. Science, 349(6250), 819-822.
GBE	Great Basin Experts (-YEAR)
Gibson and Byrd 2007	Gibson, D. D., & Byrd, G. V. 2007. Birds of the Aleutian Islands, Alaska. Cambridge, Mass: Nuttall Ornithological Club.
Gillet 2018	Allisyn Gillet, Indiana Department of Natural Resources, 2018
Gomez-Panjabi	Hector Gomez de Silva (Eagle-eye Tours, formerly with National Autonomous University of Mexico, UNAM) and Arvind Panjabi, Bird Conservancy of the Rockies. The suffix "–PS-g midpoint" appended to the source code indicates a population estimate based on the midpoint of the ACAD PS-g category range.
Gonzalez-Prieto et al. 2017	González-Prieto, A. M., Bayly, N. J., Colorado, G. J., & Hobson, K. A. (2017). Topography of the Andes Mountains shapes the wintering distribution of a migratory bird. Diversity and Distributions, 23(2), 118-129.
Graves et al. 2019	Graves, E.E., Jelks, K.A., Foley, J.E., Filigenzi, M.S., Poppenga, R.H., Ernest, H.B., Melnicoe, R. and Tell, L.A., 2019. Analysis of insecticide exposure in California hummingbirds using liquid chromatography-mass spectrometry. Environmental Science and Pollution Research, 26(15), pp.15458-15466.
Green	Michael Green, U.S. Fish and Wildlife Service. If 2012: unpublished data from 2012 Peregrine Falcon surveys. All other years: personal communication.
NATS6815	Groves, D.J. 2017. The 2015 North American trumpeter swan survey. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Juneau, AK. Unpublished report.
GUSG Final Rule 2014	Interior, U.S. Department of. 2014. Endangered and threatened wildlife and plants; Threatened status for Gunnison Sage-Grouse: Final Rule. Federal Register no. 79 (224):69192-69310.
Gustafson	Mary Gustafson, American Bird Conservancy
Handel and Sauer 2017	Handel, C.M and J.R. Sauer. 2017. Combined analysis of roadside and off-road breeding bird survey data to assess population change in Alaska. Condor 119(3) : 557-575

Hannah & Hoyt 2004	Hannah, K. C., & Hoyt, J. S. (2004).The Condor, 106(2), 420-423;
Hannah et al. 2008	Hannah, K. C., F. K. A. Schmiegelow, and K. E. H. Aitken. 2008. White-throated Sparrow response to forest harvesting in north-central Alberta: results not so clear-cut?. Avian Conservation and Ecology - Écologie et conservation des oiseaux 3(1): 6. [online] URL: http://www.ace-eco.org/vol3/iss1/art6/
Hansen et al. 2013	Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, J. R. G. Townshend. (2013). High-resolution global maps of 21st-century forest cover change. Science, 342(6160), 850-853.
Harrison	Harrison, P.H. 1996. Seabirds of the World: A Photographic Guide. Princeton University Press. Princeton, NJ.
HBW	del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & Kirwan, G. (eds.) 2016. Handbook of the Birds of the World Alive. Lynx Edicions, Barcelona. Retrieved in 2016 from http://www.hbw.com/
Hobsen & Bayne 2000a	Hobson, K. A., & Bayne, E. (2000). Breeding bird communities in boreal forest of western Canada: consequences of "unmixing" the mixedwoods. The Condor, 102(4), 759-769.
Hobsen & Bayne 2000B	Hobson, K. A., & Bayne, E. (2000). The effects of stand age on avian communities in aspen-dominated forests of central Saskatchewan, Canada. Forest Ecology and Management, 136(1), 121-134.
Hobson & Schieck 1999	Hobson, K. A., & Schieck, J. (1999). Changes in bird communities in boreal mixedwood forest: harvest and wildfire effects over 30 years. Ecological Applications, 9(3), 849-863.
Howell et al. 2009	Howell, S.N.G., McGrath, T., Hunefeld, W.T. & Feenstra, J.S. 2009. Occurrence and identification of the Leach's Storm-Petrel (Oceanodroma leucorhoa) complex off southern California. North American Birds 63: 540-549.
Hoyt & Hannon 2002	Hoyt, J. S., & Hannon, S. J. (2002). Habitat associations of black-backed and three-toed woodpeckers in the boreal forest of Alberta. Canadian Journal of Forest Research, 32(10), 1881-1888.
Hunt et al. 2017	Hunt, A. R., Bayne, E. M., & Haché, S. (2017). Forestry and conspecifics influence Canada Warbler (Cardellina canadensis) habitat use and reproductive activity in boreal Alberta, Canada. The Condor, 119(4), 832-847.
Hunter	William "Chuck" Hunter, U.S. Fish and Wildlife Service
IDFG	Idaho Fish and Game Species Diversity explorer: https://idfg.idaho.gov/species/
ID-PIF	Idaho Partners in Flight
Igl 2018	Larry Igl, Northern Prairies Research Station, USGS, 2018
IMWJV 2018	Intermountain West Joint Venture, 2018
insufficient data	Breeding Bird Survey data, degrees of freedom < 6

International Bicknell's Thrush Conservation Group 2017	Lloyd, J.D. and K.P. McFarland, Eds. 2017. A Conservation Action Plan for Bicknell's Thrush (Catharus bicknelli). International Bicknell's Thrush Conservation Group (IBTCG). International Bicknell's Thrush Conservation Group. Available at https://bicknellsthrush.org/conservation-action-plan/conservation-action-plan-for-bicknells-thrush/ or 10.6084/m9.figshare.4962608.
Ireson et al. 2015	Ireson, A. M., A. G. Barr, J. F. Johnstone, S. D. Mamet, G. van der Kamp, C. J. Whitfield, N. L. Michel, R. L. North, C. J. Westbrook, C. DeBeer, K. P. Chun, A. Nazemi, J. Sagin. (2015). The changing water cycle: the Boreal Plains ecozone of Western Canada. Wiley Interdisciplinary Reviews: Water, 2(5), 505-521.
IUCN	IUCN. 2016. The IUCN Red List of Threatened Species. Version 2016-3. www.iucnredlist.org.
J Paquet, CWS 2018	Julie Paquet, Canadian Wildlife Service, 2018
J. Valenzuela Pers. Comm.	Jorge Valenzuela, Centro de Estudios y Conservación del Patrimonio Natural (CECPAN), Chile
J. W. Fitzpatrick and R. Bowman, pers. comm. 2015	John Fitzpatrick, Cornell Lab of Ornithology, and Reed Bowman, Archbold Biological Station
JAF	Jane Fitzgerald, Central Hardwoods Joint Venture
Jim Tietz 2018	Jim Tietz, Point Blue Conservation Science, 2018
John Brett, CWS-ON 2018	John Brett, Canadian Wildlife Service, Ontario Region, 2018
Johnson and Herter 1990	Johnson S.R, Herter D.R. 1990. Bird migration in the Arctic: a review. In: Gwinner E, editor. Bird migration. Berlin, Germany: Springer. pp. 22–43.
Johnstone et al. 2010	Johnstone, J. F., Hollingsworth, T. N., Chapin, F. S., & Mack, M. C. (2010).Global Change Biology, 16(4), 1281-1295.
Joos 2018	Cara Joos, Central Hardwoods Joint Venture
Kathy Martin	Kathy Martin, University of British Columbia; Environment and Climate Change Canada
Kelly 1995	Kelly, J. 1995. Preliminary checklist of the birds of St. Lawrence Island, Alaska. Unpublished report.
Kelsey TRBL 2008 Census	Kelsey, R. 2008. Results of the Tricolored Blackbird 2008 census. Winters: Audubon California.
Ken Tuininga, CWS-ON 2018	Ken Tuininga, Canadian Wildlife Service, Ontario Region, 2018
Kessel 1989	Kessel, B. 1989. Birds of the Seward Peninsula, Alaska. Fairbanks: University of Alaska Press.
KIWA Census	Kirtland's Warbler Census Results--see https://www.fws.gov/midwest/endangered/birds/Kirtland/Kwpop.html
KIWA Conservation Team 2015	Kirtland's Warbler Conservation Team--see http://www.kwconservation.org/
Koivula & Schmiegelow 2007	Koivula, M. J., & Schmiegelow, F. K. (2007). Boreal woodpecker assemblages in recently burned forested landscapes in Alberta, Canada: effects of post-fire harvesting and burn severity. Forest Ecology and Management, 242(2), 606-618.

Kushlan et al. 2002	James A. Kushlan , Melanie J. Steinkamp, Katharine C. Parsons, Jack Capp, Martin Acosta Cruz, Malcolm Coulter, Ian Davidson, Loney Dickson, Naomi Edelson, Richard Elliot , R. Michael Erwin, Scott Hatch, Stephen Kress, Robert Milko, Steve Miller, Kyra Mills, Richard Paul , Roberto Phillips, Jorge E. Saliva , Bill Sydeman, John Trapp, Jennifer Wheeler, and Kent Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington, DC, U.S.A. , 78 pp.
Lammertink et al. 1996	Lammertink, J.M., Rojas-Tomé, J.A., Casillas-Orona, F.M., Otto, 1996. Status and conservation of old-growth forests and endemic birds in the pine-oak zone of the Sierra Madre Occidental, Mexico. Verslagen en Technische Gegevens, Vol. 69, No. 1, p.1-89. Inst. Syst. & Pop. Biol., U. Amsterdam, Netherlands. ISSN 1385-3279.9
Lappo et al. 2012	Lappo, E.G., Tomkovich, P.S., & Syroechkovskiy, E. 2012. Atlas of the breeding waders in the Russian Arctic. UF Ofsetnaya Pechat, Moscow.
Letto et al. 2015	Wiersma, Yolanda & Letto, Karla & Brazil, Joe & Rodrigues, Bruce. (2015). Bald eagle (Haliaeetus leucocephalus) population increases in Placentia Bay, Newfoundland – evidence for habitat saturation? Avian Conservation and Ecology. 10. 4. 10.5751/ACE-00729-100104.
Linda Welch, USFWS 2018	Linda Welch, US Fish & Wildlife Service 2018
Lindsay Tudor, Maine DIFW 2018	Lindsay Tudor, Maine Department of Inland Fisheries and Wildlife, 2018
Lockwood and Freeman (1st edition)	Lockwood, M. W. and B. Freeman. 2004. The TOS Handbook of Texas Birds. Texas A&M University Press, College Station, TX.
M. Clay Green	M. Clay Green, Texas State University
Machtans et al. 2014	Machtans, C. S., K. J. Kardynal, and P. A. Smith. 2014. How well do regional or national Breeding Bird Survey data predict songbird population trends at an intact boreal site? Avian Conservation and Ecology 9(1): 5. http://dx.doi.org/10.5751/ACE-00649-090105
Mahon et al. 2014	Mahon, C. L., E. M. Bayne, P.r Sólymos, S. M. Matsuoka, M. Carlson, E. Dzus, F. K. A. Schmiegelow, and S. J. Song. (2014) Does expected future landscape condition support proposed population objectives for boreal birds? Forest ecology and management 312: 28-39.
Maley & Brumfield 2013a (taxonomic reference)	Maley, J. M. & Brumfield, R. T. 2013. Mitochondrial and Next-Generation Sequence Data Used to Infer Phylogenetic Relationships and Species Limits in the Clapper/King Rail Complex. Condor 115, 316-329.
Maley and Brumfield 2013b (taxonomic reference)	Maley, J.M. and R.T. Brumfield. 2013. Proposal (639) to South American Classification Committee: Split extralimital R. l. crepitans group from Rallus longirostris. Available at http://www.museum.lsu.edu/~Remsen/SACCprop639.htm

Maritimes BBA	Stewart, R. L. M., K. A. Bredin, A. R. Couturier, A. G. Horn, D. Lepage, S. Makepeace, P. D. Taylor, M.-A. Villard, and R. M. Whittam (eds). 2015. Second Atlas of Breeding Birds of the Maritime Provinces. Bird Studies Canada, Environment Canada, Natural History Society of Prince Edward Island, Nature New Brunswick, New Brunswick Department of Natural Resources, Nova Scotia Bird Society, Nova Scotia Department of Natural Resources, and Prince Edward Island Department of Agriculture and Forestry, Sackville, 528 + 28 pp
Marsh et al. 2009	Marsh, P., Russell, M., Pohl, S., Haywood, H., & Onclin, C. (2009). Changes in thaw lake drainage in the Western Canadian Arctic from 1950 to 2000. Hydrological Processes, 23(1), 145-158
Massachusetts BBA2	Walsh, Joan, and Wayne Petersen, Eds. 2013. Massachusetts Breeding Bird Atlas 2. Mass Audubon, Lincoln, MA. 1008 pp.
Matsuoka	Steve Matsuoka, U.S. Fish and Wildlife Service
Matsuoka & Johnson 2008	Matsuoka, S.M. and J.A. Johnson, Using A Multimodel Approach to Estimate the Population Size of Mckay's Buntings, The Condor: Ornithological Applications, Volume 110, Issue 2, 1 May 2008, Pages 371–376, https://doi.org/10.1525/cond.2008.8492
Mazur et al. 1998	Mazur, K. M., S. D. Frith and P. C. James. 1998. Barred Owl home range and habitat selection in the boreal forest of central Saskatchewan. Auk no. 115:746-754.
MB BBA 2017	Artuso, C., A. R. Couturier, K. D. De Smet, R. F. Koes, D. Lepage, J. McCracken, R. D. Mooi, and P. Taylor (editors). The Atlas of the Breeding Birds of Manitoba, 2010-2014. Bird Studies Canada. Winnipeg, Manitoba. Available at http://www.birdatlas.mb.ca/.
McCloskey et al. 2018	McCloskey SE, Uher-Koch BD, Schmutz JA, Fondell TF (2018) International migration patterns of Red-throated Loons (*Gavia stellata*) from four breeding populations in Alaska. PLoS ONE 13(1): e0189954. https://doi.org/10.1371/journal.pone.0189954
McCracken et al. 2001	McCracken, K. G., Johnson, W. P., & Sheldon, F. H. 2001. Molecular population genetics, phylogeography, and conservation biology of the mottled duck (*Anas fulvigula*). Conservation Genetics, 2(2), 87-102. doi:10.1023/A:1011858312115
McDearman 2018	Will McDearman, USFWS Red-cockaded Woodpecker Recovery Team, Dec. 2018
McKellar 2018	Ann McKeller, Canadian Wildlife Service, 2018
Meese 2017	Meese, R.J. 2017. Results of the 2017 Tricolored Blackbird Statewide Survey. Calif. Dept. of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report 2017-XX, Sacramento, CA. 27 pp. + appendices.
Mexican Regional Assessment 2005	Mexican Regional Species Assessment Workshop 2005
Meyer	Ken Meyer, Avian Research and Conservation Institute
Mike Cadman, CWS-ON 2018	Mike Cadman, Canadian Wildlife Service, Ontario Region, 2018
Mig7416	Analysis by Paul and Adam Smith of International Shorebird Survey data (https://www.manomet.org/iss-focal-site-prism-background-information), trends presented in Rosenberg et al. 2019

MN BBA-17	Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017. The First Minnesota Breeding Bird Atlas (2009-2013). Available at https://mnbirdatlas.org/.
Mougeot et al. 2013	Mougeot, F., Gerrard, J., Dzus, E., Arroyo, B., Gerrard, P. N., Dzus, C., & Bortolotti, G. (2013).
MPS-2015	Redig et al. 2015. 2015 Midwest Peregrine Season Narrative. Midwest Peregrine Society.
MTFWP	Montana Fish, Wildlife, and Parks and Montana Natural Heritage Program. Montana Field Guide: http://fieldguide.mt.gov/
MX-NSAC	Mexican National Species Assessment Committee, YEAR
NatGeo	National Geographic Society. 1987. Field Guide to the Birds of North America, 2nd edition. National Geographic Society, Washington, D.C.
Natureserve	Natureserve Range Maps, version 3.0
NAWMP 2004	North American Waterfowl Management Plan, Plan Committee. 2004. North American Waterfowl Management Plan 2004. Implementation Framework: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales, 106 pp. Available at https://www.fws.gov/migratorybirds/pdf/management/NAWMP/2004NAWMP-Framework.pdf.
NAWMP 2006	NAWMP draft conservation assessment (2006) that was finalized as North American Waterfowl Management Plan. 2007. Continental Progress Assessment Final Report. Available at https://www.fws.gov/migratorybirds/pdf/management/NAWMP/FinalAssessmentReport.pdf
NAWMP 2012	North American Waterfowl Management Plan. 2012. North American Waterfowl Management Plan: people conserving waterfowl and wetlands. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Amiente y Recursos Naturales.
NAWMP 2018	North American Waterfowl Management Plan. 2018. North American Waterfowl Management Plan: connecting people, waterfowl and wetlands. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Amiente y Recursos Naturales.
NE-G&P	Nebraska Game and Parks
NE-PIF	Northeast Partners in Flight
NFWG-17	Northern Forests Working Group (Tom Will and others) (-YEAR)
NFWG-19	Northern Forest Birds Working Group, a sub-team of the UMJV Landbird Sience Team (2017)
Ng et al. 2018	Ng, J.W., E.C. Knight, A.L. Scarpignato, A.-L. Harrison, E.M. Bayne, P.P. Marra. (2018). First full annual cycle tracking of a declining aerial insectivorous bird, the Common Nighthawk (Chordeiles minor), identifies migration routes, nonbreeding habitat, and breeding site fidelity. Canadian Journal of Zoology, 96:869-875, https://doi.org/10.1139/cjz-2017-0098.
NMOS database	New Mexico Ornithological Society database
NM-PIF	New Mexico Partners in Flight

Northeast Landbird Review Group 2018	Dettmers, Rosenberg, Hunt, Dickson, Gross, Leppold, Shriver
Northeast Shorebird Review Group 2018	Boettcher, Welch, Tudor, Mizrahi, Spiegel, Hunt, Dettmers, Jones
Northeast Waterbird Review Group 2018	D'Auria, Boettcher, Welch, Tudor, Catlan, Mizrahi, Spiegel, Hunt, Dettmers, Jones
NPPWCP	Beyersbergen, G.W., N. D. Niemuth, and M.R. Norton, coordinators. 2004. Northern Prairie & Parkland Waterbird Conservation Plan. A plan associated with the Waterbird Conservation for the Americas initiative. Published by the Prairie Pothole Joint Venture, Denver, Colorado. 183pp.
NPS 2017	National Park Service. 2017. Harlequin Ducks (*Histrionicus histrionicus*) Resource Brief. Available at https://www.nps.gov/articles/upload/Harlequin-Ducks.pdf.
NV BBA	Floyd, T. 2007. Atlas of the Breeding Birds of Nevada. University of Nevada Press, Reno.
NV-PIF	Nevada Partners in Flight
NY BBA	McGowan, K. J., & Corwin, K. (Eds.). 2008. The second atlas of breeding birds in New York State. Comstock Pub. Associates.
onatl	Bird Studies Canada, Environment Canada's Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources. 2006. Ontario Breeding Bird Atlas Database, 31 January 2008. http://www.birdsontario.org/atlas/aboutdata.jsp?lang=en
ONOS-16	Bird Studies Canada Ontario Nocturnal Owl Survey, 1995-2016
OPJV	Oaks and Prairies Joint Venture
OR, WA, CA (BC) CBC	Audubon Christmas Bird Count, results from Oregon, Washington, California, and if listed, British Columbia--see https://www.audubon.org/conservation/where-have-all-birds-gone
PA BBA	Wilson, A.M., D.W. Brauning and R.S. Mulvihill (eds). 2012. Second Atlas of Breeding Birds in Pennsylvania. The Penn State University Press. University Park, PA.
Pacific Flyway Monitoring Strategy	see https://www.fws.gov/pacific/migratorybirds/Double-crested_Cormorant.html
Pam Hunt (NH Audubon) 2018	Pam Hunt, New Hampshire Audubon, 2018
Panjabi	Arvind Panjabi, Bird Conservancy of the Rockies
PB	Peter Blancher, Environment and Climate Change Canada (emeritus)
Phinney	Mark Phinney, LP Forest Resources Division, LP Corp
Piatt et al. 2020	Piatt JF, Parrish JK, Renner HM, Schoen SK, Jones TT, Arimitsu ML, et al. (2020) Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLoS ONE 15(1): e0226087. https://doi.org/10.1371/journal.pone.0226087
PIF BBS-based calculation 2016	Partners in Flight landbird population estimate based on North American Breeding Bird Survey data
PIF CAW	Partners in Flight Central America Workshop, YEAR. The suffix "–PS-g midpoint" appended to the source code indicates a population estimate based on the midpoint of the ACAD PS-g category range.

PIF(Glob)	proportion of global range outside of the Western Hemisphere was estimated by the PIF Science Committee (most done in 2007, with some updates when taxonomy changed)
PIFcalc19	Partners in Flight (PIF) population estimate from Stanton et al. (2019) calculated using BBS data from the years 2006-2015 and/or other data sets.
PIF-ON	Ontario Partners in Flight
PIFSC	Partners in Flight Science Committee, YEAR
PIFTC	Partners in Flight Technical Committee (now Partners in Flight Science Committee), YEAR
PIFTC–NBCI	6.7M in 1999 from Dimmick, R., M. Gudlin and D. McKenzie. The Northern Bobwhite Conservation Initiative: A Plan for Quail Population Recovery. PIF Technical Committee adjusted to 5.8M in 2007 based on declining BBS trend.
PIPL Recovery Team 2018	Piping Plover Recover Team--see https://www.greatlakespipingplover.org/
PLJV 2018	Playa Lakes Joint Venture, 2018
Population status of migratory game birds in Canada, Nov. 2017	Canadian Wildlife Service Waterfowl Committee. 2017. Population Status of Migratory Game Birds in Canada: November 2017. CWS Migratory Birds Regulatory Report Number 49
Potapov and Sale 2012	Potapov, E. & Sale, R. The Snowy Owl. London: T & AD Poyser, 2012.
QC BBA 2	Robert, M., M-H. Hachey, D. Lepage, and A.R. Couturier, Eds. 2019. Second Atlas of the Breeding Birds of Southern Quebec. Regroupement QuébecOiseaux, Environment and Climate Change Canada, Bird Studies Canad. Available at https://quebecoiseaux.org/index.php/en/atlas-en.
Quebec BBA	Gauthier J. and Aubry Y. (eds.) 1996. The breeding birds of Québec: atlas of the breeding birds of southern Québec. Association Québécoise des Groupes d'Ornithologues, Province of Québec Society for the Protection of Birds, Canadian Wildlife Service, Environnement Canada (Québec region), Montréal, Québec, Canada.
RGJV 2018	Rio Grande Joint Venture, 2018
RGJV-Science 2018	Rio Grande Joint Venture Science Team, 2018
Riordan et al. 2006	Riordan, B., Verbyla, D., & McGuire, A. D. (2006). Shrinking ponds in subarctic Alaska based on 1950–2002 remotely sensed images. Journal of Geophysical Research: Biogeosciences, 111(G4).
Rivera	Frank Rivera, US Fish and Wildlife Service
RMBO	Rocky Mountain Bird Observatory, now Bird Conservancy of the Rockies
Rodriguez-Estrella et al. 1992	Rodriguez-Estrella, R., Mata, E., & Rivera, L. (1992). Ecological Notes on the Green Parakeet of Isla Socorro, Mexico. The Condor, 94(2), 523-525. doi:10.2307/1369224
Rodway & Lemon 2011	Rodway, M.S. & Lemon, M.J.F. 2011. Use of permanent plots to monitor trends in burrow-nesting seabird populations in British Columbia. Marine Ornithology 39: 243–253.
Rosenberg	Ken Rosenberg, Cornell Lab. of Ornithology

Rosenberg and Blancher (2005)	Rosenberg, Kenneth V.; Blancher, Peter J. 2005. Setting numerical population objectives for priority landbird species. In: Ralph, C. John; Rich, Terrell D., editors 2005. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 1 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: p. 57-67
Rowe 2018	Karen Rowe, Arkansas Game and Fish Commission, 2018
RPD	Randy Dettmers, USFWS
Ruffed Grouse Conservation Plan 2006	Dessecker, D.R., G.W. Norman, and S.J. Williamson, eds. 2006. Ruffed Grouse Conservation Plan. Association of Fish and Wildlife Agencies, Resident Game Bird Working Group. Available at https://ruffedgrousesociety.org/wp-content/uploads/2019/07/RG_ConservationPlan-ExecRep.pdf.
Russell	Robert Russell, U.S. Fish and Wildlife Service
Rustay	Christopher Rustay, Playa Lakes Joint Venture
RWBJV 2018	Rainwater Basin Joint Venture, 2018
Ryan Burnett 2018	Ryan Burnett, Point Blue Conservation Science, 2018
S. Gibson	Scott Gibson, Utah Division of Wildlife Resources
S. Schweitzer 2017	Sara Schweitzer, North Carolina Wildlife Resources Commission, 2017
SARA Registry	Species At Risk Public Registry. 2018. Government of Canada. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html
Schieck & Song (2006)	Schieck, J., & Song, S. J. (2006). Changes in bird communities throughout succession following fire and harvest in boreal forests of western North America: literature review and meta-analyses. Canadian Journal of Forest Research, 36(5), 1299-1318.
Scott Morrison, July 2008	Scott Morrison, The Nature Conservancy, July 2008
Sea Duck JV	Sea Duck Joint Venture
SE-PIF	Southeast Partners in Flight
Sergio Harding (Virginia DGIF) 2018	Sergio Harding, Virginia Department of Game and Inland Fisheries, 2018
SGS-17	Special analysis performed by John Sauer for PIF of American Woodcock Singing Ground Survey (https://migbirdapps.fws.gov/mbdc/databases/awsgs/aboutwcsgs.htm) data, 1970-2017
SGS-17_adj	Special analysis performed by John Sauer for PIF of American Woodcock Singing Ground Survey (https://migbirdapps.fws.gov/mbdc/databases/awsgs/aboutwcsgs.htm) data from 1970-2017 adjusted by Pete Blancher to account for proportion of BCR outside of breeding range
SGS6817	American Woodcock Singing Ground Survey data from 1968-2017 as analyzed in Rosenberg et al. 2019
SHARP program	Saltmarsh Habitat & Avian Research Program--see https://www.tidalmarshbirds.org/

Shaw	Allison Shaw, Bird Conservancy of the Rockies
Shuford and Gardali 2008	Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=10425&inline
Shuford et al. 2001	Shuford, W. D., Humphrey, J. M., & Nur, N. 2001. Breeding status of the Black Tern in California. Western Birds, 32(4).
Siegel	Rodney Siegel, Institute for Bird Populations
Sinclair	Pam Sinclair, Canadian Wildlife Service
Sinclair et al. 2003	Sinclair, P. H., Nixon, W. A., Eckert, C. D., & Hughes, N. L. 2003. Birds of the Yukon Territory. UBC Press, Vancouver.
SJV-SWG 2017	Sonoran Joint Venture Science Working Group, 2017
Smith 1996	Smith. P.W. 1996. Antillean Nighthawk. In Rodgers, Kale, & Smith, eds., Rare & Endangered Biota of Florida. Vol. 5. U. Florida Press, Gainesville.
Soulliere-17	Greg Soulliere, Upper Mississippi River and Great Lakes Region Joint Venture (2017)
Spautz et al. 2005	Spautz, H., Nur, N., & Stralberg, D. (2005). California Black Rail (Laterallus jamaicensis coturniculus) distribution and abundance in relation to habitat and landscape features in the San Francisco Bay Estuary. In In: Ralph, C. John; Rich, Terrell D., editors 2005. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 1 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: US Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: p. 465-468 (Vol. 191).
Stanton et al. 2019	Stanton, J. C., P. Blancher, K. V. Rosenberg, A. O. Panjabi, and W. E. Thogmartin. 2019. Estimating uncertainty of North American landbird population sizes. Avian Conservation and Ecology 14(1):4. https://doi.org/10.5751/ACE-01331-140104
Status of Birds in Canada 2014	Environment and Climate Change Canada. 2015. The Status of Birds in Canada Website, Data-version 2014. Environment and Climate Change Canada, Gatineau, Quebec, K1A 0H3
Status of Birds in Canada 2019	Environment and Climate Change Canada. 2019. The Status of Birds in Canada Website, Data-version 2019. Environment and Climate Change Canada, Gatineau, Quebec, K1A 0H3. Northern Fulmar population status available at https://wildlife-species.canada.ca/bird-status/tendance-trend-eng.aspx?sY=2019&sL=e&sB=NOFU&sM=c&sT=d08f637e-aa91-46cf-be66-ab7aa8709863.
Storey & Lien 1985	Storey, A.S. and J. Lien. 1985. Development of the First North American Colony of Manx Shearwaters. The Auk, 102(2), 395-401.
Stralberg et al. 2015	Stralberg, D., S. M. Matsuoka, A. Hamann, E. M. Bayne, P. Sólymos, F. K. A. Schmiegelow, X. Wang, S. G. Cumming, S. J. Song (2015). Projecting boreal bird responses to climate change: the signal exceeds the noise. Ecological Applications, 25(1), 52-69.

Svedarsky-99	Svedarsky, Hier, and Silvy, eds., 1999 The Greater Prairie Chicken: A National Look. U. Minn. Misc. Publ. 99 -- 1999.
Swallow-tailed Kite Conservation Alliance 2016	Swallow-tailed Kite Conservation Alliance, 2016
Tessler et al. 2014	Tessler, D.F., J.A. Johnson, B.A. Andres, S. Thomas, & R.B. Lanctot. 2014. A global assessment of the conservation status of the Black Oystercatcher Haematopus bachmani. International Wader Studies 20: 83–96.
Thomas et al. 2012	Thomas, Susan M., James E. Lyons, Brad A. Andres, Elise Elliot T-Smith, Eduardo Palacios, John F. Cavitt, J. Andrew Royle, Suzanne D. Fellows, Kendra Maty, William H. Howe, Eric Mellink, Stefani Melvin, Tara Zimmerman. 2012. Population Size of Snowy Plovers Breeding in North America. Waterbirds, 35(1), 1-14.
TOS Handbook 2004	Texas Ornithological Society Handbook, 2004
TrUST	Trial Unified Science Team of the U.S. Migratory Bird Habitat Joint Ventures (now the Unified Science Team)
Tudor 2017	Lindsay Tudor, Maine Dept. of Inland Fisheries and Wildlife, unpublished data, 2017
UMJV-17	Upper Mississippi River and Great Lakes Region Joint Venture Science Team (2017)
UMJVWBS-17	Upper Mississippi River and Great Lakes Region Joint Venture Waterbird Strategy (2017) and review team
UMJVWFS-17	Upper Mississippi River and Great Lakes Region Joint Venture Waterfowl Strategy (2017)
USFWS 2006	U.S. Fish and Wildlife Service. 2006. Alaska Seabird Information Series: Pelagic Cormorant [fact sheet]. Retrieved from https://www.fws.gov/alaska/mbsp/mbm/seabirds/pdf/peco.pdf.
USFWS 2007	U.S. Fish and Wildlife Service. Feb. 2007. RefugeNet E-Bulletin. http://refugeassociation.org/wp-content/uploads/2011/10/sbc-feb07.pdf.
USFWS 2014	U.S. Fish and Wildlife Service. 2014. Species assessment report yellow-billed loon (*Gavia adamsii*). Fairbanks: U.S. Fish and Wildlife Service, Ecological Services
USFWS Eagle Rule Revision 2016	U.S. Fish and Wildlife Service. 2016. Bald and Golden Eagles: Population demographics and estimation of sustainable take in the United States, 2016 update. Division of Migratory Bird Management, Washington D.C., USA.
USFWS GUSG fact sheet	https://www.fws.gov/mountain-prairie/es/species/birds/gunnisonsagegrouse/January2013FactSheet.pdf
USSCP 2016	US Shorebird Conservation Partnership 2016, which relied upon Andres, B.A., P.A. Smith, R.I.G. Morrison, C.L. Gratto-Trevor, S.C. Brown, and C.A. Friis. 2012. Population estimates of North American shorebirds, 2012. Wader Study Group Bulletin 119: 178–194. http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds.
UST 2017	Unified Science Team, 2017
UT-PIF	Utah Partners in Flight

Van Wilgenburg & Hobson 2008	Van Wilgenburg, S. L., & Hobson, K. A. (2008). Landscape-scale disturbance and boreal forest birds: Can large single-pass harvest approximate fires?. Forest ecology and management, 256(1), 136-146.
Venier et al. 2014	Venier, L. A., I. D. Thompson, R. Fleming, J. Malcolm, I. Aubin, J. A. Trofymow, D. Langor, R. Sturrock, C. Patry, R. O. Outerbridge, S. B. Holmes, S. Haeussler, L. De Grandpré, H. Y. H. Chen, E. Bayne, A. Arsenault, J. P. Brandt. (2014). Effects of natural resource development on the terrestrial biodiversity of Canadian boreal forests. Environ. Rev. 22, 457–490. 10.1139/er-2013-0075doi:10.1139/er-2013-0075
Vermillion	Bill Vermillion, U.S. Fish and Wildlife Service
WAFWA 2015	Western Association of Fish and Wildlife Agencies. 2015. GREATER SAGE-GROUSE POPULATION TRENDS: AN ANALYSIS OF LEK COUNT DATABASES. 1965-2015. http://www.wafwa.org/Documents%20and%20Settings/37/Site%20Documents/News/Lek%20Trend%20Analysis%20final%208-14-15.pdf
WAFWA/WEST 2017	McDonald, L., K. Nasman, T. Rintz, F. Hornsby, and G. Gardner. 2017. Range-wide population size of the Lesser Prairie-Chicken: 2012-2017. Western EcoSystems Technology, Inc. (WEST), Laramie, Wyoming, USA.
Waterbird Working Group 2017	S. Schwietzer, C. Hunter, B. Andres, B. Ortego, C. Green, A. Mini, W. Vermillion
Watts 2016	Watts, B. D. 2016. Status and distribution of the eastern black rail along the Atlantic and Gulf Coasts of North America. The Center for Conservation Biology Technical Report Series, CCBTR-16-09. College of William and Mary/Virginia Commonwealth University, Williamsburg, VA. 148 pp. Retrieved from http://www.ccbbirds.org/wp-content/uploads/2017/01/CCBTR-16-09_BLRA-State-Assessment_final_reduced.pdf
Watts et al. 2012	Watts, J. D., Kimball, J. S., Jones, L. A., Schroeder, R., & McDonald, K. C. (2012). Satellite Microwave remote sensing of contrasting surface water inundation changes within the Arctic–Boreal Region. Remote sensing of environment, 127, 223-236.
Whelan et al 2017	Whelan, S., Strickland, D., Morand-Ferron, J., & Norris, D. R. (2017). Reduced reproductive performance associated with warmer ambient temperatures during incubation in a winter-breeding, food-storing passerine. Ecology and evolution, 7(9), 3029-3036.
Whooping Crane Recovery Plan	Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2005. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 162 pp. https://www.fws.gov/uploadedFiles/WHCR%20RP%20Final%207-21-2006.pdf.
Wiest et al. 2019	Wiest, W.A., M.D. Correll, B.G. Marcot, B.J. Olsen, C.S. Elphick, T.P. Hodgman, G.R. Guntenspergen, and W.G. Shriver. 2019. Estimates of tidal-marsh bird densities using Bayesian networks. J. Wildlife Management 83 (1): 109-120.
Wilhelm 2018	Sabina Wilhelm, Canadian Wildlife Service
Will	Tom Will, U.S. Fish and Wildlife Service

Williamson et al 2008	Williamson, S.J., D. Keppie, R. Davison, D. Budeau, S. Carrière, D. Rabe and M. Schroeder. 2008. Spruce grouse conservation plan. Association of Fish andWildlife Agencies. Washington, DC. 73 pages.
WPE5	Wetlands International (2017). "Waterbird Population Estimates". http://wpe.wetlands.org.
WWG	Western Working Group of Partners in Flight
WYGFD	Orabona, A. C., C. K. Rudd, N. L. Bjornlie, Z. J. Walker, S. M. Patla, and R. J. Oakleaf. 2016. Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming. Wyoming Game and Fish Department Nongame Program, Lander, USA.
Wylie	Jim Wylie, US Geological Service

Appendix C: Changes Since Recent Versions of the Database

Changes since version 2020

- Simplified and standardized geography and habitat classification for all species, eliminating former columns (Breeding Habitat Description, Winter Habitat Description, Primary Winter Habitat, Major Habitat_C America, Primary Habitats_PIF16, Primary Breeding Habitat_PIF16, Primary Wintering Geography) and substituting Breeding and Nonbreeding Biome, Primary and Secondary Breeding Habitat, Primary and Secondary Nonbreeding Habitat.
- Added Urban and Agriculture columns.
- Abbreviated the field names Continental Importance (now CI), Continental Importance in Region (CIR), Regional Concern (RC), Regional Stewardship (RS), Regional Importance (RI).
- Changed Mexican regions as explained in Appendix D.
- Removed non-breeding-only birds in Central American regions from the Regional ACAD.
- Removed pelagic species that were never scored due to lack of pelagic experts in the 2005 Mexican Regional Assessment in the former Mexican regions ISRE (Islas Revillagigedo, now merged into BCR33*) and CEPL (Central Mexican Pacific Lowlands, now merged into SCPL, Southcentral Pacific Lowlands). CONABIO is planning to eventually convene pelagic experts at which time those species will be added.
- Added when scores were last reviewed for Mexican and Central American regions.
- Changed to “not reviewed” for the latest review field for data-driven RD-b scores (BCRs 10 and 32) and PT-r scores (BCR 10) that were not reviewed by regional experts.
- Corrected RD-b scores for American Woodcock for BCRs 8, 13, and 23.
- Corrected Singing Ground Survey citation details for %Pop and RD-b for American Woodcock.

Changes since version 2019

- Updated taxonomy and AOS sequence number to AOS 60th supplement (Chesser et al 2019)
- Species listed as extinct or extirpated from North America in Chesser et al. (2019) have been removed from the ACAD.
- Added suffix to PS-g_s to indicate which global population estimates are geometric midpoints of PS-g population range rather than more precise estimates.
- Updated population estimates and trend data and resulting PS-g and PT-g scores, primarily based on sources used by Rosenberg et al. 2019.
- The field PopYr was added to the Global ACAD where population estimates from Rosenberg et al. 2019 were used.
- The years of trend data used were explicitly added to the trend source, e.g. BBS7017.
- Restored “pop change” field with updated estimates

- A handful of a species in BCR's 2 and 4 changed PT-r source to expanded BBS9317 to obtain a score more informative than 3 for insufficient data.
- "Intro in BCR" field dropped from Regional ACAD due to inconsistencies in its application across BCR's.
- The field "%WH_US-Ca-b" was added.
- Values for "%Breeding Pop in US & Canada" for species with breeding phenology significantly different from the June + 1st week of July window used in the Regional ACAD %Pop analysis of eBird data were changed from the sum of regional %Pop estimates in continental U.S. and Canada to (a) the continental US/Canada population estimate divided by the global population estimate where we had greater confidence in these population estimates than in the regional %Pop estimates, or (b) null where global and continental US/Canada estimates were based on different data sources that may not be appropriate to compare and/or we lacked confidence in the global population estimate.
- Corrected "Mig Status" field.
- Eliminated erroneous comments "migrants only" from RD-b_com field for BCR 19.
- Truncated comments were restored to full comments.
- Restored comments regarding continental US/Canada estimates from the 2012 version of the database that were lost when this comment field was eliminated in the 2017 version.
- "_last reviewed" fields were added to the continental U.S./Canada Regional ACAD to indicate when a score was last reviewed to alert users to possibly obsolete scores, since not all review teams were able to review all scores.
- Applied changes made to TB-c in calibration process (see explanation in following section) to the TB-r scores that were based on TB-c.
- TB-r scores were copied into gaps in TN-r for species in Guatemala and Costa Rica where known to be residents locally even if partial migrants range-wide.
- Added sources for Mexican and Central American regional scores.
- Corrected PR action code.

Changes since version 2017

- Data sources changed for many species for PS-g, PT-c, RD-b, PT-r, and TB-r based on expert review determining that a more appropriate data set existed for a given species.
- The field "%GL_WH-b" was updated with new data.
- Population estimates for continental USA/Canada were added for many species.
- A comment field for continental U.S./Canada population estimates, "Pop Size_US-Ca_com", was added.
- Where previous TB-r was based on old TB-c, updated TB-r to current TB-c. TB-c and TB-r scores were calibrated by comparing the weighted mean TB-r (for species where %Pop estimates were available to weight by) to TB-c. Those with >0.5 difference between mean

TB-r and TB-c were reviewed and in most cases either TB-r or TB-c scores were adjusted based on expert opinion to bring the two scales into agreement.

- Added trend metadata (degrees of freedom, confidence intervals, relative abundance, etc.) to Global ACAD. Trends with decimals truncated were corrected. PT-c scores were updated to include data through 2017. CBC analysis for PT-c scores was clarified to be a custom analysis, not that of Soykan et al. 2016, and the citation for the latest version was added. CBC trends were corrected after an error was discovered in the CBS analysis. PT-r scores generated using erroneous scoring thresholds or precision criteria for BBS trends were corrected. Sister species traditionally lumped by BBS were split by John Sauer to generate species-specific trends and PT-c/PT-r scores.

- Typographic errors in the handbook were corrected. The only significant errors corrected were:
    - Definitions for CCSb and CCSn in Appendix A, the dictionary of database field names.
    - Years used for determining population trend scores
- The term "Continental Concern" was replaced with "Continental Importance" to clarify that Common Birds in Steep Decline (CBSD) are included in this field, not just Watch List species. For a species to qualify for Continental Importance in a region, we reduced the criteria for Watch List (but not CBSD) species from RD > 1 to RD > 0 (i.e. not peripheral).

- The criteria for CBSD has been simplified to PT-c = 5, eliminating the criteria that PS-g < 4, BD-g < 4, and ND –g < 4 that were designed to limit this category to common species, but these criteria are unnecessary since any species with PT-c = 5 that is rare or has a restricted range is already on the watch list. Removing these criteria has no effect on which species qualify as CBSD as long as the watch list criteria allow species with CCSmax = 13 and PT-c = 5 to make the watch list.

- International Union for Conservation of Nature (IUCN) Red List status was updated for each species to the 2018 version of the Red List.

- Non-landbirds were added back to the Regional ACAD.

- Central American and Mexican regional assessments were added via a downloadable spreadsheet.

- Added the codes ER (Extirpated Regionally), and NE (Nearly Extirpated) as options for RD-b and made these species eligible for Regional Importance.

- For both Continental Importance in Region species qualifying via Watch List (as opposed to via CBSD) and for Regional Concern (RC), the threshold for the criteria that a species must occur regularly in significant numbers in the BCR was lowered to RD > 0 instead of >1 to address the problem that reviewers would inflate RD scores to ensure that species of interest made it onto these lists.

- The criteria for Regional Stewardship (RS) was simplified to %Pop> 25%, eliminating species with RD=5 and %Pop between 5 and 25% to limit species on this list to those with a higher proportion of their total population in the BCR and focus stewardship efforts on a shorter more relevant list of species.

- Removed the action code CX (possibly extinct) since only relevant to a couple of species.

Appendix D: Assessment Regions

The 2021 ACAD integrates, for the first time, the regional assessments from Central America and Mexico with those from the U.S. and Canada. As before, all regional assessments in the U.S. and Canada are scored at the scale of Bird Conservation Regions (BCRs). However, until now, those assessments stopped at the U.S.-Mexico border, and different scoring regions were used on the Mexican side of the border. Now these "borderland" BCRs extend across into Mexico and include the avifauna on both sides of the border. The merger of the regional assessment databases also required some other relatively minor changes to the assessment regions in Mexico, in part to improve the biogeographic basis of the regions, as well as to take advantage of available eBird data outputs, including from their recent STEM models, that will be used to assess relative abundance and assign RD scores in the future, among other uses. These changes are described in detail further below. In Central America, regional scores continue to use countries as the scale of the assessment, (in spite of eBird STEM model outputs lumping Belize and Guatemala, and El Salvador and Honduras) in order to facilitate national conservation planning in those countries. See Figure 2 below for a map of current regions.

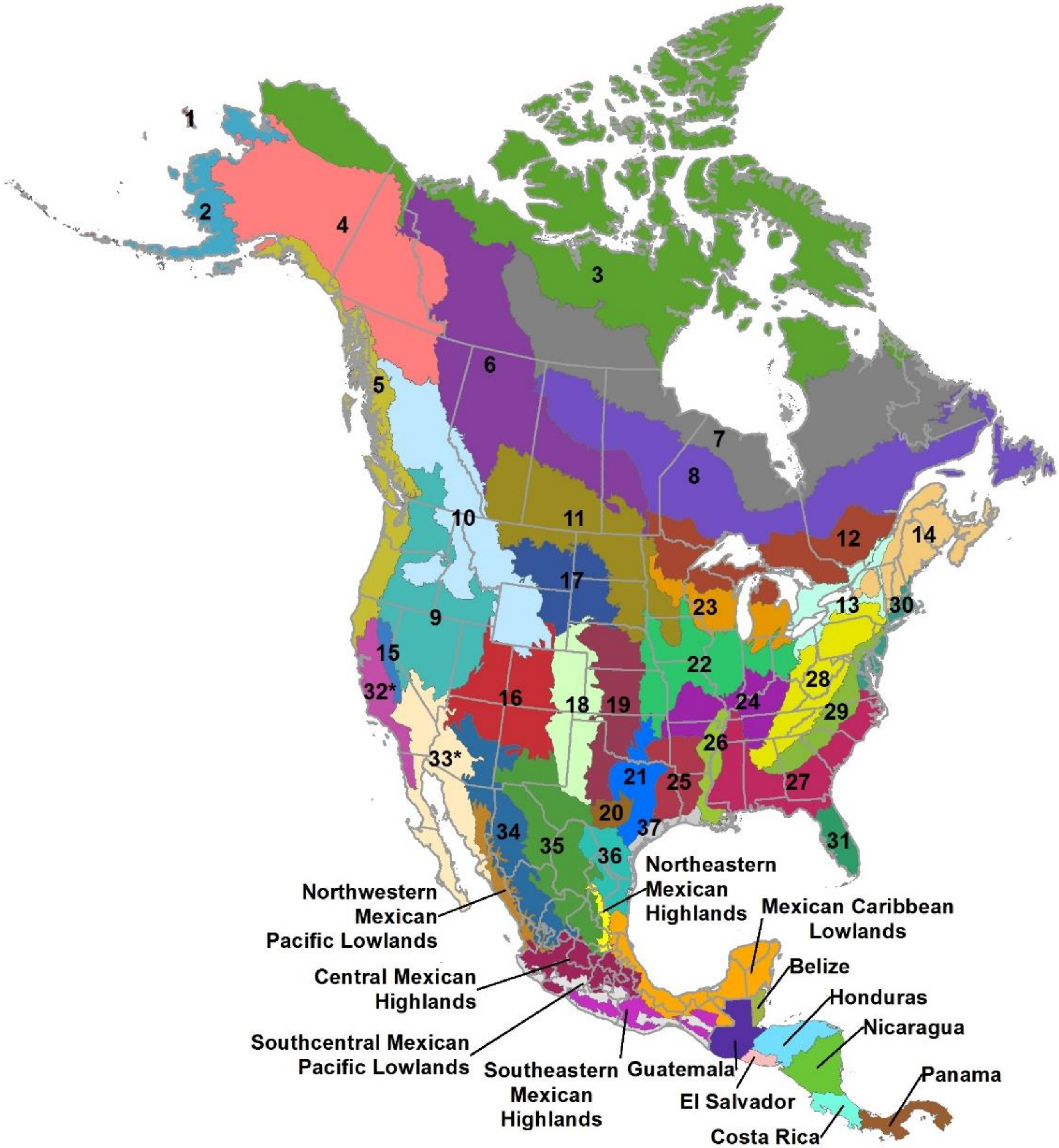

Figure 2. ACAD assessment regions as of 2021.

Mexican assessment regions

Current assessment regions in Mexico

See Figure 3 below for a map of the regions described as follows:

- BCR32: Coastal California (BCRs 32 & 39)
- BCR33: Sonoran and Mojave Deserts (BCRs 33, 40, 41, 42, 62 & 63)
- BCR34: Sierra Madre Occidental (BCR 34 except for the part in Aguascalientes, Jalisco, Guanajuato, & San Luis Potosí; BCR 46 in Zacatecas)
- BCR35: Chihuahuan Desert (BCR 35)
- BCR36: Tamaulipan Brushlands (BCR 36)
- BCR37: Gulf Coast Prairie (BCR 37)
- NWPL: Northwestern Pacific Lowlands (BCRs 38, 43 & 44; portion of BCR 45 in Nayarit)
- SCPL: South-central Pacific Lowlands (BCRs 45 (except Nayarit portion), 50, 53 (small disjunct part ~20 km west of Presa Benito Juarez only), 59 & 61)
- NEMH: Northeastern Mexican Highlands (BCR 48 in Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, Guanajuato, Querétaro)
- CEMH: Central Mexican Highlands (BCR 34 in Aguascalientes, Jalisco, Guanajuato, & San Luis Potosí; BCR 46 except portion in Zacatecas; BCR 47; BCR 48 in Hidalgo, Veracruz, Puebla; BCR 51 in Puebla; BCR 54 in Puebla & Veracruz)
- SEMH: Southeastern Mexican Highlands (BCR 51 in Oaxaca; BCR 53 except small disjunct part ~20 km west of Presa Benito Juarez; BCR 54 in Oaxaca; BCR 58; BCR 60)
- MXCL: Mexican Caribbean Lowlands (BCRs 49, 52, 55, 56, 57, 64, 65 & 66)

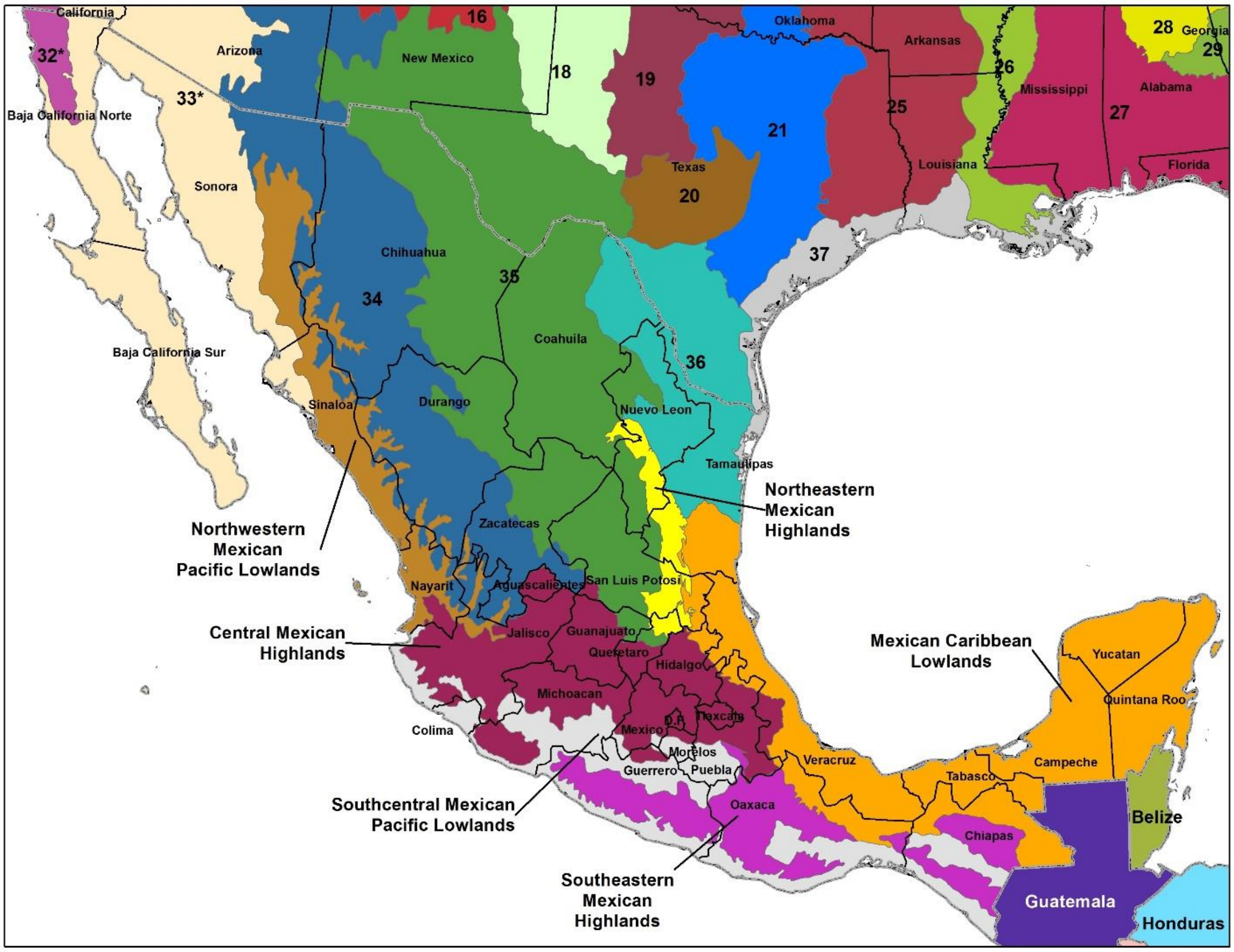

Figure 3. Color-coded ACAD assessment regions in Mexico as of 2021.

Original Mexican assessment regions

In Mexico, assessment regions were originally created using the intersections of avifaunal biomes (i.e., combinations of BCRs), "AICA" (Important Bird Areas, in Spanish) regions (Arizmendi & Márquez-Valdelamar 2000) and state boundaries. Rich et al. (2004) delineated avifaunal biomes from a cluster analysis that grouped BCRs into biomes based on avifaunal similarities; this analysis was later extended through Mexico. The Mexican biomes were divided into four geographic regions (Northwest, Northeast, Central, and Southeast) roughly following AICA regions along state boundaries. The Islas Revillagigedo were treated separately from these regions, due to their remoteness and distinct avifauna, but some species there, especially seabirds, were not scored due to insufficient expertise during the assessment. Regional scores were assigned in 2003-2005 by regional experts for the following 14 regions in Mexico:

- ISRE: Islas Revillagigedo (BCR 62)
- NWCH: Northwestern Chaparral (BCRs 32 and 39)
- NWAB: Northwestern Arid Borderlands (BCRs 33, 40, 41, 42 and 63)
- NWPL: Northwestern Pacific Lowlands (BCRs 38, 43 & 44; portion of BCR 45 in Nayarit)

- NWMH: Northwestern Mexican Highlands (BCR 47 in Nayarit; BCR 34 except for the portion in Aguascalientes, Jalisco, and Guanajuato)
- NEAB: Northeastern Arid Borderlands (BCRs 35 & 36)
- NECP: Northeastern Coastal Plain (BCR 37, in Tamaulipas only)
- NEMH: Northeastern Mexican Highlands (BCR 48 in Guanajuato, Querétaro, San Luis Potosí, Tamaulipas, Nuevo León, and Coahuila)
- NECL: Northeastern Caribbean Lowlands (BCR 49, in Tamaulipas only)
- CEPL: Central Pacific Lowlands (BCR 45 in Jalisco, Colima, Michoacán and Guerrero; BCR 50)
- CEMH: Central Mexican Highlands (BCR 34 in Aguascalientes, Jalisco, and Guanajuato, BCRs 46 & 47, also BCR 48 in Hidalgo, Veracruz, and Puebla, BCR 53 in Guerrero and Puebla, and 54 in Puebla and Veracruz)
- SEPL: Southeastern Pacific Lowlands (BCR 45 in Oaxaca and Chiapas; BCRs 59 & 61)
- SEMH: Southeastern Mexican Highlands (BCRs 51, 53 and 54 in Oaxaca, BCRs 58 and 60)
- SECL: Southeastern Caribbean Lowlands (BCRs 49 in Veracruz and San Luis Potosí, BCRs 52, 55, 56, 57, 64, 65 & 66)

Changes between original and current Mexican regions

Crosswalk of current vs. old regions:

current region	equivalent in old regions
BCR32	NWCH
BCR33	NWAB + ISRE
BCR34	NWMH (except Nayarit & San Luis Potosi now in CEMH)
BCR35	NEAB (BCR 35 portion)
BCR36	NEAB (BCR 36 portion)
BCR37	NECP
NWPL	NWPL
SCPL	CEPL + SEPL + tiny disjunct part of BCR 53 (formerly in SEMH)
NEMH	NEMH
CEMH	old CEMH (except BCR 53 in Guerrero & Puebla) + BCR 47 in Nayarit (formerly in NWMH) + BCR 34 in San Luis Potosi (formerly in NWMH)
SEMH	old SEMH (except tiny disjunct part of BCR 53) + BCR 53 in Guerrero & Puebla (formerly in CEMH)
MXCL	NECL + SECL

- The former Mexican regions that touch the US border, NWCH (Northwestern Chaparral), NWAB (Northwestern Arid Borderlands), NWMH (Northwestern Mexican Highlands), NEAB (Northeastern Arid Borderlands), and NECP (Northeastern Coastal Plain), have now been replaced by cross-border BCRs, which in some cases still represent multiple BCRs on the Mexican side, due to insufficient sample size for eBird models in small BCRs in Mexico. These include “BCR32”, which incorporates BCR 39 in Mexico (formerly lumped together as

NWCH), and “BCR33” which includes BCRs 40, 41, 42, & 63 in Mexico (formerly lumped together as NWAB). BCR 62, formerly scored as the Mexican region ISRE (Islas Revillagigedo), was also lumped into “BCR33” following eBird STEM models that lump it with these other BCRs due to insufficient eBird records on the islands. These combinations of BCRs may change in future iterations of the ACAD as more data become available in these regions.

- Note that the region “BCR34” omits the portion of BCR 34 in Aguascalientes, Jalisco, Guanajuato, and San Luis Potosí (SLP), which is instead included in the CEMH (Central Mexican Highlands) region, as originally assessed for all but SLP, which was originally assessed as part of NWMH (Northwestern Mexican Highlands). Note that it includes the portion of BCR 46 in Zacatecas.
- The species not present on the US side of their corresponding BCR were added to cross-border BCRs 32, 33, 34, 35, 36, 37, respectively, and given an asterisk on BCR# to denote they are only found on the Mexican side (e.g., “BCR33*”).
- Species were split out from the NEAB region into BCRs 35 and 36 using eBird (https://ebird.org/map, accessed Jan. 2021) as a guide to decide which species occurred as breeders in each BCR.
- Species occurring on both sides of the border in a given cross-border BCR are currently displaying only the US score because the US scores are more up to date (2018 in most cases vs. 2005 in Mexico), but these scores will be reviewed by regional experts to reconcile any score differences for a future version of the ACAD.
- The portion of BCR 47 in Nayarit was transferred from NWMH (Northwestern Mexican Highlands) to CEMH (Central Mexican Highlands) by eBird STEM models, so we have followed suit.
- CEPL (Central Pacific Lowlands) and SEPL (Southeastern Pacific Lowlands) were lumped together into the SCPL (South-Central Pacific Lowlands). For species found in both former regions, the entries with the higher RD scores were retained. If RD scores were equal then the entry with the higher TB-r scores were retained, and if TB-r scores were identical then the entry with the high PT-r score was retained. This same process was also used to lump the NECL (Northeastern Caribbean Lowlands) and SECL (Southeastern Caribbean Lowlands) regions into the new MXCL (Mexican Caribbean Lowlands) region.
- The portion of the Sierra Madre del Sur (BCR 53) found in Guerrero and Puebla had previously been lumped into the CEMH (Central Mexican Highlands), in both the eBird model output regions and during the Mexican species assessment, but biologically the region belongs with the rest of the Sierra Madre del Sur that extends into Oaxaca and is part of the SEMH (Southeastern Mexican Highlands), so species listed in CEMH but found only in BCR 53 (per CONABIO’s eBird list for each BCR (CONABIO, unpublished data, 2021) and not BCR 47 (Eje Volcanico) were removed from CEMH and added to SEMH (if missing there). If the species already occurred in the SEMH, the assessment (SEMH vs. CEMH) with the higher RD score (followed by highest TB-r, and then PT-r, if RD or TB was the same in both regions) was retained.

- eBird STEM models moved the small disjunct part of BCR 53 that was in SEMH (Southeastern Mexican Highlands) into the surrounding SEPL (Southeastern Pacific Lowlands), probably because the topography is similar, so we have followed suit.