The Partners in Flight

Avian Conservation Assessment Database Handbook

Version 2019

Partners in Flight Science Committee

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Changes since 2017 version (*more details coming soon!*)

The Christmas Bird Count (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.

The criteria for Common Birds in Steep Decline (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.

For both regional Watch List and 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.

Typographic errors 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

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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 (www.partnersinflight.org). While PIF has focused primarily on landbirds, it works in conjunction with other bird partners to promote coordinated conservation of all birds.

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;
6. Evaluating success, making revisions, and setting new objectives for the future.

The 2017 PIF Handbook on Species Assessment (2017 PIF Handbook) documents assessment rules and scores used in 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). It updates previous versions of the handbook (Panjabi et al. 2012, 2005, 2001) developed to accompany 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 scores, data sources, and other related information are contained in databases hosted by the Bird Conservancy of the Rockies. Scores can be viewed online and downloaded as excel files, including archived versions (http://pif.birdconservancy.org/acad). The current accompanying Avian Conservation Assessment Database (ACAD) holds assessment scores and data for all 1585 native and 18 well-established non-native bird species found in mainland North America south to Panama plus adjacent islands and oceans. The taxonomy follows the American Ornithological Society's 7th Edition Checklist of North and Middle American Birds, including updates though the 57th supplement, published in 2016 (http://checklist.aou.org/). The ACAD builds on archived PIF databases that hosted only data on the 882 landbirds native to Canada, USA and Mexico.

This handbook is presented in two principal sections. Part I details 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 that evaluate distinct components of vulnerability throughout the life cycle of each species across its range. Part II describes the process of how the factors and the corresponding scores can be combined to highlight conservation needs (i.e. step 2 of the planning approach above). Both the scores and the process have evolved over time (Hunter et al. 1992, Carter et al. 2000, Panjabi et al. 2001, 2005, 2012) and continue to be updated in response to external review (Beissinger et al. 2000), broad partner expertise, and the emergence of new data and analytical tools.

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 for 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 (www.nabci-us.org/bcrs.html). In Mexico and Central America, regional scores have been assigned at biome or country levels.

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 avifuanas 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 due to 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	World breeding population ≥50,000,000
2	World breeding population <50,000,000 and ≥5,000,000
3	World breeding population <5,000,000 and ≥500,000
4	World breeding population <500,000 and ≥50,000
5	World 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; but 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 new BBS-derived estimates include measures of uncertainty, as estimated by Stanton et al. 2019. For shorebirds, population estimates are from the U.S. Shorebird Conservation Plan (2016), which considers Canada. Estimates for waterfowl are from the North American Waterfowl Management Plan (NAWMP 2012, 2018), Wetlands International (2017), or Birdlife International. Estimates for waterbird species are from Birdlife International (2016), IUCN (IUCN 2016) or Wetlands International (2017). For waterbirds and waterfowl, we multiplied estimates by 2/3 where it was clear they were based on non-breeding surveys and thus represented total population

(including adults and juveniles), as per instructions in the Waterbird Population Estimates Database v.5 (Wetlands International 2017) in order 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 below into range-wide density criteria unique to each species based on the extent of its breeding distribution:

$$\text{PS-g criterion}_{\text{Density}} = \text{PS-g criterion} / \text{Area (km2) of species' breeding range}$$

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. 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 (2016). Range maps were reviewed for accuracy by the PIF International 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 very 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 populations segments that spend time in North America.

Threats are also scored regionally for species breeding (TB-r) or species remaining between breeding seasons (TN-r) in North America. 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 are 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 US 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 US 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, threats 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 derived according to a multiple-choice list of scenarios that place the species into one of the broad, relative threats categories in the table below. For a species to be placed in a particular category, it must meet the criteria of that threats category definition, *and* meet one or more of the examples listed under the possible scenarios that follow each definition. 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	Definitions and possible scenarios
1	*Future conditions for breeding (TB) or non-breeding (TN) populations are expected to significantly improve (e.g., due to widespread human activities or land-uses that benefit the species) for the majority of the population.* This category includes potential problem species (e.g., European Starling [*Sturnus vulgaris*]), along with species that benefit substantially from human activity such as habitat fragmentation, urbanization, bird-feeding, etc. (e.g., American Robin [*Turdus migratorius*], American Crow [*Corvus brachyrhynchos*]).
2	*Future conditions for breeding (TB) or non-breeding (TN) populations are expected to remain stable; no significant threats*. One or more of the following statements should be true: - no significant known threats in scope and severity to population or habitats - species relatively tolerant of future changes likely to result from human activities or land-use trends (i.e., breeds in altered landscapes) - potential threats exist, but management or conservation activities have

	stabilized or increased populations (e.g., Osprey [*Pandion haliaetus*]) - threats are assumed to be low
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." One or more of the following statements should be true: - moderately vulnerable to human activities and land-use trends, with increased human activity expected - does not occur in highly altered landscapes, with some expectation of increased landscape alteration within breeding or non-breeding range - area-sensitive species, or sensitive to habitat fragmentation (with fragmentation expected to increase within the area for which scores are being assigned) - 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 - requires relatively specialized conditions within habitats that are limiting populations, or expected to become limiting, due to human activity or natural changes - relatively sensitive to biotic factors, such as cowbird parasitism, predation, overgrazing, and other phenomena that are limiting populations - demographic factors (low productivity, single-brooded) may contribute to limiting populations, especially when combined with other threats - concentration or coloniality increases vulnerability to otherwise lesser threats - threats potentially increasing if present trends/conditions continue - population likely to decline in future if trends/conditions continue
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). One or more of the following statements should be true: - highly vulnerable to human activities and land-use trends, with increased human activity expected - highly area sensitive or intolerant of fragmentation (with fragmentation a significant factor within the area for which scores are being assigned) - highly specialized/ dependent on sensitive or undisturbed habitats (e.g., old-growth-dependent, upper margins of saltmarsh, etc.) that are in short supply, are under threat, or expected to come under threat -extremely specialized on specific conditions within a habitat (e.g., requires large snags or specific water levels) that are in short supply, under threat, or expected to decrease in availability

	- biotic factors (parasitism, hybridization) currently are having or are expected to have a strong adverse effect on a majority of the breeding population - population certain to decline and may reach level where in danger of major range contraction if threats continue
5	*Extreme deterioration in the future suitability of breeding (TB-c) or non-breeding (TN-c) conditions is expected; species is in danger of extirpation from substantial portions of range leading to a major range contraction, or has a low probability of successful reintroduction across a substantial former range.* This designation should only be applied to species that are in danger of extirpation from substantial portions of range within the area for which scores are being assigned, or have already suffered major range contractions (e.g., Red-cockaded Woodpecker).

Note: derivation of threats 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 threats scores, population trend scores reflect trends for North American populations only, even for species with ranges that extend beyond the continent. We scored 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 assessment of trend, 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 (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, USGS, (pers.comm.communication, 2016) that differs slightly from that presentation 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 PIT analysis applies a linear fit to the long-term annual abundance index, thus diminishing the influence of the end points and providing greater stability in trend scores across updates.

A similar custom 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.

For the continental score (PT-c), the BBS trends from 1970-2017 were analyzed for landbirds, whereas both for non-landbirds' continental score (PT-c) and for all birds' regional score (PT-r), the period was 1970-2015. The later starting date of the trend period (1970) than previous PIF population trend assessments (1966) is due to relatively poor geographic coverage of BBS data collected during the first few years of the survey. CBC continental trends were calculated over the period 1970-2017. USFWS waterfowl trends were estimated from 1970-2016 and International Shorebird Survey trends were estimated from 1974-2014. We then converted annual rates of population change to total change over the 1970 to most current year time period, 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 ($P \leq 0.1$) and df $\geq$ 14	67% CI excludes 0 ($P \leq 0.33$) and df = 6-13	67% CI excludes 0, 90% CI includes 0 ($0.1 < P \leq 0.33$) and df $\geq$ 14	67% CI includes 0 ($P > 0.33$) and Trend is Reliable	67% CI includes 0 ($P > 0.33$) and Trend is Not Reliable
$\leq$ -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
$\geq$ +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 $\leq$ 3 % / yr above or below trend
2. Sample size: degrees of freedom $\geq$ 14 (for BBS and CBC, df = # of Routes – # of Strata – 1)
3. Count Abundance: Average count $\geq$ 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 that receives a PT score of 3 because of an uncertain trend is reviewed by experts to determine whether 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 recently extinct (EE), extirpated (ER) or nearing extirpation (NE) from a region, unique codes are assigned in lieu of an RD score to ensure they are not overlooked in conservation planning.

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 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:

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

In fact, 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.

Mean density is usually based on BBS, but in some cases other sources of population data were used to estimate %Pop (e.g., use of checklist counts combined with Breeding Bird Census data in arctic Canada, Rich et al. 2004). Percent of range was used as a surrogate for %Pop for parts of range outside of BCRs with BBS coverage, for example in countries south of the U.S., and for a few species particularly poorly sampled by BBS and other surveys everywhere.

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. However, compared to trend estimates, relative abundance (and subsequent %Pop) estimates are not as sensitive to problems of low detection rate along routes.

[1] In the database %Pop is rounded to the nearest %. For species with <0.5 %Pop, the value appears as 0%. 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.)

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 or Shared Birds: a Tri-National Vision for Landbird Conservation* (Berlanga et al. 2010, Panjabi et al. 2012). Both of these categories have been retained in the current version, 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 these species reflect a diversity of reasons for recognizing continental importance, including high vulnerability, high stewardship responsibility and steep declines and 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 are 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 (CS-b) and non-breeding (CS-n) seasons, as follows:

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

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

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

Maximum Combined Score (CS-max) = maximum of CS-b or CS-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 $\geq$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 close to 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 have 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 –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. 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

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 two 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

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., Threat Score > 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

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".

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 this 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 ensure these birds, characteristic of a region, stay 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 (www.pif.birdconservancy.org/acad) contains all BCR scores for categories A-D 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[1] 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[1] 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[1] 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 Concern but not Regional Concern[1], OR continental or regional Stewardship Species that are neither of continental nor regional concern, OR additional species added to the pool (i.e., do not meet any of criteria A-D). 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.

[1] Many, although not all, species of continental concern that occur in a BCR may also qualify as species of regional concern

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 US 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).

Primary Habitat

Because the largest factor causing declines and high concern for species is the loss, degradation, and threats to habitat, grouping species by habitat is an important component of conservation planning at continental and regional scales. Although information on general habitat and other ecological requirements (e.g., food supply, nest site) can be compiled from the literature for each species, no standardized terminology exists to describe avian habitats for all species.

To address this need, *Primary Breeding Habitat* and *Primary Winter Habitat* assignments were adapted from the State of North America's Birds report that included "major" habitats for all species in Canada, U.S., and Mexico (NABCI 2016). These broad habitat categories (e.g., forests, grasslands, oceans, etc.) were used to compare levels of concern across groups of species at the continental scale and were derived from similar categories used to develop habitat indicators based on composite species trends in previous State of the Birds reports in the U.S. and Canada (e.g. NABCI 2009, 2014, NABCI-Canada 2012; http://www.stateofcanadasbirds.org/). Also adapted from the 2016 State of North America's Birds report were more specific sub-categories within each major habitat called *Primary Breeding and Wintering Habitat Descriptions* (e.g. Temperate Eastern Forests; Chihuahuan Grasslands, Freshwater Marshes) to facilitate similar comparisons at finer scales. For Central American species not also found in Mexico, we assigned Primary Breeding and Wintering Habitats to species using the same categories as NABCI (2016); *Primary Breeding/Winter Habitat Descriptions* were adapted from classifications based on Stotz et al. (1996), both of which are available in the downloadable ACAD.

For species that use two primary habitats in roughly equal importance, both are listed; species that use three or more habitats are considered habitat generalists. Note that for space reasons, only *Primary Breeding Habitat* is listed in the web version of the ACAD; all habitat categories are available in the downloadable version. Also note that a combination of primary and sub-habitat categories most relevant to U.S. and Canadian landbirds was presented in the 2016 Landbird Conservation Plan; these are also available in the downloadable ACAD.

Determining the important habitats for each species in the pool of regionally important species, and developing specific conservation actions to protect or improve those habitats, is one of the 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 of species that share habitats or other ecological needs, either using the broad categories assigned to species at range-wide scales, or using locally important habitat designations. These ecological suites serve to identify habitats that are a priority because they are used by many species of regional importance, and where conservation actions can efficiently meet the needs of many species at once (Rosenberg 2016).

The following Primary Habitat and Habitat Descriptions currently used in the ACAD are defined as follows:

Primary Habitat: Wetlands = freshwater, inland wetlands; does not include coastal marshes

Wetland generalist = uses a wide variety of freshwater wetlands, over a wide geographic area; birds may have a specific nesting requirement, but can nest in a variety of situations that provide that nesting substrate (e.g. trees, shorelines)

Freshwater marshes = permanent or semi-permanent freshwater wetlands with emergent aquatic vegetation (cattails, etc.); often embedded within other "parent" habitats; species often widespread geographically

Prairie wetlands = ephemeral or seasonal wetlands, usually dominated by grasses (as opposed to cattails, etc.); primarily within Prairie biome of U.S. and Canada

Boreal forests, Arctic tundra, etc. = indicates wetlands within forested or tundra biomes; implies both geography and forested wetland type (i.e. not typically freshwater marsh)

Freshwater lakes and rivers = primarily used for wintering water birds that primarily use open freshwater bodies (as opposed to marshes)

Primary Habitat: Coasts = all habitats associated with the Coastal zone, including saltmarsh, beach and tidal estuary, inshore marine waters (but not mangrove swamps, see below)

Arctic Coastal = intertidal, and saline tundra habitats along immediate Arctic coastline -- i.e. to be distinguished geographically from other temperate zone coastlines, including coastal areas of western and southern Alaska, Labrador, etc.

Arctic polynyas = unique areas of Arctic Ocean that are ice-free in winter

Coastal marine = littoral zone; area of marine influenced by continental coastline; includes bays and deep estuaries

Coastal saltmarshes = emergent marsh in the upper coastal intertidal zone dominated by salt-tolerant grasses, herbs and/or low shrubs that is regularly flooded by the tides

Beaches and estuaries = sandy beaches and bars, and tidally influenced adjacent shallow waters

Rocky intertidal = intertidal zone dominated by rocks (including rock jetties) rather than beaches

Coastal cliffs and islands = refers to nesting sites on rocky cliffs or on nearshore islands that could include cliffs or flatter vegetated areas

Primary Habitat: Mangroves = mangrove swamps from Florida and Mexico south; although part of coastal ecosystems, mangroves have a uniquely associated avifauna

Primary Habitat: Oceans = marine zones not influenced by continental coastlines, plus oceanic islands and surrounding waters

Pelagic = marine zone beyond the littoral zone; not influenced by continental coastlines

Oceanic islands = islands beyond continental shelf of N. America; includes any habitats on those islands used for nesting

Primary Habitat: Tundra = Arctic tundra or Alpine tundra not associated with wetlands or Coastal tidal influence

Primary Habitat: Grasslands = native grassland, pasture, and agriculture that supports grassland birds

Temperate grasslands = includes Shortgrass, Tall and mixed-grass prairie, other grassland areas in U.S. and Canada including agricultural areas that support grassland birds (e.g. pasture)

Chihuahuan grasslands = arid grasslands of northern Mexico and southwestern U.S., centered on the Mexican state of Chihuahua

Tropical grasslands = all grasslands south of the Tropic of Cancer, including high-elevation grasslands in the Mexican sierras and tropical savannahs in the lowlands of Mexico and farther south

Primary Habitat: Aridlands = all arid shrub-dominated communities; primarily in southwestern U.S. and northwestern Mexico

Sagebrush = Great Basin sage-dominated desert and steppe region of western U.S. and sw Canada

Chaparral = unique shrub community, primarily in coastal California and Baja (including coastal sage), but also similar shrub habitats in interior Southwest

Desert scrub = a broad range of desert communities including Mojave, Sonoran, and Chihuahuan deserts, and deserts of Mexico's Central Plateau

Rocky cliffs = barren rocky areas within aridland regions and also forested mountains

Primary Habitat: Forests = very broad category for all forest types, from old-growth conifers and tropical rainforests to arid thorn forests (many forest birds may also be found in urban/suburban and agroforestry landscapes)

Boreal forests = "True" boreal forest of Canada and Alaska, and also the boreal zone (primarily spruce-fir) of high mountains in the western and northeastern U.S.

Temperate eastern forests = all forest types of eastern U.S. and southeastern Canada (below the boreal), including northern hardwoods, oak-hickory, pine-oak, southern pine, and bottomland hardwood associations

Temperate western forests = all forest types of western U.S. and Canada (below the boreal) and extending in high mountains south into northwestern Mexico; includes Pacific NW rainforest, all western conifer, oak-dominated, and riparian forests, pinyon-juniper, juniper-oak woodlands of Edward's Plateau, and high-elevation conifer forests of northwestern Mexico (above pine-oak)

Mexican highland forests = high-elevation conifer and hardwood forests from central Mexico south to Honduras, above pine-oak forest zone, including "tropical" elements (e.g. epiphytes) not present in Western temperate (and not including true Cloud forest)

Cloud forests = high elevation tropical evergreen forest that is wet throughout the year and typically covered with epiphytes, from southern Mexico southward)

Mexican pine-oak forests = distinctive pine-oak forests of Mexican mountains, including similar forests in "sky island" mountains from SE Arizona to W. Texas, and extending south in northern Central America to Honduras, northern Nicaragua, and El Salvador.

Tropical dry forests = broad array of deciduous and semi-deciduous forests, including arid thorn forest; primarily on Pacific slope from NW Mexico to NW Costa Rica, but also including Tamaulipan "thornscrub" and dry forests of Yucatan and other transitional

areas

Tropical evergreen forests = wet forests of lowland ('rainforests') and lower montane (upper tropical) regions from southern Mexico southward

Forest generalist = occurs in roughly equal abundance in three or more forest types

Primary Habitat: Generalist = occurs in roughly equal abundance in three or more major habitat types, usually including forest and non-forest categories (Habitat sub-category also = Generalist)

Primary Wintering Geography

To address the challenge of full life-cycle conservation for migratory birds, we need to know the geographic regions that species occupy year-round. For birds that migrate to the Neotropics, our knowledge of important nonbreeding areas is often imperfect, and for some species we don't even know where most individuals migrate to in winter. Nevertheless, we are able to assign every species to a broad geographic region where the majority of the population spends the stationary nonbreeding period during the boreal winter. Grouping species by their wintering geography also can give us insights into threats faced by migratory species away from the breeding grounds that could be major drivers of population declines—for example, a higher proportion of species that winter in Central and South American highlands are declining than species that winter in Mexico or the Caribbean, even if these species share similar breeding areas and habitats.

Primary Wintering Geography was first assigned for U.S. and Canadian Watch List species and formed the basis for organizing conservation business planning workshops at the PIF V conference in Snowbird, Utah, in 2013. We subsequently assigned Primary Wintering Geography for all migratory species in the U.S., Canada and Mexico, as part of the State of North America's Birds report in 2016. These designations were expanded to all North American birds for the current version of this database.

For migratory species that winter primarily within the U.S. and Canada, we describe the broad geography within which most individuals occur (e.g. Western U.S. and Canada). For species that winter south of the U.S., we use a modified version of the regions identified for the PIF V conference. These were then expanded to include coastal and oceanic regions, as defined below. Species that are non-migratory are designated as 'Resident.'

Southwestern Aridlands = aridland region of southwestern U.S., northwestern Mexico and Mexican Plateau.

Chihuahuan Grasslands = distinctive arid grassland region of northern Mexico and extreme SW U.S.

Pacific Lowlands = Pacific slope from northwestern Mexico to northwestern Costa Rica; including inland drainages (e.g. Balsas watershed); Primarily tropical dry forest regions, including thornscrub.

Gulf-Caribbean Lowlands = Atlantic slope region from northeastern Mexico to Panama (based on avifauna, potentially also including lowlands of Panama from Canal Zone south, and low areas of northern Colombia north and west of Andes)

Mexican Highlands = Pine-oak, Cloud forest, and Mexican highland forest zone from northern Mexico through Guatemala and Honduras to northern Nicaragua and El Salvador

Central and South American Highlands = subtropical and Cloud forest zones of mountain regions from Honduras south though Central America to the northern Andes and other mountains of northern South America

South American Lowlands = all lowland areas east and south of the Andes, including Amazonia, Pantanal, dry forest types, and grasslands

Southern Cone = far southern South America, including coastal and inland habitats (grasslands and wetlands)

Widespread Neotropical = occurs in roughly equal numbers in 3 or more regions within the Neotropics

Palearctic = occurs primarily in Europe and Asia

Paleotropical = Old world tropical regions in Africa, Asia, and Australia

Arctic Coast = coastline from Alaska across northern Canada

Atlantic Coast = coastline from eastern Canada to South America

Pacific Coast = coastline from Alaska to South America (for species wintering in coastal habitats)

Tropical Coasts = coastal areas within tropical regions; often occurs across hemispheres

Widespread coastal = winters on coastlines in many parts of Western Hemisphere, both Pacific and Atlantic

Pacific Ocean = for Pacific seabirds that travel from breeding islands in non-breeding seasons

Atlantic Ocean = for Atlantic seabirds that travel from breeding islands in non-breeding seasons

Tropical Oceans = oceanic areas within tropical regions; often occurs across hemispheres

Widespread Ocean = for species that are widespread pelagic species in both Atlantic and Pacific oceans

Widespread = occurs in roughly equal abundance in 3 or more geographic regions

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Appendix A. Database Dictionary and Key to Data Sources

The following list explains the field headings (in alphabetical order) in the Partners in Flight Avian Conservation Assessment Database (www.pif.birdconservancy.org/acad), 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.

%Breeding Pop in US & Canada	% of global breeding population found in U.S. and Canada, as published in the PIF North American Landbird Plan 2016
%Pop	Estimate of percent of species' global breeding population in region
%Pop_s	Data source for estimate of percent of global population in region
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
Annual % change	Annual trend estimate from long-term survey data, if available
AOS_57	Taxonomic order according to the American Ornithological Society (AOS) 7th edition checklist, 57th supplement
BBS 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
BD area	Area estimate (in sq. km) 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 Habitat Description	Primary Breeding Habitat description, adapted from State of North America's Birds 2016 Report, assigned post-hoc to Central American species.
C America	Occurs in Central America
Canada	Occurs in Canada
CCSb	Continental combined score for breeding season (PS-g + BD-g + TB-c + PT-c)
CCSmax	The higher of CCSb and CCSn
CCSn	Continental combined score for non-breeding season (PS-g + ND-g + TN-c + PT-c)
Common Name	Common English name according to AOS 7th edition checklist, 57th supplement
Continental Concern	Category of Continental Concern: Watch List (Red, Yel-d, Yel-r) or CBSD (Common Bird in Steep Decline). See handbook for more detailed definitions.
D-max	Higher of BD-g and ND-g score
Extinct	E=Extinct, according to the AOS 7th edition checklist, 57th supplement
family	Family according to AOS 7th edition checklist, 57th supplement
Global Pop Size	Estimate of global population size (breeding-aged individuals)
group	Type of bird (waterbird, waterfowl, shorebird, landbird)
Intro in BCR?	Introduced in the BCR, according to regional reviewers
Introduced	I=Introduced species in North America, according to AOS 7th edition checklist, 57th supplement

IUCN Red List 2016	Conservation status according to the International Union for the Conservation of Nature's (IUCN) Red List of Threatened Species (2016)
Major Habitat_C America	Major Habitat type in Central America (assigned using classification scheme by Stotz et al. 1996)
Mexico	Occurs in Mexico
Mig Status	Migratory status in North America (R=resident, M=migratory, PM=partial migrant); only done for some landbirds, needs to be completed
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 only	Occurs only as a non-breeder (N) in North America, according to AOS 7th edition checklist, 57th supplement
Order	Order according to AOU 7th edition checklist, 57th supplement
%GL_WH	Percent of global population in Western Hemisphere (only populated for US, Can, and MX species so far)
Pop Size_US-Ca	Current population size estimate (US-Can landbirds only) for U.S. and Canada from PIF North American Landbird Conservation Plan (2016)
Pop Size_US-Ca_s	Source for US-Can population estimate
Primary Breeding Habitat	Primary breeding habitat, adapted from State of North America's Birds 2016 Report, assigned post-hoc to Central American species.
Primary Breeding Habitat_PIF16	Primary breeding habitat for U.S. and Canada landbird species from PIF Landbird Plan update (Rosenberg et al. 2016)
Primary Habitats_PIF16	Primary breeding / winter habitats for U.S. and Canada landbird species on Watch List from PIF Landbird Plan update (Rosenberg et al. 2016)
Primary Winter Habitat	Primary wintering habitat, adapted from State of North America's Birds 2016 Report, assigned post-hoc to Central American species.
Primary Wintering Geography	Winter Geographic Area from PIF Landbird Plan update (Rosenberg et al. 2016)
PS-g	Assessment score for global population size (breeding-aged individuals)
PS-g + D-max	Sum of PS-g + D-max
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 + T-max	Sum of PT-c + T-max
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_s	Source for current regional population trend score
RCS-b	Regional Combined Score for breeding season
RD-b	Assessment score for Relative Density of breeding population in region
RD-b_com	Comments for Relative Density breeding score
RD-b_s	Source for Relative Density score in region
Region	Geographic scope of regional conservation assessment

Regional Concern	Regional Concern designation (1=yes)
Regional Stewardship	Regional Stewardship designation (1=yes)
Scientific Name	Scientific name according to AOS 7th edition checklist, 57th supplement
Taxonomic notes	Annotations on taxonomy and recent changes from AOU 7th edition checklist, 57th 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_s	Source for regional threats-breeding score
T-max	Higher of TB-c and TN-c 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_s	Source for current regional threats-non-breeding score
USA	Occurs in USA
Winter Habitat Description	Primary Wintering Habitat description, adapted from State of North America's Birds 2016 Report, assigned post-hoc to Central American species

Key to data sources:

AB Atlas	Federation of Alberta Naturalists. 2007. The atlas of breeding birds of Alberta: a second look. Edmonton: Federation of Alberta Naturalists.
AFWA Sage- and Columbian Sharp-tailed Grouse Tech Cmte, 2008	Association of Fish and Widlife Agencies, Sage and Columbian Sharp-tailed Grouse Technical Committee, 2008
Alberta Atlas	Federation of Alberta Naturalists. 2007. The atlas of breeding birds of Alberta: a second look. Edmonton: Federation of Alberta Naturalists.
Alisauskas et al. 2011	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
Andres	Brad Andres, U.S. Fish and Wildlife Service
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 1983	American Ornithologists' Union. 1983. Checklist of North American birds. 6th edition and supplements. American Ornithologists' Union, Washington, D.C.
AOU Checklist 57th Suppl.	Chesser, R. Terry, Kevin J. Burns, Carla Cicero, Jon L. Dunn, Andrew W. Kratter, Irby J. Lovette, Pamela C. Rasmussen, J. V. Remsen, Jr., James D. Rising, Douglas F. Stotz, and Kevin Winker. 2016. Fifty-seventh Supplement to the American Ornithologists' Union Check-list of North American Birds. The Auk: Ornithological Advances 133:544–560. http://americanornithologypubs.org/doi/pdf/10.1642/AUK-16-77.1?code=coop-site.
Aubry	Yves Aubry, Canadian Wildlife Service
AWCP-08	American Woodcock Conservation Plan (2008)
AZ Game & Fish	Arizona Dept. of Game and Fish
AZPIF	Arizona Partners in Flight
AZRC	Arizona Review Committee
BAMP	Boreal Avian Modeling Project (http://www.borealbirds.ca/)
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
BBS	Breeding Bird Survey, https://www.pwrc.usgs.gov/bbs/
BBS-02	Breeding Bird Survey (1966-2002)
bbs07	Breeding Bird Survey (1966-2007)
BBS-08	Hierarchical linear regression analysis of Breeding Bird Survey data (1966-2008) provided by John Sauer to Partners In Flight
BBS-14	Hierarchical linear regression analysis of Breeding Bird Survey data 1970-2014 provided by John Sauer to Partners in Flight
bbs14adj	BBS avg. count data from 2005-2014 times max eBird frequency in US/Canada divided by max eBird frequency in any region
BBS-15	Hierarchical linear regression analysis of Breeding Bird Survey data 1970-2015 provided by John Sauer to Partners in Flight
bbs99	Hierarchical linear regression analysis of Breeding Bird Survey data (1990-1999) provided by John Sauer to Partners In Flight
BBS-derived, Rosenberg and Blancher (2005)	BBS-derived population estimate per Rosenberg and Blancher (2005)
BC Atlas	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
BCR10/17bbs08	Hierarchical linear regression analysis of Breeding Bird Survey (1966-2008) for Bird Conservation Regions 10 and 17 provided by John Sauer to Partners In Flight
BCR11/23bbs08	Hierarchical linear regression analysis of Breeding Bird Survey (1966-2008) for Bird Conservation Regions 11 and 23 provided by John Sauer to Partners In Flight

BCR12bbs08	Hierarchical linear regression analysis of Breeding Bird Survey (1966-2008) for Bird Conservation Region 12 provided by John Sauer to Partners In Flight
BCR22bbs08	Hierarchical linear regression analysis of Breeding Bird Survey (1966-2008) for Bird Conservation Region 22 provided by John Sauer to Partners In Flight
BCR23bbs08	Hierarchical linear regression analysis of Breeding Bird Survey (1966-2008) for Bird Conservation Region 23 provided by John Sauer to Partners In Flight
Beardmore	Carol Beardmore, U.S. Fish and Wildlife Service
Beason et al. 2005	Beason, J., K. Hutton, R. Sparks, A. Panjabi, and D. Hanni. 2005. Monitoring Colorado's Birds: 2005 Field Season Report. Tech. Rep. M-MCB05-01. Rocky Mountain Bird Observatory, Brighton, CO, 185 pp.
Bellrose 1986	Ducks, geese and swans of North America. Frank C. Bellrose. 1980. Harrisburg, Pennsylvania, Stackpole Books.
BirdLife	BirdLife International IUCN Red List for birds, YEAR. http://datazone.birdlife.org/species/search; http://datazone.birdlife.org/species/requestdis.
BirdLife and NatureServe (2012)	Bird species distribution maps of the world. BirdLife International, Cambridge, UK and NatureServe, Arlington, USA. Area estimated using the Eckert IV projection.
BirdLife Int. 2000	BirdLife International. 2000. Threatened birds of the world. Barcelona and Cambridge, UK: Lynx Edicions and BirdLife International.
Blake	Blake, E.R. 1977. Manual of Neotropical Birds, volume 1. The University of Chicago Press. Chicago and London
Blancher	Peter Blancher, Environment and Climate Change Canada
BNA	Rodewald, P. (Editor). 2015. The Birds of North America: https://birdsna.org. Cornell Laboratory of Ornithology, Ithaca, NY.
BNA Atwood & Bontrager 2001	Atwood & Bontrager. 2001. California Gnatcatcher. In BNA No. 574, Poole & Gill, eds., BNA, Phil.
BNA Beedy & Hamilton 1999	Beedy & Hamilton. 1999. Tricolored Blackbird. In BNA No. 423, Poole & Gill, eds., BNA, Philadelphia.
BNA Briskie 1993	Briskie. 1993. Smith's Longspur. In BNA No. 34. Poole, Stettenheim, & Gill, eds., Acad. Natl. Sci., Phil., & AOU, D.C.
BNA Bull & Duncan 1993	Bull & Duncan. 1993. Great Gray Owl. In BNA No. 41, Poole & Gill, eds., BNA Philadelphia.
BNA Butler and Buckley 2002, Black Guillemot	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 Chardine & Morris 1996, Brown Noddy	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 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 Evans and Knopf 2004	Knopf, Fritz L. and Roger M. Evans.(2004). American White Pelican (Pelecanus erythrorhynchos), 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/amwpel
BNA Evers et al. 2010, Common Loon	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 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 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 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 Hipfner and Chapdelaine 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 Johnson et al 2000	Johnson, Hendricks, Pattie, & Hunter. 2000. Brown-capped Rosy-Finch. In BNA No. 536, Poole & Gill, eds., BNA, Phil.
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 2013	Bond, Alexander L., Ian L. Jones, Sampath Seneviratne and Sabir Bin Muzaffar.(2013).Least Auklet (Aethia pusilla), 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/leaauk
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 Ladd & Gass 1999	Ladd & Gass. Golden-cheeked Warbler. 1999. In BNA No. 420, Poole & Gill, eds., BNA, Phil.
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 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 Nisbet et al. 2014, Roseate Tern	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 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, Red-tailed Tropicbird	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., R. W. Schreiber and G. A. Schenk. (1996). Red-footed Booby (Sula sula), 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/refboo
BNA Tacha 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 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
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.
Butcher	Greg Butcher, US Forest Service International Program
CAFF 2018	CAFF. 2018. A Global audit of the status and trends of Arctic and Northern Hemisphere goose populations. Conservation of Arctic Flora and Fauna International Secretariat, Akureyi, Iceland. ISBN 978-9935-431-66-0.
Camfield	Alaine Camfield, Canadian Wildlife Service
Cannings	Richard Cannings, Bird Studies Canada
Carter	Michael Carter, Playa Lakes Joint Venture
Casey	Dan Casey, American Bird Conservancy
CBC-01	Christmas Bird Count trend graphs to 2001
CBC-06	Christmas Bird Count analysis through 2006
CBC-17	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)
CDE	Chihuahuan Desert Experts, YEAR
Cdn BCR plans	Canadian Bird Conservation Region Plans
CDTT	Chihuahuan Desert Technical Team of the Rio Grande Joint Venture
Central American Assessment Committee	Central American Assessment Committee
Chipley	Robert Chipley, American Bird Conservancy
Clements checklist	Clements, J. F., T. S. Schulenberg, M. J. Iliff, D. Roberson, T. A. Fredericks, B. L. Sullivan, and C. L. Wood. 2016. The eBird/Clements checklist of birds of the world: v2016. Downloaded from http://www.birds.cornell.edu/clementschecklist/download/
CO BBA 1998	Kingery, H.E [Ed.]. 1998. Colorado breeding bird atlas: Colorado Bird Atlas Partnership and Colorado Division of Wildlife.
Continental TB Scores	TB-r default to continental TB score
CO-PIF	Colorado Partners in Flight
Corman	Troy Corman, Arizona Game and Fish
Correll et al. 2017	Correll, M.D., Wiest, W.A., Hodgman, T.P., Shriver, W.G., Elphick, C.S., McGill, B.J., O'Brien, K.M., & Olsen, B.J. 2017. Predictors of specialist avifaunal decline in coastal marshes. Conservation Biology 31: 172-182.
Crosbie	Scott Crosbie, University of California - Davis
CWS-Atl	Canadian Wildlife Service - Atlantic Provinces
CWS-ON	Canadian Wildlife Service - Ontario
CWS-ON BCR plan	Canadian Wildlife Service - Ontario BCR plan
CWS-PNR	Canadian Wildlife Service - Prairie and Northern Region
CWS-Quebec	Canadian Wildlife Service - Quebec
Dale	Brenda Dale, Canadian Wildlife Service

Default to global score	Global score used for Regional score; See Global Score database for details on score
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
Delany and Scott, 2002	Delany, S., and Scott, D. 2002. Waterbird Population Estimates, 3rd ed. Wetlands International Global Series 12, Huddersfield, United Kingdom.
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.
Dettmers	Randy Dettmers, U.S. Fish and Wildlife Service
DOD/USFWS 2006 fact sheet	Department of Defense and U.S. Fish and Wildlife Service. 2006. "Red-cockaded Woodpecker (Picoides borealis)" [fact sheet]. Retrieved from https://www.fws.gov/endangered/esa-library/pdf/RCW_fact_sheet-Aug06.pdf
Dunn	Erica Dunn, Environment and Climate Change Canada
Easton	Wendy Easton, Canadian Wildlife Service
eBird17	eBird frequency data, 1970 to January 2017 (from eBird. 2012. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. http://www.ebird.org.)
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.
Elphick	Chris Elphick, University of Connecticut
Environment Canada 2013	Environment Canada. 2013. Bird Conservation Strategy for Bird Conservation Region 6: Boreal Taiga Plains. Canadian Wildlife Service, Environment Canada. Edmonton, Alberta. 288 pp.
EWS-QC	Eastern Waterfowl Survey—Quebec Province, CA
Falardeau	Gilles Falardeau, Canadian Wildlife Service
Fed Register Vol 71 N 74	U.S. Federal Register Volume 71, Number 74, April 18, 20016
Fitzgerald	Jane Fitzgerald, American Bird Conservancy
FWS BCVI Recovery Plan 1991	U.S. Fish and Wildlife Service. 1991. Black-capped Vireo (Vireo atricapillus) Recovery Plan. Austin, TX. Pp. vi + 74.
FWS GCWA Recovery Plan 1992	U.S. Fish and Wildlife Service. 1992. Golden-cheeked Warbler (Dendroica chrysoparia) Recovery Plan. Albuquerque, New Mexico. 88 pp.
FWS Mig Birds/ Sea Duck JV	U.S. Fish & Wildlife Service Division of Migratory Bird Management/ Sea Duck Joint Venture expert consensus, 2017
FWS-16	U.S. Fish and Wildlife Service. 2016. Waterfowl population status, 2016. U.S. Department of the Interior, Washington, D.C. USA.
Gauthier and Aubry 1996	Gauthier, J. and Y. Aubry (eds.). 1996. The Breeding Birds of Quebec: Atlas of the Breeding Birds of Southern Quebec. Association quebecoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montreal, 1302 pp.

GBE	Great Basin Experts, YEAR
Giocomo	Jim Giocomo, American Bird Conservancy
Giocomo et al. 2017	Giocomo, James; Vermillion, William; DeMaso, Stephen; and Panjabi, Arvind (2017) "How Many Are There? Estimating the North American Northern Bobwhite Population Size for Conservation Planning Purposes," National Quail Symposium Proceedings: Vol. 8, Article 36. Available at: http://trace.tennessee.edu/nqsp/vol8/iss1/36
Global default	Global score default (see species' score in Global database for source info.)
Gomez	Hector Gomez de Silva (Eagle-eye Tours, formerly with National Autonomous University of Mexico - UNAM)
Goodrich, HMANA	Laurie Goodrich, Hawk Migration Association of North America
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
Handbook of the Birds of the World	del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & de Juana, E. (eds.). Handbook of the Birds of the World Alive. Lynx Edicions, Barcelona. http://www.hbw.com/species.
Hannah	Kevin Hannah, Canadian Wildlife Service
Harrison	Harrison, P.H. 1996. Seabirds of the World: A Photographic Guide. Princeton University Press. Princeton, NJ.
Haukos	Dave Haukos, Kansas Cooperative Fish and Wildlife Research Unit Leader, US Geological Survey/Kansas State University
HBW	del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & de Juana, E. (eds.). Handbook of the Birds of the World Alive. Lynx Edicions, Barcelona. http://www.hbw.com/species.
historical decline	Evidence of past decline based on pre-BBS data sources
Hodgman & Wilson 1999	Hodgman, T.P. and P.U. Wilson. 1999. Saltmarsh Birds. in A survey of rare, threatened, and endangered fauna in Maine: eastern central and eastern coastal regions. Maine Department of Inland Fisheries and Wildlife, Bangor, Maine.
Howe	William Howe, U.S. Fish and Wildlife Service
Howell & Webb 1995	Howell, S.N.G. and S. Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press. New York.
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.
Hunter	William C. Hunter, U.S. Fish and Wildlife Service
ID-PIF	Idaho Partners in Flight
insufficient coverage	insufficient coverage by survey program to assign score
International Bicknell's Thrush Conservation Group (2010)	International Bicknell's Thrush Conservation Group (2010)

IUCN	IUCN. 2016. The IUCN Red List of Threatened Species. Version 2016-3. www.iucnredlist.org.
J Raptor Res 2001	Journal of Raptor Research, Volume 35 (2001), Issue 4. Proceedings from the 2nd International Burrowing Owl Symposium
Jim Johnson	Jim Johnson, US Fish and Wildlife Service
Jones	Stephanie Jones, U.S. Fish and Wildlife Service
Kathy Martin	Kathy Martin, University of British Columbia; Environment and Climate Change Canada
Kelsey 2008 TRBL Survey	Rodd Kelsey, Audubon California; Tricolored Blackbird Survey 2008
KIWA Census	https://www.fws.gov/midwest/endangered/birds/Kirtland/Kwpop.html
Knutson	Melinda Knutson, U.S. Fish and Wildlife Service
Krueper	David Krueper, U.S. Fish and Wildlife Service
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, Roja-Tome, Cassillas-Orona, & Otto. 1996. Tech. Rep. #69, Inst. Syst. & Pop. Biol., U. Amsterdam, Netherlands. In, BirdLife 2000. Threatened Birds of the World.
LEPC WG 2003	Lesser Prairie Chicken Interstate Working Group, 2003
M. Clay Green	M. Clay Green, Texas State University
Maley & Brumfield 2013	James M. Maley and Robb T. Brumfield, August 2013. Proposal (639) to South American Classification Committee: Split extralimital R. l. crepitans group from Rallus longirostris.
Matsuoka	Steve Matsuoka, U.S. Fish and Wildlife Service
MB BBA	Atlas of the Breeding Birds of Manitoba, online
Mesta	Robert Mesta, U.S. Fish and Wildlife Service
Mexican Regional Assessment 2005	Mexican Regional Species Assessment Workshop 2005
Meyer	Ken Meyer, Avian Research and Conservation Institute
Michigan DNR 2008 males x 2	Michigan Department of Natural Resources 2008 survey of singing males (doubled, to account for presumed 1:1 ratio of males:females)
Mike Green	Mike Green, U.S. Fish and Wildlife Service
MN BBA	Minnesota Breeding Bird Atlas, online
MPS-15	Redig et al. 2015. 2015 Midwest Peregrine Season Narrative. Midwest Peregrine Society.
MW-PIF	Midwest Partners in Flight
MX-NSAC	Mexican National Species Assessment Committee, YEAR
MxRange	Range in Mexico (per NatureServe)

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)
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 MX workshop	Northeast Mexico PIF Species Assessment Workshop 2004
NE-G&P	Nebraska Game and Parks
NE-PIF	Northeast Partners in Flight
NFWG	Northern Forest Birds Working Group, a sub-team of the UMJV Landbird Science Team
Niemuth	Neal Niemuth, U.S. Fish and Wildlife Service, Bismarck ND HAPET Office
NL BCR Plan	Newfoundland and Labrador Bird Conservation Region Plan
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
Northern Bobwhite Conservation Initiative website 2009	https://bringbackbobwhites.org/
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.
NV-PIF	Nevada Partners in Flight
NWT	Northwest Territories/Nunavut Bird Checklist Survey http://www.mb.ec.gc.ca/nature/migratorybirds/nwtbcs/index.en.html
ON 7 BCR Plan	Ontario BCR7 Plan

ON atlas	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
onatl	see ON atlas
ONOS-16	Bird Studies Canada Ontario Nocturnal Owl Survey, 1995-2016
Ontario 2nd Atlas	see ON atlas
Panjabi	Arvind Panjabi, Bird Conservancy of the Rockies
Patten and McCaskie 2004	Patten MA, McCaskie G (2004) Patterns and processes of the occurrence of pelagic and subtropical waterbirds at the Salton Sea. Studies in Avian Biology 27:33–41.
PB	Peter Blancher, Environment and Climate Change Canada (emeritus)
Peregrine Fund Website	http://www.peregrinefund.org/condor_factsheet.asp
Phinney	Mark Phinney, LP Forest Resources Division, LP Corp
PIF BBS-based calculation, YEAR	Partners in Flight landbird population estimate based on North American Breeding Bird Survey data
PIF CAW	Partners in Flight Central America Workshop, YEAR
PIF-DB v. 2005	Partners In Flight Species Assessment Database, 2005
PIF-ON	Ontario Partners in Flight
PIF-QC	Quebec Partners in Flight
PIFSC	Partners in Flight Science Committee, YEAR
PIFTC	Partners in Flight Technical Committee, YEAR
PIFTC-old	Partners in Flight Technical Committee (old score)
Potapov and Sale 2012	Potapov, E. & Sale, R. The Snowy Owl. London: T & AD Poyser, 2012.
Pulich 1976	Pulich, W .M. 1976. The Golden-cheeked Warbler: A bioecological study. Texas Parks and Wildlife Department, Austin, Texas.
QC BBA	Gauthier & Aubry, Atlas of the Breeding Birds of Southern Quebec (1996)
range	Range (Natureserve 3.0) used in estimation
RMBO	Rocky Mountain Bird Observatory, now Bird Conservancy of the Rockies
RngG	Global Range
Robichaud	Isabelle Robichaud, Canadian Wildlife Service
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
Rosenberg et al. 2019	Rosenberg, K.V., A.M. Dokter, P.J. Blancher, J.R. Sauer, A.C. Smith, P.A. Smith, J.C. Stanton, A. Panjabi, M. Parr, P.P. Marra. 2019. Decline of the North American Avifauna. Science.
Ruffed Grouse Conservation Plan	Dessecker, D. R., G. W. Norman, and S. J. Williamson, editors. 2006. Ruffed Grouse Conservation Plan. Association of Fish and Wildlife

	Agencies Resident Game Bird Working Group Report. Available at http://ruffedgrousesociety.org/conservation-plan#RG
Russell	Robert Russell, U.S. Fish and Wildlife Service
Rustay	Christopher Rustay, Playa Lakes Joint Venture
Sauer-08	Sauer et al., A Hierarchical Model for Estimating Change in American Woodcock Populations, JWM (2008)
Schweitzer	Sara Schweitzer, North Carolina Wildlife Resources Commission
Scott Morrison	Scott Morrison, The Nature Conservancy
SE-PIF	Southeast Partners in Flight
SGS-15	American Woodcock Singing Ground Survey, 1970-2015 (Sauer-17)
Shackelford	Cliff Shackelford, Texas Parks and Wildlife
Siegel	Rodney Siegel, Institute for Bird Populations
Sinclair	Pam Sinclair, Canadian Wildlife Service
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	Greg Soulliere, Upper Mississippi River and Great Lakes Region Joint Venture Science Coordinator
Spruce Grouse Continental Conservation Plan (Williamson et al 2008)	Williamson, S.J., D. Keppie, R. Davison, D. Budeau, S. Carrière, D. Rabe and M. Schroeder. 2008. Spruce Grouse Continental Conservation Plan. Association of Fish and Wildlife Agencies. Washington, DC. 60 pp.
STKI_Int.WG	Swallow-tailed Kite International Working Group
Svedarsky et al. 1999	Svedarsky, Hier, and Silvy, eds., 1999 The Greater Prairie Chicken: A National Look. U. Minn. Misc. Publ. 99 -- 1999.
Svensson et al. 1999 + global range	Svensson, L., K. Mullarney, D. Zetterstrom, and P.J. Grant. 1999. Birds of Europe. Harper Collins, London. + global range
Tapley et al 2007: WITU status in 2004	STATUS AND DISTRIBUTION OF THE WILD TURKEY IN 2004; http://www.nwtf.org/NAWTMP/downloads/Literature/Status_Distribution_Wild_Turkey_2004.pdf
TOS Handbook 2004	Texas Ornithological Society Handbook, 2004
TrUST 2016	Trial Unified Science Team of the U.S. Migratory Bird Habitat Joint Ventures (now the Unified Science Team)
TX BBA	Texas Breeding Bird Atlas
UMJV	Upper Mississippi River and Great Lakes Region Joint Venture Science Team
UMJVWBS	Upper Mississippi River and Great Lakes Region Joint Venture Waterbird Strategy and review team
UMJVWFS	Upper Mississippi River and Great Lakes Region Joint Venture Waterfowl Strategy
USBR	U.S. Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
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 2015	U.S. Fish and Wildlife Service. 2015. California Condor Recovery Program 2015 Annual Condor Population Status Update. Available at https://www.fws.gov/cno/es/pdf%20files/Ca-Condor-Recovery-Prog2015PopulationStatus.pdf
USFWS BPOP Report	U.S. Fish and Wildlife Service. 2015. Waterfowl population status, 2015. U.S. Department of the Interior, Washington, D.C. USA. https://www.fws.gov/migratorybirds/pdf/surveys-and-data/Population-status/Waterfowl/WaterfowlPopulationStatusReport15.pdf.
USFWS Dec 2015 CaCo Recovery Program	U.S. Fish and Wildlife Service. 2015. California Condor Recovery Program 2015 Annual Condor Population Status Update. https://www.fws.gov/cno/es/pdf%20files/Ca-Condor-Recovery-Prog2015PopulationStatus.pdf.
USFWS Eagle Rule Revision, 2016	Available at https://www.fws.gov/birds/management/managed-species/eagle-management.php
USFWS, 1992	U.S. Fish and Wildlife Service. 1992. Golden-cheeked Warbler (Dendroica chrysoparia) Recovery Plan. Albuquerque, New Mexico. 88 pp.
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.
UT-PIF	Utah Partners in Flight
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
Waterbird Working Group 2017	S. Schwietzer, C. Hunter, B. Andres, B. Ortego, C. Green, A. Mini, W. Vermillion
Watts 2016	B. Watts 2016 Black Rail status assessment report (http://www.ccbbirds.org/wp-content/uploads/2017/01/CCBTR-16-09_BLRA-State-Assessment_final_reduced.pdf)
White et al. 2002, BNA, upper end	White, C. M., N.J. Clum, T.J. Cade, and W.G. Hunt. 2002. Peregrine Falcon, Bird of North America No. 660, Poole & Gill, eds., BNA, Phil. (upper end of population estimate range)
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.

Will	Tom Will, U.S. Fish and Wildlife Service
Winker et al. 2002	Winker, Kevin; Gibson, Daniel D.; Sowls, Arthur L.; Lawhead, Brian E.; Martin, Philip D.; Hoberg, Eric P.; and Causey, Douglas, "The Birds of St. Matthew Island, Bering Sea" (2002). Faculty Publications from the Harold W. Manter Laboratory of Parasitology. 319. http://digitalcommons.unl.edu/parasitologyfacpubs/319
Wires	Linda Wires, University of Minnesota
WPE5	Wetlands International (2017). "Waterbird Population Estimates". http://wpe.wetlands.org.
WWG	Western Working Group of Partners in Flight
Wylie	Jim Wylie, US Geological Service
Young	Jock Young, University of Montana