



BIRD POPULATIONS AND HABITAT TREATMENT EFFECTS AT THE LAS VEGAS WASH, 2005-2018



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Cover photo: Las Vegas Wash #7A, 27 June 2018. Photo by Ned Bohman.

Abstract

In 2018, Great Basin Bird Observatory (GBBO) completed the tenth year of bird surveys and vegetation assessments along an 8.7 km stretch of the Las Vegas Wash (hereafter: Wash). This effort, conducted on behalf of the Las Vegas Wash Coordination Committee (LVWCC), continues work done in the first four years (2005-2009) by the San Bernardino County Museum. It accompanies the LVWCC's stabilization and enhancement project designed to prevent erosion and reclaim wetland, riparian, and upland habitat in the Wash. The project includes in-channel construction and habitat restoration, resulting in 21 weirs and impoundments, a major reduction of tamarisk cover and more than 500 acres revegetated with native plants.

In this report, we summarize bird species occurrence, trends in richness and abundance, and changes in vegetation over the 13 years of the project. In each of the ten years of data collection, bird surveys were completed year-round every two weeks using 29 (later amended to 31) permanently established survey points. Once a year, in the fall, vegetation assessments were conducted at each survey point.

A total of 220 bird species were recorded over the ten years, constituting approximately 45% of the total bird species richness recorded in Nevada. Of these, 53 are conservation priority species according to conservation rankings by regional bird initiatives.

Average species richness and total abundance increased significantly over the project period, particularly in the four most recent years of Wash surveys. Species-specific trends were mixed with six species showing significant declines and ten showing significant increases over the study period. Several of the declining birds are riparian shrub-associated, including non-native shrubs, and many of the species with increasing trends are marsh or water-dependent.

Over the most recent two years of the project, detections on recently revegetated (< 5 years) sites supported significantly greater numbers of several aquatic and wetland species than did recently cleared/completed sites. Older revegetation sites tended to be further from the Wash, thereby containing less wetland habitat and more shrubs and large riparian woody vegetation. These sites supported significantly greater numbers of shrub- and cavity-associated species than sites that were recently constructed or revegetated. Total bird abundance was greater on recently revegetated sites than in other areas, which was mostly a function of increased abundances of coots and waterfowl.

A marked shift has occurred in bird recovery along the Wash in the past four years (2014-2018) of the project, as species richness and abundance significantly increased relative to the first six years of surveys (2005-2011). These increases are largely the result of increased open water and wetland formation resulting from weir construction along the Wash. Riparian shrub-associated species are expected to recover more slowly than the marsh- and water-associated species. However, as woody riparian and mesquite habitats continue to recover and are actively restored, we expect the numbers of these species to continue to increase, as has been the case in older revegetation areas. GBBO is working with the Southern Nevada Water Authority, the LVWCC's lead agency, on a long-term plan to guide bird habitat management along the channel.

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Introduction

The Las Vegas Wash (hereafter: Wash) is the primary drainage of the Las Vegas Valley Hydrographic Basin and is located in the southeastern portion of Las Vegas Valley. The lower Wash extends approximately 20 km, flowing through the Clark County Wetlands Park (Figure 1) and terminating in Las Vegas Bay of Lake Mead. While the Wash was historically ephemeral, it has become a perennial riverine and wetland complex due to drainage of treated wastewater and urban runoff, as well as a shallow groundwater table. From the increasing Las Vegas Valley discharge in past decades, the Wash began to degrade through channel down-cutting, which led in 1998 to the formation of the Las Vegas Wash Coordination Committee (LVWCC), a stakeholder group that includes local, state, and federal agencies, citizens, businesses, a university, and environmental groups. The LVWCC developed the Las Vegas Wash Comprehensive Adaptive Management Plan that recommended measures to halt the channel degradation, restore wetland, riparian, and upland habitats, and conduct wildlife monitoring (LVWCC 2000). In 2000, implementation of this plan began and continues to the present. Plan activities included installing weirs and bank protection to halt erosion, and extensive vegetation improvements through tamarisk (*Tamarix ramosissima*) control, revegetation with native woodland species, and other plantings. For more details on the history of these efforts, see Braden et al. (2009). The plan also led to the creation and implementation of the Las Vegas Wash Wildlife Management Plan, which contains 31 recommended actions designed to conserve native species, protect and enhance their habitats, and increase community awareness of these resources (Shanahan et al. 2008).

In 2005, the San Bernardino County Museum, in conjunction with the Southern Nevada Water Authority (SNWA; the lead agency of the LVWCC), began point count bird surveys along an 8.7 km reach of the Wash (Braden et al. 2007, 2009). The purpose of these bird surveys was to (1) inventory bird populations and bird habitat parameters to provide a baseline dataset, (2) set up a long-term monitoring program that is designed to document the benefits of project activities, and (3) assist in the adaptive management process by providing valuable insight to which activities are effective and in what time frame. Our report summarizes ten years of bird surveys along the

Wash including the first four years of surveys conducted by the museum and the years of surveys conducted by the Great Basin Bird Observatory (GBBO; 2009-2011 and 2014-2018), for which we analyzed all data to characterize bird community structure, population trends and treatment effects. Bird-habitat changes throughout the project period were previously analyzed and are reported elsewhere (GBBO 2018).

Methods

Study Area

The study area encompasses 8.7 km of the Wash between the Upper Diversion and Powerline Crossing weirs (Figure 1). Twenty-nine points were established in 2005, and later additions and a deletion yielded 31 points by the end of 2006. The survey points are arranged along both sides of the Wash (Figure 1) at evenly-spaced intervals to monitor the bird community and vegetation where channel modification and revegetation has occurred or will occur, as well as in areas where project activities are unlikely to occur (Braden et al. 2007), providing a broad cross-section of the different habitat types found at the Wash. The site's upland vegetation falls into the Mojave scrub landcover type, which is dominated by creosote bush (*Larrea tridentata*). Early in the project, the riparian area was dominated by the invasive, non-native tamarisk and common reed (*Phragmites australis*), and due to vegetation treatments, these cover types have steadily declined. Native vegetation present includes Goodding's willow (*Salix gooddingii*), sandbar willow (*S. exigua*), seep willow (*Baccharis salicifolia*), Fremont cottonwood (*Populus fremontii*), honey and screwbean mesquite (*Prosopis glandulosa* and *P. pubescens*), arrowweed (*Pluchea sericea*), cattail (*Typha domingensis*), and bulrush (*Schoenoplectus* spp.). Mesquites have now become the most abundant tree along the Wash (GBBO 2018).

Active channel stabilization and revegetation activities occurred along the length of the study area throughout the study period. By the end of the first year, nine weirs and 75 acres of revegetation had been installed. Mid-way through the study period (Year 6), 12 weirs and approximately 280 acres of revegetation were in place. By the end of 2018, all 21 planned weirs were constructed and more than 500 acres were revegetated.

Bird Data and Analyses

Data Collection Methods

Birds were surveyed using standardized five-minute point counts (Ralph and Scott 1981). Initially, 26 survey points were established and three were added within a few months, reaching a total of 31 by the end of the second year. Subsequently, from Year 3 through Year 13, all 31 points were surveyed or attempted to be surveyed each year, with some survey points having to be skipped in some years due to active construction. Some survey points had to be replaced due to recent construction activities during the course of the project (Table 1). Replacement points

were established in locations as close as was safely possible to the original location, which resulted in replacement points up to 50 m from their original location. In 2018, construction at one survey point (#17) made surveying unsafe, and this point was removed from the survey rotation. In late June 2018, a new survey point (#34) was added to the survey schedule, covering a newly planted riparian revegetation site next to the recently completed Tropicana Weir.

Each survey point was visited approximately every two weeks, with all survey points visited over a two-day period. The order in which points were sampled was rotated among survey visits. Surveys were conducted from sunrise to approximately five hours post-sunrise to capture the period of greatest bird activity and vocalization frequency. Nesting evidence was collected from 2009 onward using standard breeding bird atlas methods (e.g., Floyd et al. 2007), which consider breeding to be confirmed if active nests, dependent young, food/nest material/fecal sac carrying, or nest building is observed. For more details on the point count protocol, see Braden et al. (2007).

Twenty-six surveys were conducted per year (Table 1), with the survey year typically running from mid-February through January for the first phase of the study. For the four most recent years of surveys, the survey year ran from September through August. The majority of this report covers the first full six years between 12 February 2005 and 31 January 2011, and the final four years between 5 September 2014 and 31 August 2018. The few seventh-year surveys conducted in 2011 (1 February through 24 April) were not included in most of our analyses, but they were included in a comprehensive species list.

Data Analysis

Species List

A comprehensive species list of all birds recorded at the Wash was generated based on all visits between 12 February 2005 and 31 August 2018, including all survey points (the total of which typically varied among years), all detection distances, and all birds detected incidentally outside of formal surveys. The list also includes “fly-over” sightings (e.g., Red-tailed Hawks flying high overhead) of birds that were in the Wash area but may not have been closely tied to the vegetation present at the survey point. This species list was generated to characterize the bird community of the Wash as comprehensively as possible, and because no quantitative comparisons are necessary to do that, all survey results and incidental and fly-over detections were included regardless of survey effort.

Species Richness and Abundance

Unlike our approach for the comprehensive species list, species richness and abundance patterns were analyzed using standardized comparisons that included only bird detections that occurred within a 100 m radius of each survey point. Fly-overs were also excluded even if they occurred directly above a survey point, because these birds were generally not assumed to actively use the surveyed area. Limiting the sample to detections within 100 m of the point allowed us to compare bird abundances among survey points and treatment areas, but it precluded analyses for species with a primarily aerial lifestyle, such as swallows, swifts, and nighthawks. For these

species, a separate analysis that includes fly-overs would be necessary, if determining their trends and habitat associations is desired.

We included survey data from all survey points for which data were available, which varied slightly over the first few years of the project. Although species richness (i.e., the number of species detected) can be sensitive to survey effort, we considered the variation to be minor, particularly given that the added and deleted survey points were representative of the rest of the study area in terms of habitat types and species composition present.

To be able to compare the Wash data to other regional abundance data (see below), we used the standardized estimate of density of the number of bird detections per 40 ha, converted from the fixed radius of 100 m around each point (3.14 ha). We then plotted the number of bird species and the number of bird detections per 40 ha by survey visit in order to illustrate temporal variation in species richness and abundance. Juvenile birds were excluded from analyses of breeding season data. We also performed simple linear regression analyses on total abundance and total species richness by survey visit. For all statistical analysis results in this report, $P < 0.05$ was used as the significance level, unless otherwise noted.

Species richness and abundance were also examined for the breeding and non-breeding seasons. In previous analyses (Braden et al. 2009), the breeding season was defined as the period between 15 March through 31 August to encompass the breeding of the majority of both year-round resident and migrant species. In this report, we used the same definitions to retain consistency with previous analyses. This time period overlaps with spring and early fall migration of several mid and long-distance migrants, so at least some non-breeding birds are included in the breeding season estimates. The non-breeding season was defined as 1 October through 31 January to include overwintering birds, but to exclude nesting of most resident species. Average species richness and estimated density per survey were calculated for these seasons. Transitional periods covering the dates not included in either the breeding or non-breeding seasons were also included in the results, where appropriate.

Species-Specific Abundances

For each species, estimated bird density (birds per 40 ha) was calculated for each year overall, and for its breeding and non-breeding seasons. Relative abundance (proportion of total bird abundance contributed by a species) was calculated for the same periods, but only for species representing at least one percent of the total abundance in one or more periods. We also report species frequency, which stands for the percentage of Wash survey points at which the species was detected. This metric provides a measure of how widespread a species is within the study area. Partway through Year 13, one point was dropped and another point was added; this resulted in 32 points used for the frequency calculations, rather than the usual 31 (past point changes have either been close to changes in survey-year or have been relatively minor shifts in location to accommodate construction).

Breeding season abundances from the Wash surveys were also compared to data collected as a part of GBBO's Nevada Bird Count (NBC) in other Clark County lowland riparian areas. This was done to provide a reference point for the estimated densities at the Wash from regional data

collected in similar habitat types. The NBC data were collected on 190 survey visits of 46 transects, generating surveys on approximately 1,900 point-visits (since each transect typically consists of ten points) in roughly the same period (2005-2014) as the Wash surveys (7,853 point-visits). Data from SNWA's Warm Springs Natural Area, another lowland riparian site, are also provided in comparison. These data were collected on two primary point count transects as a part of the NBC, between 2008 and 2016 (391 point-visits). The NBC results for Clark County include Warm Springs data through 2014; however, because of SNWA's ownership of the property and extensive restoration work there, they have been included separately, as well. All datasets included only detections from within 100 m of the survey point for the purpose of comparisons. However, NBC data were collected over a ten-minute survey period per point, rather than the five-minute period used at the Wash. Further, the breeding season periods differed in that the Wash data were for the period between 15 March through 31 August, with surveys evenly distributed throughout that time period, while the NBC data were collected from mid-April through June, with surveys primarily occurring in May and early June. Regardless of these differences in methods, we consider the regional comparisons of estimates of breeding densities reported here informative for most breeding landbird species. No similar datasets were available for the non-breeding season, preventing us from making regional comparisons for that period.

Finally, to determine whether population trends over time were significant, we performed negative-binomial regression analyses for count data, using year as a predictor and number of points per visit as an exposure variable. The 20 species for which we performed population analyses were selected based on minimum abundance (at least 40 detections over the study period), the fact that they represent conservation priority or indicator species for the project (see earlier GBBO reports), and that they comprised a balanced mix of species representing different seasonal bird use of the Wash.

Vegetation Measurements

Vegetation data were collected at each bird survey point along the Wash during each fall in 2005-2010 and in 2014-2017, using a vegetation protocol developed by Braden et al. (2009). Three 100 m vegetation transects were laid out radially at 120° angles from the point. Data were collected every 2 m along each transect at the distances of 20-40 m and 50-70 m from the survey point, yielding 60 sampling stations per point. Data recorded included: plant species occurrence, height, and vertical structure. Using an 11-15 m survey rod, perennial plant height was measured to within 0.1 m; any vegetation exceeding the height of the survey rod was estimated to within 0.5 m. Perennial plant structure was measured as the number of vegetation contacts at 1 m vertical intervals along the survey rod. These data were analyzed through 2016 and reported in GBBO (2018).

Restoration Treatment Effects

Wash stabilization treatments included clearing vegetation for construction and building weirs that locally widened the channel and impounded the stream to arrest channel downcutting. In these areas, water surface area increased and led to passive establishment of marsh vegetation

cover. The revegetation treatments included removing monotypic stands of tamarisk and planting native wetland, riparian, riparian-transitional (i.e., mesquite and acacia) and upland vegetation covers. Following weir construction, several survey points were flooded. Cleared areas were hydroseeded immediately after construction and then later revegetated with container plants.

For our analyses of restoration treatment effects on bird populations, we divided the 31 survey points into five categories based on the 2017-2018 status of project implementation affecting the area within 100 m of the survey point: no treatment (n = 1 survey point), recently cleared/completed (n = 4; treatment occurred < 5 years ago); recently revegetated (n = 11; revegetation occurred < 5 years ago), moderately recently revegetated (n = 1; revegetation occurred 5 – 9 years ago), and older revegetation (n = 14; revegetation occurred at least 10 years ago). The intermediate site was then lumped with the older sites for analysis. The single untreated site was summarized but not included in the analysis.

To determine bird responses to treatments, we used only the 2016-2018 bird survey data. To compare species richness effects of treatments, we calculated total species richness per survey point for detections within 100 m. Total bird abundance and species abundances were summarized as the number of birds per 40 ha to maintain comparability with other abundance analyses reported here. The species selected for abundance comparisons included all species with an observed frequency of at least 50%. Presence of differences between treatment classes was determined by Analysis of Variance (ANOVA). Where the ANOVA produced significant results, negative binomial count regression modelling was used to compare treatment categories to the recently cleared/completed sites, with surveys per point used as an exposure variable.

Results

Species List

Between 12 February 2005 and 30 August 2018, 220 bird species were observed during visits to the Wash (Table 2). In the 13th year of the project (tenth year of surveys), seven new species were detected for the first time in the Wash, including Cassin's Vireo, Common Nighthawk, Fox Sparrow, Short-billed Dowitcher, Solitary Sandpiper, Swamp Sparrow, and Vermilion Flycatcher (all scientific names in Table 2). Sixty species that had been detected at least once (including as incidentals) during the first nine years of surveys were not found in 2017-2018, including Ash-throated Flycatcher, Bushtit, Neotropic Cormorant, Pine Siskin, Ruddy Duck, and Western Grebe.

Of the 220 species observed during the ten years of surveys, 190 were recorded during the breeding season (15 March - 31 August), and 163 were recorded during the non-breeding season (1 October - 31 January). Only a small number of species (9) were detected exclusively during the transitional seasons between the designated breeding and non-breeding seasons, suggesting that most migrants actually passed through during the "breeding" or "non-breeding" seasons.

Fifty-three species recorded in the Wash are conservation priorities according to the Nevada Comprehensive Bird Conservation Plan (GBBO 2010), the Clark County Multiple Species Habitat Conservation Plan (Clark County 2000), the Lower Colorado River Multi-Species Conservation Program (Bureau of Reclamation 2006), and/or the Partners in Flight Landbird Conservation Plan (Rosenberg et al. 2016; Table 2). Thirty-six of the priority species were recorded during the non-breeding season, and 45 were recorded during the breeding season. Forty priority species were detected during the transitional periods, but only four of these were detected exclusively in the transitional seasons.

No new species were confirmed as breeders in 2017-2018, resulting in a total of 42 species confirmed to be nesting in the Wash based primarily on breeding evidence gathered in 2009-2018. Ten conservation priority species were confirmed to nest within the Wash, including Gambel's Quail, Least Bittern, Costa's Hummingbird, Loggerhead Shrike, Bell's Vireo, Long-eared Owl, Lucy's Warbler, Yellow Warbler, Abert's Towhee, and Blue Grosbeak. The full list of birds confirmed as breeders along the Wash is as follows:

Abert's Towhee	Indigo Bunting
American Kestrel	Killdeer
Bell's Vireo	Least Bittern
Bewick's Wren	Loggerhead Shrike
Black Phoebe	Long-eared Owl
Black-chinned Hummingbird	Lucy's Warbler
Black-crowned Night-Heron	Mallard
Black-tailed Gnatcatcher	Mourning Dove
Blue Grosbeak	Northern Harrier
Brown-headed Cowbird	Northern Mockingbird
Canada Goose	Northern Rough-winged Swallow
Common Gallinule	Red-shouldered Hawk
Common Yellowthroat	Red-tailed Hawk
Cooper's Hawk	Red-winged Blackbird
Costa's Hummingbird	Say's Phoebe
Crissal Thrasher	Song Sparrow
Double-crested Cormorant	Verdin
Gambel's Quail	Western Kingbird
Greater Roadrunner	Yellow Warbler
Great-tailed Grackle	Yellow-breasted Chat
House Finch	Yellow-headed Blackbird

Species Richness and Total Abundance

Species richness varied seasonally across the study period. It was lowest in June and peaked during September due to migration and juvenile dispersal (Figure 2a). However, richness patterns changed after the first six years of the project. In the early years, richness typically was

lowest during the non-breeding season and the winter transition and highest during the fall transition. The pattern became less clear in the four most recent years, other than that the lowest richness was most often observed in the breeding season (Figure 2b; Table 3). In Year 10, the lowest richness was observed during the fall transition, and the highest during the breeding season. In Years 11 through 13, the lowest richness was observed during the breeding season, while the highest richness in Year 11 was found in the winter transition, and in Years 12 and 13 in the fall transition.

Overall species richness remained similar throughout the first six years, showing only a slight increase, but it was significantly higher in Years 10 through 13 ($R^2 = 0.51$; $P < 0.001$; Figure 3; Table 3).

Total bird abundance (bird detections per 40 ha) also varied seasonally (Figure 4a), and the pattern changed over time (Figure 4b). Over the first six years, the pattern shows a peak in the breeding season (specifically, in May-July) and a larger increase during the late fall migration period (October-November; Figure 4b). However, from year to year, the season with the highest abundance varied within this period, while the lowest abundances were found in either February/March or August/September, generally corresponding with the winter and fall transitional periods (Table 4). For the most recent four years of surveys, the pattern became more consistent, with the lowest abundances found in the breeding season and fall transition (May, July, August, and September) and the highest abundances found in the non-breeding and winter transition seasons (December, January, and February; Figure 4b; Table 4).

Total bird abundance increased almost every year (Figure 5; Table 4) and showed an overall significant increasing trend ($R^2 = 0.31$; $P < 0.001$). The largest increases in abundance occurred during the non-breeding season and the winter transition, with the former nearly tripling, from an average of 131 birds per 40 ha in Year 1 to 386 birds per 40 ha in Year 13, and the latter increasing by more than 270%, from fewer than 80 birds per 40 ha in Year 1 to 292 birds per 40 ha in Year 13.

Species-Specific Abundances

Overall Abundance Patterns

For the entire study period, the ten species with the greatest overall abundances were American Coot, Red-winged Blackbird, Abert's Towhee, Yellow-rumped Warbler, Mallard, Gadwall, Song Sparrow, Marsh Wren, American Wigeon, and White-crowned Sparrow (Table 5). In the four most recent survey years, waterbird numbers increased dramatically from the first six years, particularly American Coot, American Wigeon, Gadwall, and Mallard (Tables 5 and 6). The average density of American Coots over the past four years of surveys was more than seven times their average density from the first six years of the project. In the most recent four-year period, the average abundance of Mallards more than quadrupled, while Gadwalls averaged more than 13 times, and American Wigeons averaged an impressive 70 times their average abundance from the first six years of the study. While waterbirds made substantial gains, several species associated with riparian shrub/tree habitats declined over this period (e.g., Abert's Towhee,

Bewick's Wren, Lucy's Warbler, Song Sparrow, Ruby-crowned Kinglet, and Yellow-breasted Chat).

The species with the highest absolute abundances also had the highest relative abundances (percentage of total bird abundance by each species; Tables 7 and 8), including American Coot, Red-winged Blackbird, Abert's Towhee, and Yellow-rumped Warbler. American Coots increased from approximately two to 18 percent of the total bird abundance between the first and most recent year's surveys. Abert's Towhees, on the other hand, have declined from approximately 12 to three percent of total bird abundance over the same period (Table 7). The relative frequency of each species (i.e., the percentage of total survey points at which the species was detected at least once) showed that the species that are most widespread within the study area are typical riparian songbirds, such as Yellow-rumped Warbler, Black Phoebe, Abert's Towhee, White-crowned Sparrow, Verdin, Song Sparrow, Common Yellowthroat, Black-tailed Gnatcatcher, Bewick's Wren, and Brown-headed Cowbird (Table 9).

Breeding Season Species Abundances in Relation to Regional Abundances

For the ten years of surveys, the ten most abundant species at the Wash during the breeding season included Red-winged Blackbird, Abert's Towhee, Song Sparrow, Common Yellowthroat, Great-tailed Grackle, American Coot, Verdin, Brown-headed Cowbird, Gambel's Quail, and Bewick's Wren (Table 10). In comparison, the ten most abundant species recorded during ten years of NBC surveys within Clark County lowland riparian areas included Gambel's Quail, Abert's Towhee, Lucy's Warbler, Mourning Dove, Brown-headed Cowbird, Yellow Warbler, Verdin, House Finch, Red-winged Blackbird, and Song Sparrow (Table 10). At the Warm Springs Natural Area, the ten most abundant species during eight years of surveys were Gambel's Quail, Red-winged Blackbird, Abert's Towhee, Phainopepla, Mourning Dove, Brown-headed Cowbird, Lucy's Warbler, House Finch, Verdin, and Common Yellowthroat. There was significant overlap among the sites with just 15 species comprising the lists of the ten most abundant species for all three datasets.

The Wash tended to support greater numbers of wetland-associated species, such as Red-winged Blackbirds, Song Sparrows, Common Yellowthroats, and American Coots than were found at Warm Springs or in regional riparian areas. Species found to be more common regionally than at the Wash included Gambel's Quail, Lucy's Warbler, Mourning Dove, House Finch, and Phainopepla. In particular, the Warm Springs Natural Area supported substantially higher numbers of these species (Table 10). Bird abundances at the Wash were likely influenced by construction and other barren areas, resulting in reduced habitat cover near some survey points for species such as Gambel's Quail. Also, while mesquites and catclaws are present on the Wash, they may not yet be old enough to support sufficient mistletoe, and/or possibly not yet widespread enough, to support Phainopepla. Lucy's Warblers and House Finches are cavity nesters and require woody plants of sufficient size to support cavities. While less abundant than the previously mentioned species, the cavity nesting Brown-crested Flycatchers and Ladder-backed Woodpeckers were all most abundant on Warm Springs and least abundant on the Wash. Bewick's Wrens, however, were found in slightly higher numbers at the Wash than on Warm Springs; while they are predominantly cavity nesters, they are also more flexible in their nesting

requirements, including using crevices between small boulders (Kennedy and White 2013), which are abundantly available at the Wash.

Non-Breeding Season Species Abundances

The ten most abundant species for the entire study period during the non-breeding season were American Coot, Yellow-rumped Warbler, Mallard, White-crowned Sparrow, Gadwall, American Wigeon, American Pipit, Marsh Wren, Abert's Towhee, and Red-winged Blackbird (Tables 5 and 6). These species are a mix of year-round residents (e.g., Abert's Towhee, Red-winged Blackbird), migrants and wintering species of the Mojave Desert (e.g., Yellow-rumped Warbler, White-crowned Sparrow, American Pipit), and wetland/aquatic species (e.g., American Coot, Gadwall, Mallard, Marsh Wren, American Wigeon).

The change in composition of this list through 2018 relative to that through 2010 shows again that waterbirds have become significantly more abundant. In 2010, the most abundant species during the non-breeding season for the six years studied were Yellow-rumped Warbler, White-crowned Sparrow, Abert's Towhee, Marsh Wren, American Coot, Song Sparrow, American Pipit, Red-winged Blackbird, Ruby-crowned Kinglet, and Mallard. Now, Gadwall and American Wigeon are among the ten most abundant species, and American Coots and Mallards are among the three most abundant species, while Song Sparrow and Ruby-crowned Kinglet are no longer among the ten most abundant. In total, the ten most abundant species in the past four years included American Coot, Gadwall, Mallard, American Wigeon, Yellow-rumped Warbler, White-crowned Sparrow, American Pipit, Marsh Wren, Red-winged Blackbird, and Abert's Towhee.

Trends in Species Abundances

We examined trends in abundance for 20 species of interest in the Wash over the 13-year survey period (Figures 6a-e; Table 11). Ten species showed significant increases, including American Coot, Red-winged Blackbird, Mallard, Gadwall, Verdin, Black-tailed Gnatcatcher, American Pipit, Gambel's Quail, Orange-crowned Warbler, and Crissal Thrasher. These species are associated with wetland marsh (e.g., Red-winged Blackbird), open water (e.g., American Coot, Mallard, Gadwall), and drier or more open habitat types than cottonwood/willow woodlands (e.g., Black-tailed Gnatcatcher, Verdin, American Pipit, Gambel's Quail, Crissal Thrasher). Orange-crowned Warbler migration and overwintering habitats are variable, with western individuals primarily associated with riparian corridors (e.g., cottonwood, willow, and tamarisk) and shrubby woodland habitats (Gilbert et al. 2010).

Six of the species showed significant declines including Abert's Towhee, Song Sparrow, Bewick's Wren, Ruby-crowned Kinglet, Lucy's Warbler, and Yellow-breasted Chat. These species tend to be found in dense riparian shrub habitats (e.g., Abert's Towhee, Song Sparrow, Bewick's Wren, Yellow-breasted Chat), deciduous riparian woodlands with shrub understory (Ruby-crowned Kinglet), and where stems are large enough to provide nest cavities (Lucy's Warbler). These species likely responded to the initial reduction of such vegetation due to tamarisk removal; as sites recover from disturbance and revegetated stands mature, these species are likely to increase in abundance.

Vegetation Treatment Effects

Recently cleared/completed sites tended to be very close to the Wash and thus water and some marsh vegetation, and so bird detections were higher than one might expect from such sites (Table 12). Results may also have been influenced by increased detectability of birds. American Pipit density was significantly higher in the recently cleared/completed sites than the other treatments. These sites include the substantial amount of barren ground preferred in their migration and overwintering habitats.

Recently revegetated sites were often directly adjacent to the Wash and near expansive open water containing significant wetland vegetation. This is reflected in the bird community – the bird species found in significantly greater numbers here relative to the recently cleared/completed sites were almost entirely aquatic and wetland species: American Coot, Marsh Wren, Red-winged Blackbird, Gadwall, and Mallard. The disturbance-associated Great-tailed Grackle was the exception, although at the Wash it favors emergent marsh vegetation for nesting.

Older revegetation sites tended to be further from the Wash, thereby containing less wetland habitat and more shrubs and larger riparian woody plants. This, too, was reflected in the bird community in that, relative to recently cleared/completed sites, older revegetation sites had significantly greater numbers of Abert's Towhee, Verdin, Black-tailed Gnatcatcher, Bewick's Wren, Ruby-crowned Kinglet, Northern Flicker, and Lucy's Warbler.

There were no significant differences in species richness among the treatments, but total abundance of birds was significantly greater at recently revegetated sites relative to recently cleared/completed sites, mostly reflecting the abundant coots and waterfowl.

Discussion

As discussed in previous reports (GBBO 2011a and b, 2018), the bird community of the Wash is rich, featuring approximately 45% of the total bird species richness recorded in Nevada, and providing important habitat for 53 conservation priority species, ten of which were confirmed to be nesting on the site.

The Wash's bird community fluctuates throughout the year. Bird species richness was lowest in June and peaked during September; however, species richness patterns changed over the course of the project. In the early years, richness was typically lowest during the non-breeding season and the winter transition, and highest during the fall transition. In the four most recent years, the lowest richness was found most often in the breeding season, and the highest richness was most often in transition periods, particularly in fall.

Total bird abundance also changed dramatically over the course of the project. During the early years, abundances were high during the breeding season and at their highest in October and November, which was mostly attributable to regularly-recorded winter birds that flock, such as

American Pipits. More recently, abundances peaked December through February, as wintering and migrating waterbirds increasingly used the created wetlands.

Over the life of the Wash stabilization and enhancement project, 21 weirs were constructed, non-native tamarisk was removed, and more than 500 acres were revegetated with native plants. This has resulted in significant increases in species richness and abundance of birds, particularly those associated with aquatic and wetland habitat types, such as Red-winged Blackbirds, American Coots, Mallards, and Gadwalls. The replacement of dry tamarisk sites by upland shrubs and mesquites has also resulted in significant increases in several species, including Black-tailed Gnatcatcher, Verdin, and Gambel's Quail. However, several species requiring denser riparian shrub habitats and larger stems have declined over the course of the project, including Song Sparrow, Lucy's Warbler, and Yellow-breasted Chat. We attribute these declines to the initial responses of these species to vegetation removal. Active revegetation is ongoing, but it takes time to grow a dense riparian shrub layer and trees of sufficient stem diameter to support cavities.

The Wash supported larger estimated densities of many wetland bird species compared with similar areas in the Mojave Desert, including Red-winged Blackbird, Song Sparrow, Common Yellowthroat, and Marsh Wren. Species found to be more common regionally than at the Wash included Gambel's Quail, Lucy's Warbler, Mourning Dove, House Finch, and Phainopepla. In particular, the Warm Springs Natural Area supported substantially higher numbers of these species, as well as Brown-crested Flycatcher and Ladder-backed Woodpecker, most of which are associated with cavities and/or mesquites. Because this site has always had significant stands of mature riparian and mesquite woodlands, these bird species were already established at the site, while at the Wash, such habitat types were originally rare and are currently being encouraged to establish through revegetation efforts. On a similar monitoring project of a habitat creation effort along the lower Colorado River, we found a similar lag of late-successional species getting established, and even ten years after revegetation, several late-successional species including cavity nesters had yet to colonize the maturing sites (GBBO unpubl. data).

Recently revegetated sites tended to be adjacent to the Wash channel, particularly beside weir impoundments. As a result, significantly greater numbers of aquatic and wetland species were found at these survey points, including American Coot, Marsh Wren, and Gadwall. Older revegetation sites tended to have less wetland habitat and more well-developed shrub and tree habitats. These sites supported significantly greater numbers of such species, including Abert's Towhee, Bewick's Wren, Ruby-crowned Kinglet, and Lucy's Warbler. Because many of these species have declined since the start of the project, it is encouraging that they are found in greater numbers in the older revegetation areas.

Recommendations

Conservation and Management

The past four years of surveys began to show a large positive response of migrating and wintering birds to the restoration activities along the Wash, particularly in the aquatic habitat and wetlands created through weir construction, but several bird species, particularly associates of riparian shrubs and larger stems, also showed initial declines after vegetation had to be cleared for construction and restoration. However, many of these species were found in significantly greater numbers in older revegetation areas, indicating that as the Wash recovers from construction and revegetation sites mature, many of these species are likely to increase in number. As mesquite stands are restored across the Wash, we also expect increases in mesquite-associated species that are currently rare along the Wash, such as Phainopepla, and those that require large trees, such as Lucy's Warblers and other cavity nesters.

GBBO has just begun to work with SNWA to develop a long-term plan to direct bird habitat management along the Wash. As the plan is developed, it will be important to balance the needs of future weir maintenance with those of species requiring mid-successional and mature stands of riparian vegetation. It may also be possible to use periodic weir maintenance (e.g., clearing of vegetation from a weir's surface) to mimic natural disturbance and enhance early successional habitat.

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Figures

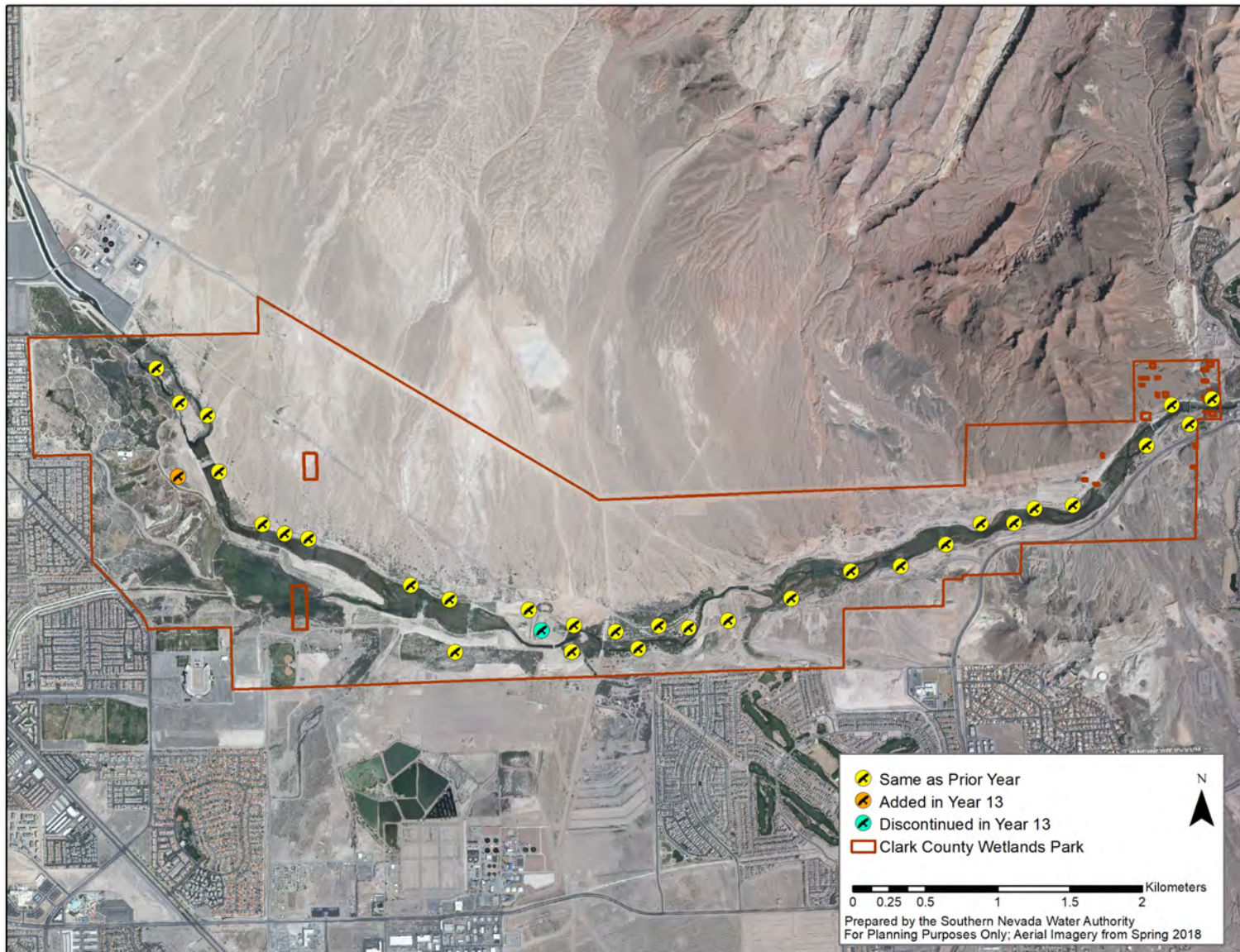


Figure 1. Distribution of points across Las Vegas Wash. Map courtesy of Southern Nevada Water Authority.

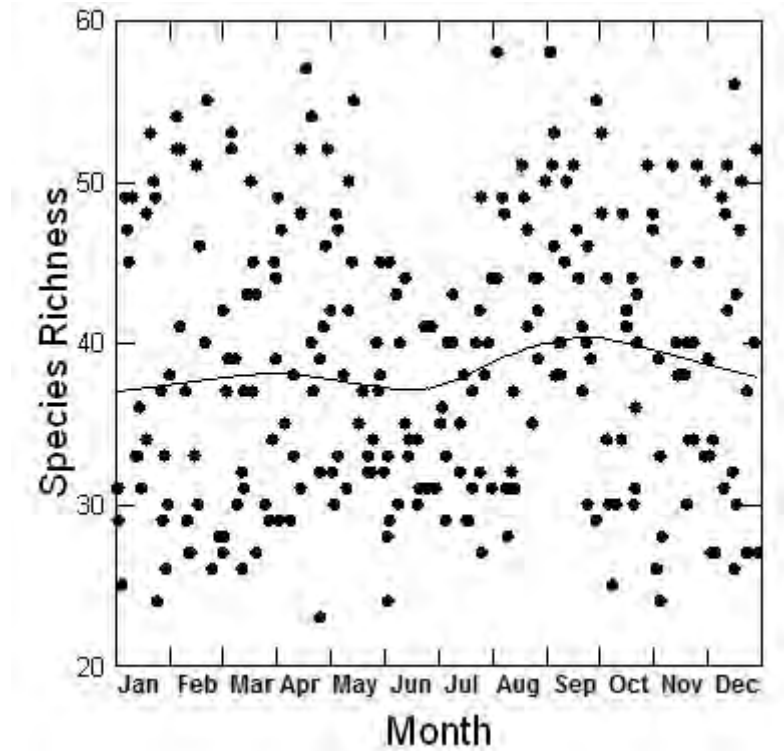


Figure 2a. Seasonal species richness per survey visit from 260 surveys of the Las Vegas Wash (2005 – 2018). Curve represents a LOWESS smoothed fit for variation in richness among survey visits.

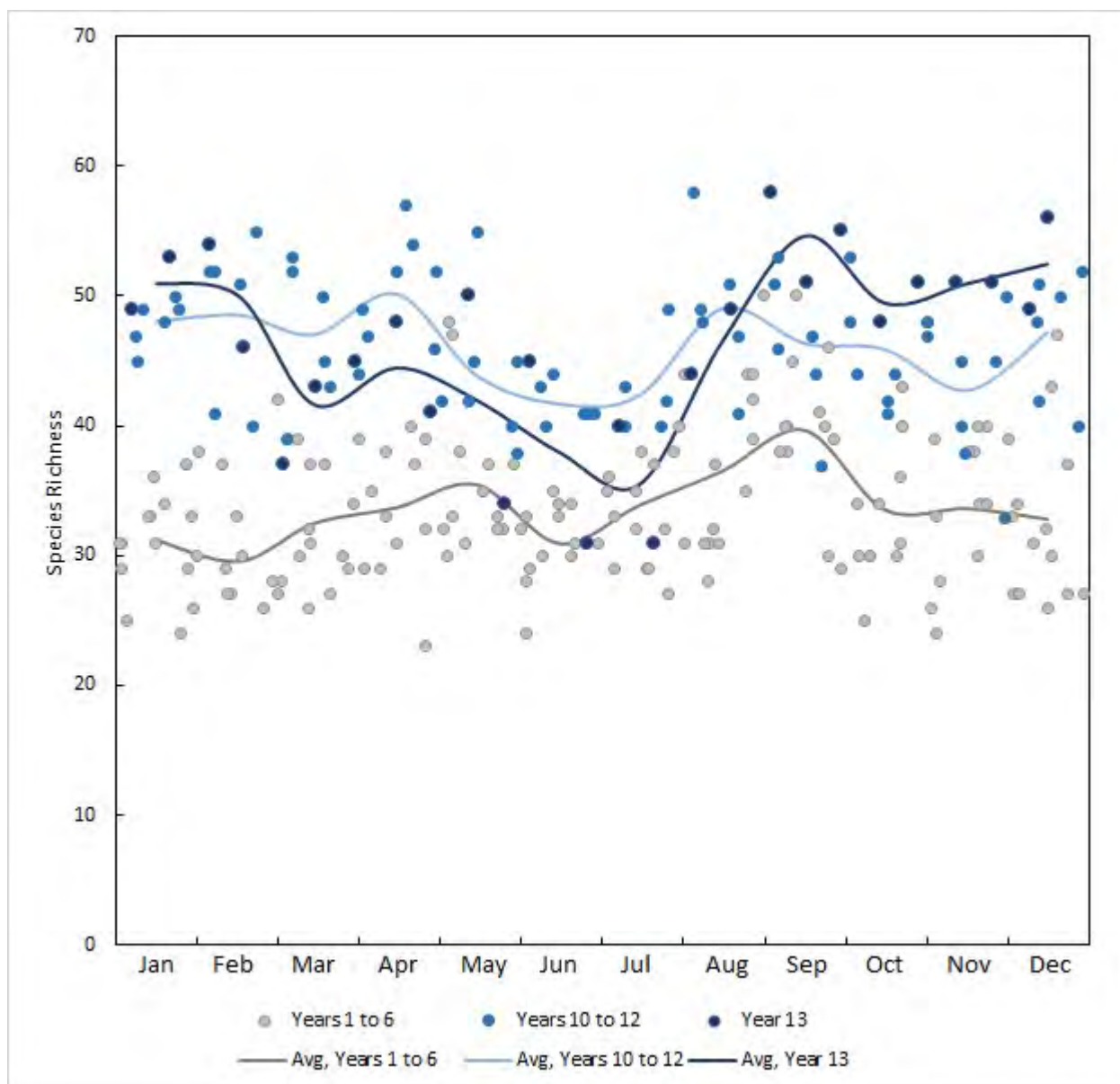


Figure 2b. Seasonal bird richness per survey visit from 260 surveys of the Las Vegas Wash (2005-2018), showing smoothed fit of average richness per month by period (Years 1 to 6, Years 10 to 12, and Year 13).

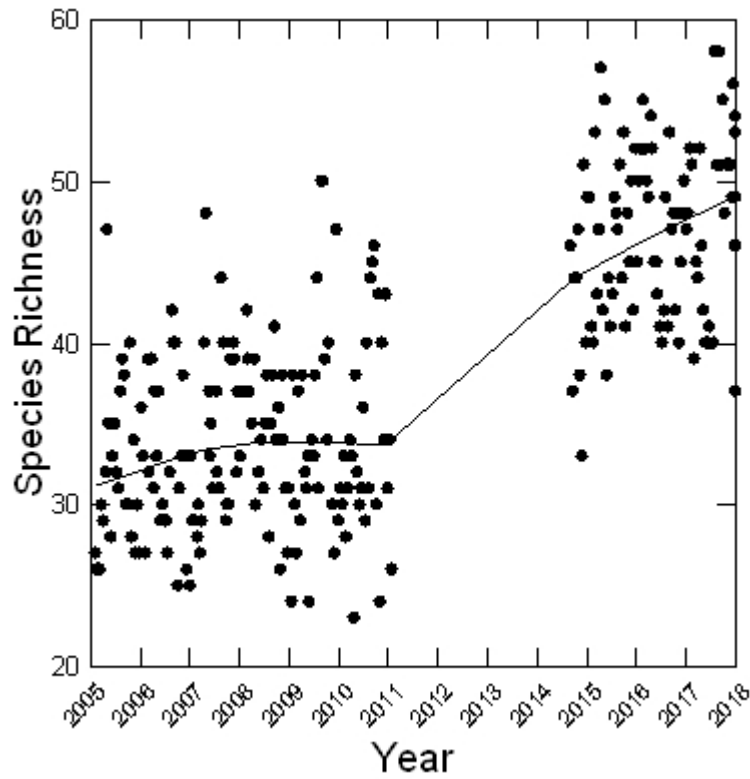


Figure 3. Trend in species richness from 260 surveys of the Las Vegas Wash (2005 – 2018). Curve represents a LOWESS smoothed fit for variation in richness among survey visits. ($R^2 = 0.51$; $P < 0.001$)

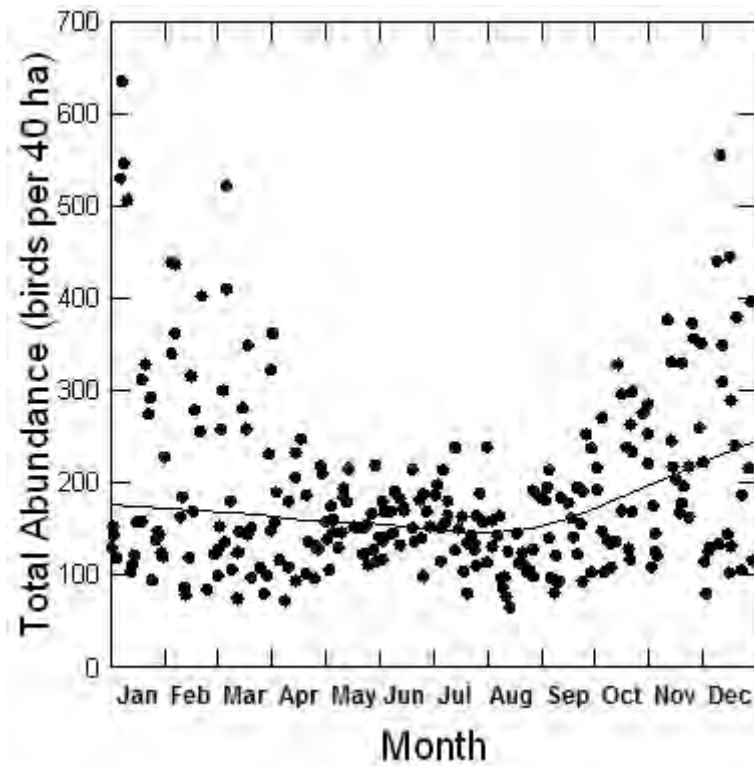


Figure 4a. Seasonal total bird abundance per survey visit from 260 surveys of the Las Vegas Wash (2005-2018). Curve represents a LOWESS smoothed fit for variation in abundance among survey events.

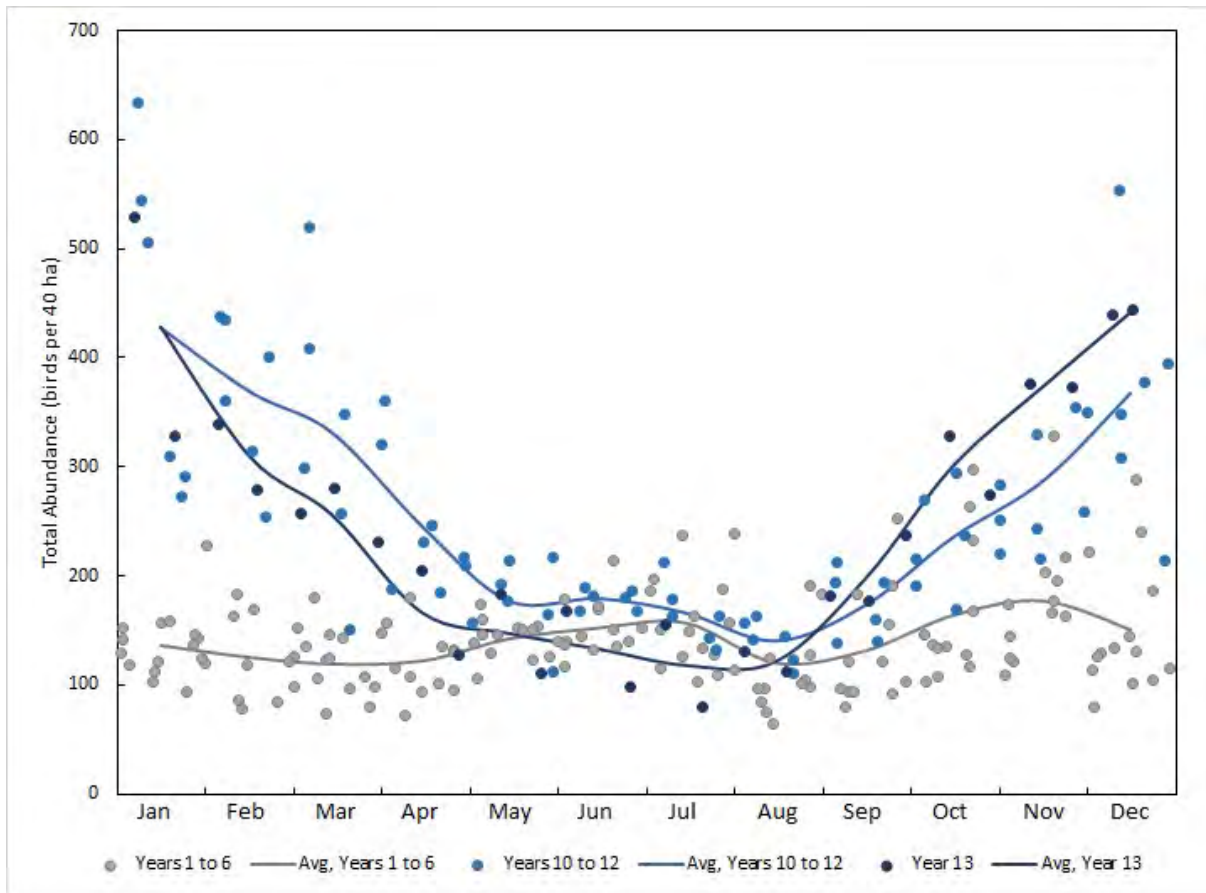


Figure 4b. Seasonal total bird abundance per survey visit from 260 surveys of the Las Vegas Wash (2005-2018), showing smoothed fit of average abundance per month by period (Years 1 to 6, Years 10 to 12, and Year 13).

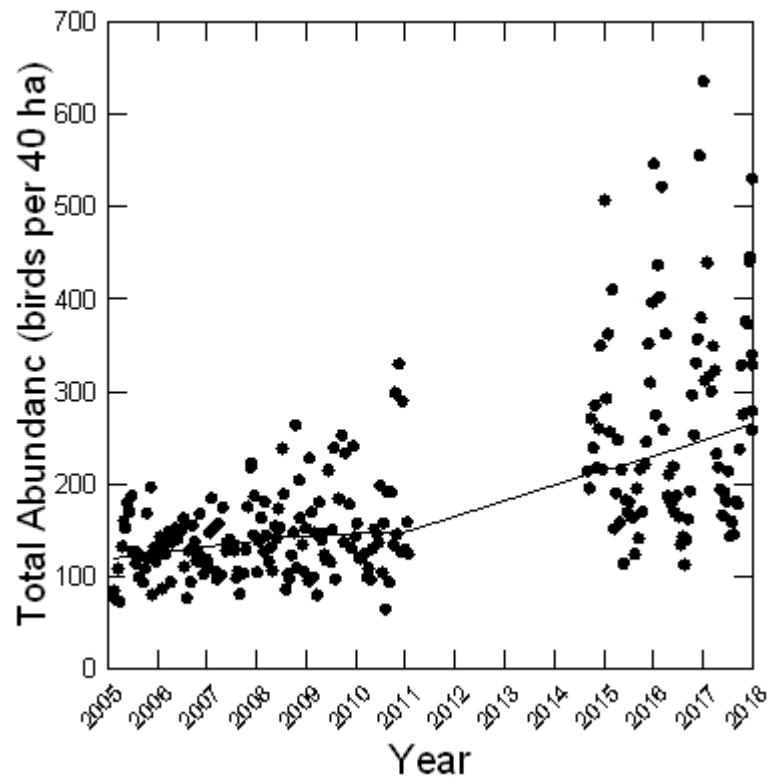


Figure 5. Trend in estimated total bird abundance from 260 surveys of the Las Vegas Wash (2005-2018). Curve represents a LOWESS smoothed fit for variation in abundance among survey visits. ($R^2 = 0.31$; $P < 0.001$)

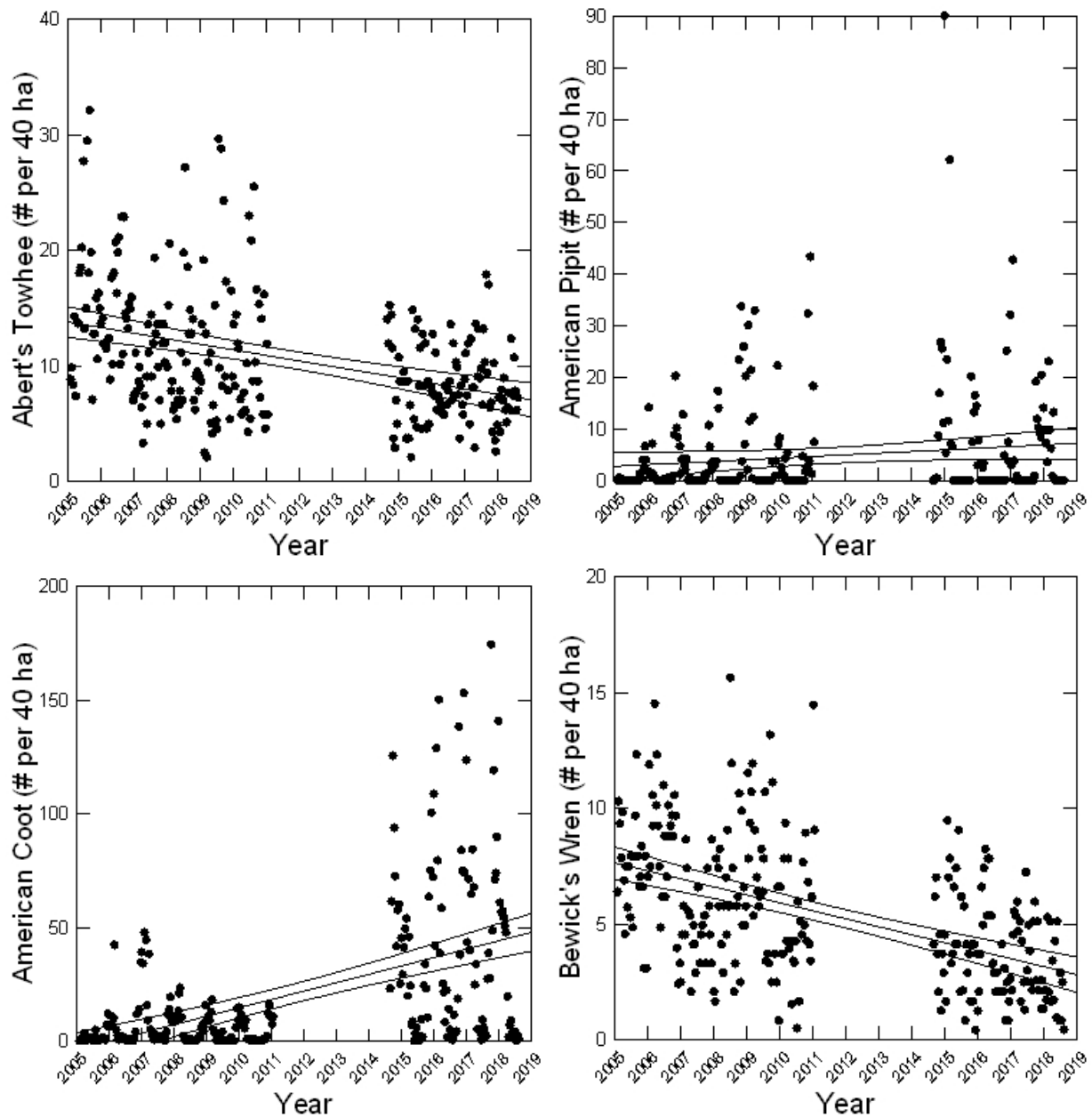


Figure 6a. Population trends of four common species along the Las Vegas Wash, by year (2005 – 2018). See Table 11 for statistical analysis results.

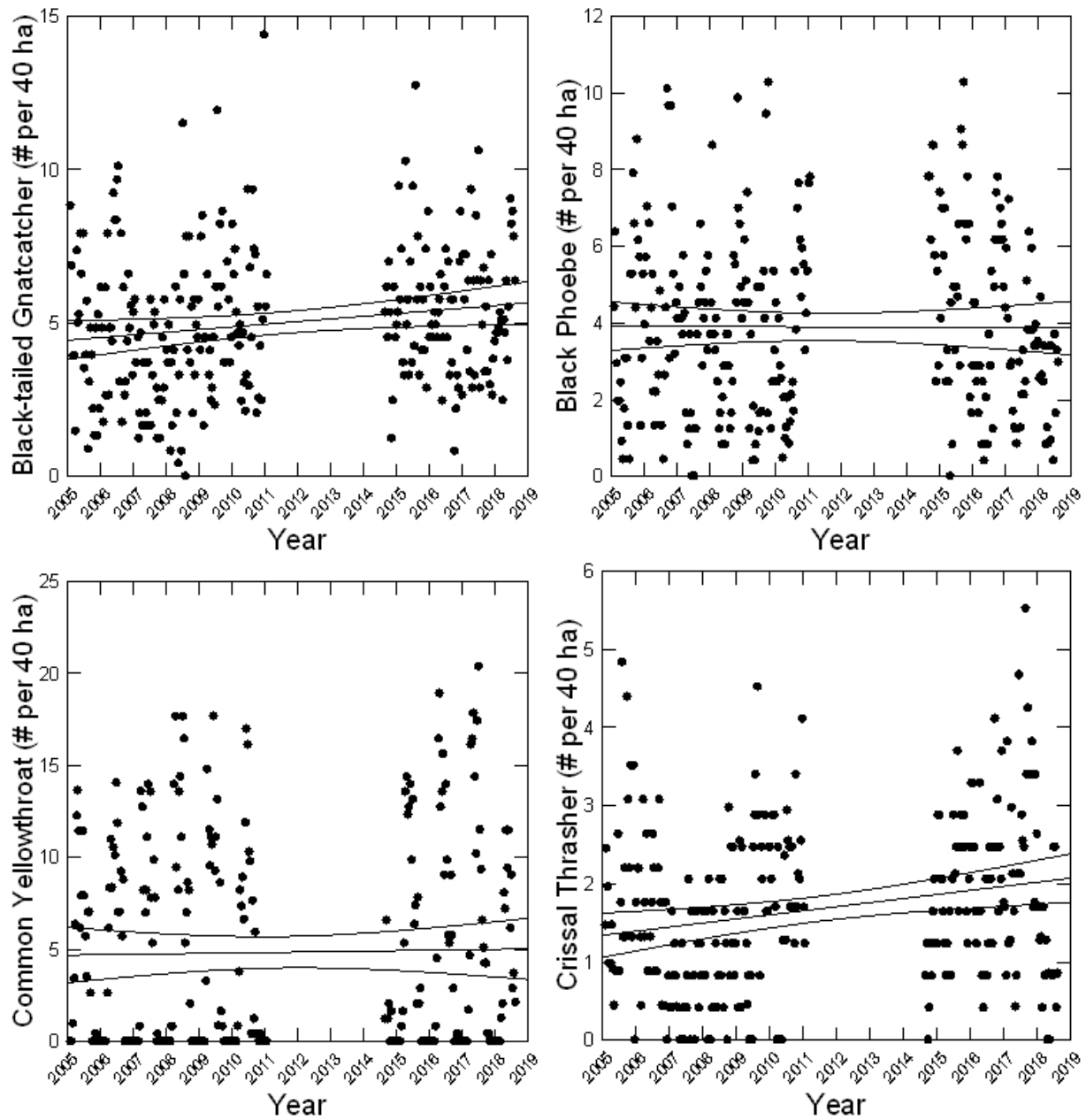


Figure 6b. Population trends of four common species along the Las Vegas Wash, by year (2005 – 2018). See Table 11 for statistical analysis results.

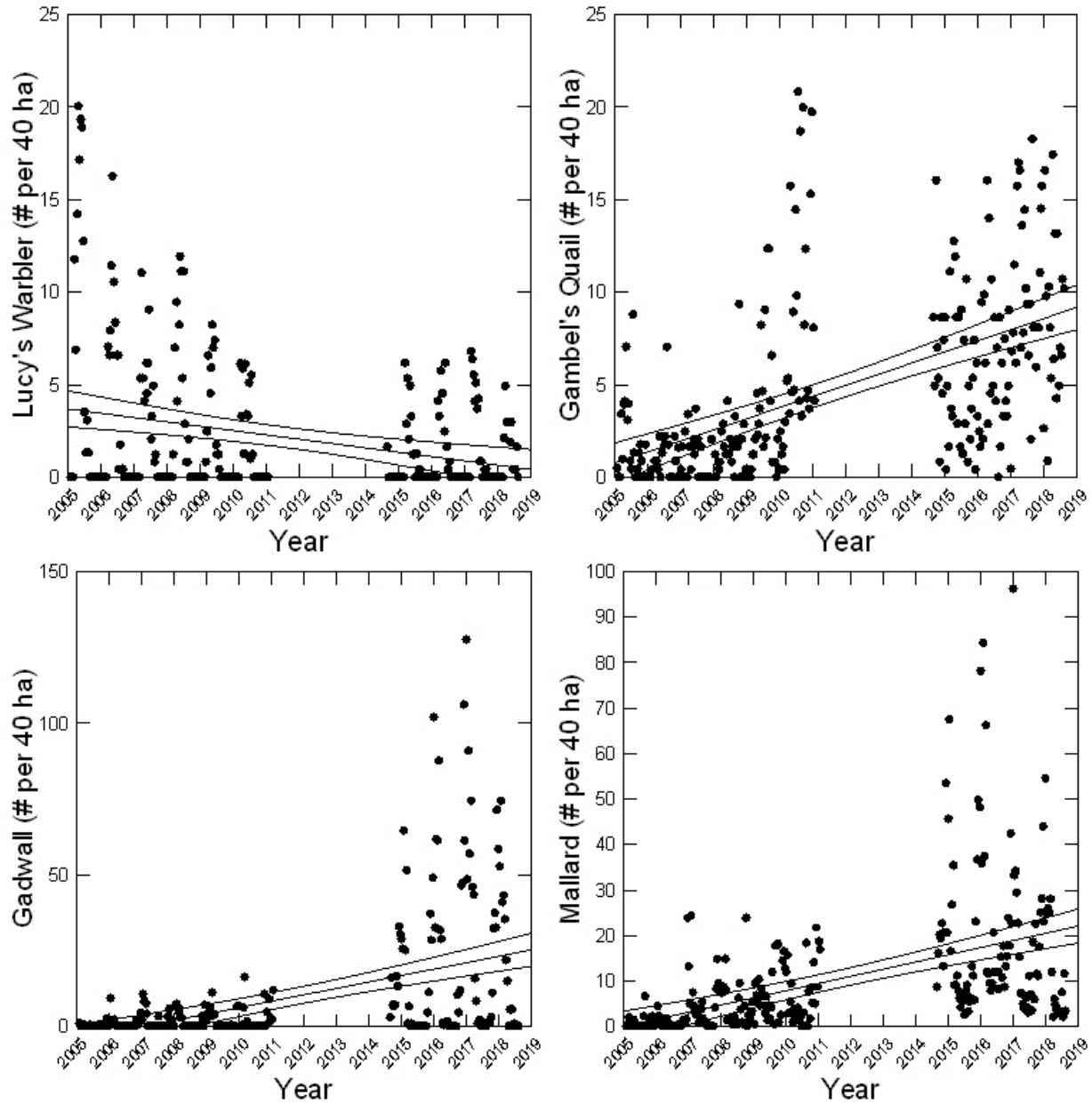


Figure 6c. Population trends of four common species along the Las Vegas Wash, by year (2005 – 2018). See Table 11 for statistical analysis results.

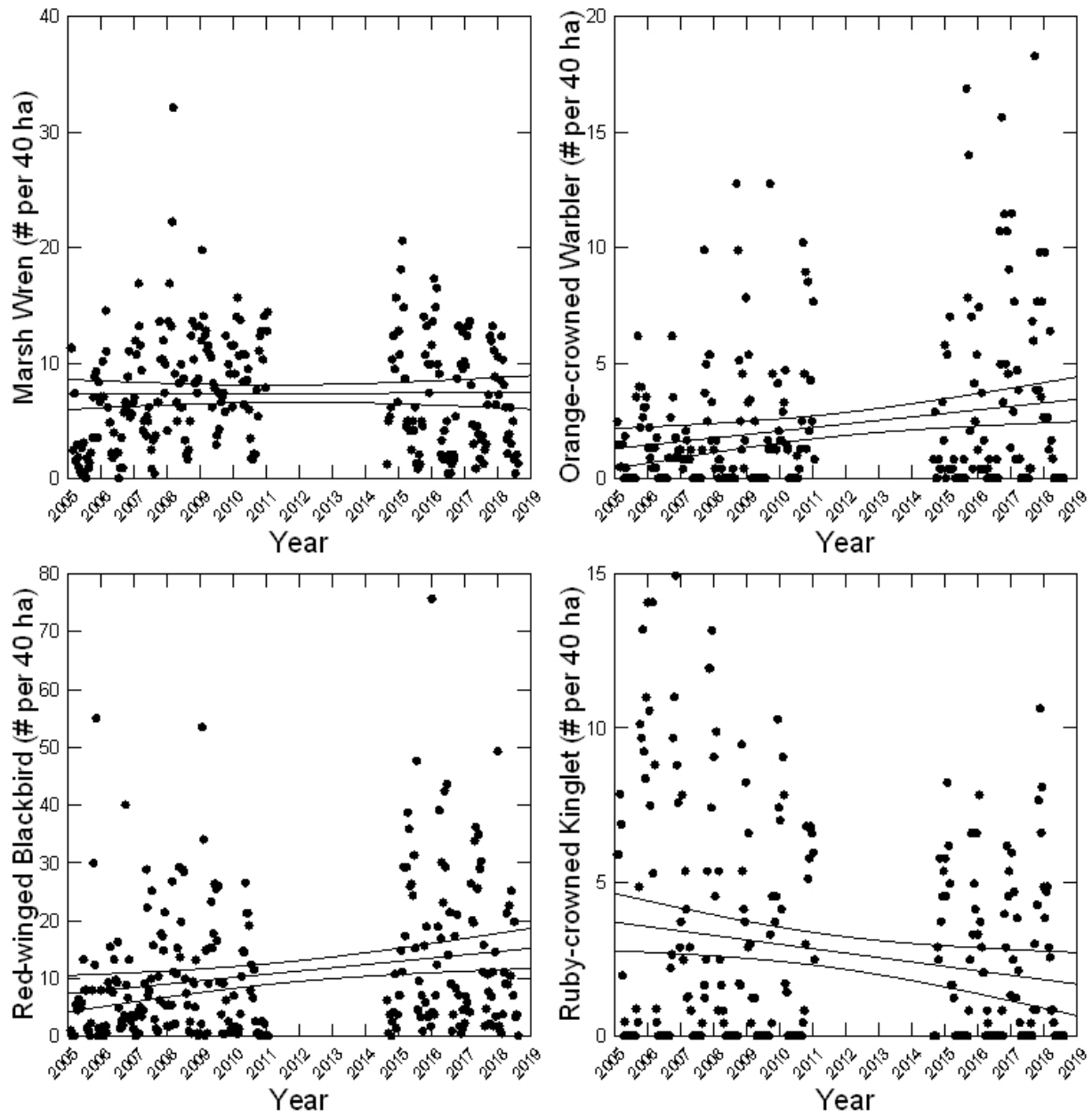


Figure 6d. Population trends of four common species along the Las Vegas Wash, by year (2005 – 2018). See Table 11 for statistical analysis results.

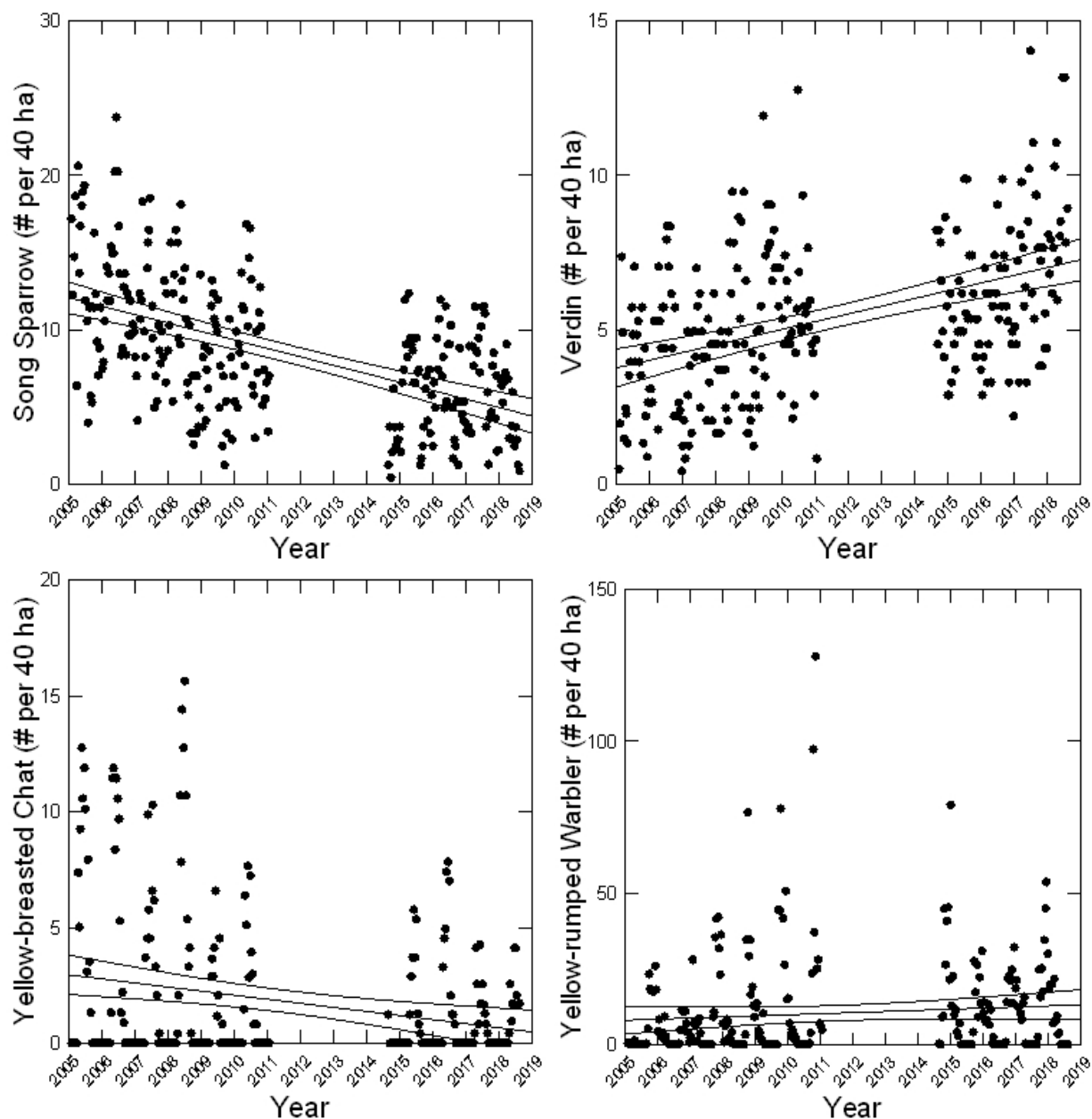


Figure 6e. Population trends of four common species along the Las Vegas Wash, by year (2005 – 2018). See Table 11 for statistical analysis results.

Tables

Table 1. Number of point count surveys conducted per year along the Las Vegas Wash.

Year	Points/Survey	Number of Surveys	Max. Number of Points/Year	Total Number of Survey-Visits
Year 1	26	6	29	26
	28	1		
	29	19		
Year 2	29	22	32	26
	31	3		
	32	1		
Year 3	30	2	31	26
	31	24		
Year 4	30	1	31	26
	31	25		
Year 5	22	1	31	26
	28	1		
	30	2		
	31	22		
Year 6	25	1	31	26
	26	2		
	27	2		
	29	1		
	30	11		
	31	9		
Year 10	30	1	37*	26
	31	25		
Year 11	31	26	33*	26
Year 12	29	2	31	26
	30	10		
	31	14		
Year 13	27	1	35*	26
	29	3		
	30	16		
	31	6		

* Numbers are larger than 31 because they include original and replacement points.

Table 2. All bird species detected at Las Vegas Wash, February 2005 through August 2018, during breeding, non-breeding, and transitional seasons. Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight). X denotes at least one detection in that season (for season definitions, see Methods). Asterisks indicate species that were recorded incidentally, as fly-overs, or >100 m from a survey point. Species listed in taxonomic order.

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Greater White-fronted Goose	<i>Anser albifrons</i>			X	
Snow Goose	<i>Chen caerulescens</i>		*	*	X
Ross's Goose	<i>Chen rossii</i>			X	
Graylag Goose	<i>Anser anser</i>		*	*	*
Canada Goose	<i>Branta canadensis</i>		X	X	X
Tundra Swan	<i>Cygnus columbianus</i>	C		*	
Wood Duck	<i>Aix sponsa</i>			X	*
Gadwall	<i>Anas strepera</i>		X	X	X
American Wigeon	<i>Anas americana</i>		X	X	X
Mallard	<i>Anas platyrhynchos</i>		X	X	X
Blue-winged Teal	<i>Anas discors</i>		*	X	*
Cinnamon Teal	<i>Anas cyanoptera</i>	C	X	X	X
Northern Shoveler	<i>Anas clypeata</i>		X	X	X
Northern Pintail	<i>Anas acuta</i>	C	*	X	X
Green-winged Teal	<i>Anas crecca</i>		X	X	X
Canvasback	<i>Aythya valisineria</i>	C		*	
Redhead	<i>Aythya americana</i>	C	*	*	X
Ring-necked Duck	<i>Aythya collaris</i>		*	X	X
Lesser Scaup	<i>Aythya affinis</i>	C	X	X	X
Bufflehead	<i>Bucephala albeola</i>		X	X	X
Common Goldeneye	<i>Bucephala clangula</i>		X	X	X
Hooded Merganser	<i>Lophodytes cucullatus</i>		X	X	X
Common Merganser	<i>Mergus merganser</i>		X	X	X
Ruddy Duck	<i>Oxyura jamaicensis</i>		*	X	X
Gambel's Quail	<i>Callipepla gambelii</i>	C	X	X	X
Pied-billed Grebe	<i>Podilymbus podiceps</i>		X	X	X
Horned Grebe	<i>Podiceps auritus</i>		X	X	*
Eared Grebe	<i>Podiceps nigricollis</i>	C	X	X	X
Western Grebe	<i>Aechmophorus occidentalis</i>	C	X	X	*
Clark's Grebe	<i>Aechmophorus clarkii</i>	C	*	*	
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>		X		X

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Double-crested Cormorant	<i>Phalacrocorax auritus</i>		X	X	X
American White Pelican	<i>Pelecanus erythrorhynchos</i>	C	X	X	X
American Bittern	<i>Botaurus lentiginosus</i>		X		X
Least Bittern	<i>Ixobrychus exilis</i>	B; C	X	X	X
Great Blue Heron	<i>Ardea herodias</i>		X	X	X
Great Egret	<i>Ardea alba</i>		X	X	X
Snowy Egret	<i>Egretta thula</i>	C	X	X	X
Cattle Egret	<i>Bubulcus ibis</i>		*		X
Green Heron	<i>Butorides virescens</i>		X	X	X
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>		X	X	X
White Ibis	<i>Eudocimus albus</i>		*		
White-faced Ibis	<i>Plegadis chihi</i>	C	X	X	X
Turkey Vulture	<i>Cathartes aura</i>		X	*	X
Osprey	<i>Pandion haliaetus</i>		X	X	X
White-tailed Kite	<i>Elanus leucurus</i>		*		
Northern Harrier	<i>Circus cyaneus</i>		X	X	X
Sharp-shinned Hawk	<i>Accipiter striatus</i>		X	X	X
Cooper's Hawk	<i>Accipiter cooperii</i>		X	X	X
Northern Goshawk	<i>Accipiter gentilis</i>	C		*	
Red-shouldered Hawk	<i>Buteo lineatus</i>		X	X	X
Swainson's Hawk	<i>Buteo swainsoni</i>	C	X		
Red-tailed Hawk	<i>Buteo jamaicensis</i>		X	X	X
Virginia Rail	<i>Rallus limicola</i>		X	X	X
Sora	<i>Porzana carolina</i>		X	X	X
Common Gallinule	<i>Gallinula galeata</i>		X	X	X
American Coot	<i>Fulica americana</i>		X	X	X
Sandhill Crane	<i>Grus canadensis</i>	C	X	*	*
Black-necked Stilt	<i>Himantopus mexicanus</i>	C	X		*
American Avocet	<i>Recurvirostra americana</i>	C	X	X	X
Semipalmated Plover	<i>Charadrius semipalmatus</i>		X		
Killdeer	<i>Charadrius vociferus</i>		X	X	X
Spotted Sandpiper	<i>Actitis macularius</i>		X	X	X
Solitary Sandpiper	<i>Tringa solitaria</i>		X		X
Greater Yellowlegs	<i>Tringa melanoleuca</i>		X	X	X
Willet	<i>Tringa semipalmata</i>	C	X		
Lesser Yellowlegs	<i>Tringa flavipes</i>		X	*	X
Whimbrel	<i>Numenius phaeopus</i>		*		

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Long-billed Curlew	<i>Numenius americanus</i>	C	*		*
Marbled Godwit	<i>Limosa fedoa</i>	C			*
Stilt Sandpiper	<i>Calidris himantopus</i>				*
Dunlin	<i>Calidris alpina</i>		X		
Least Sandpiper	<i>Calidris minutilla</i>	C	X	X	X
Pectoral Sandpiper	<i>Calidris melanotos</i>				X
Semipalmated Sandpiper	<i>Calidris pusilla</i>		X		
Western Sandpiper	<i>Calidris mauri</i>	C	X	X	X
Short-billed Dowitcher	<i>Limnodromus griseus</i>		*		
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	C	X	X	X
Wilson's Snipe	<i>Gallinago delicata</i>		X	X	X
Wilson's Phalarope	<i>Phalaropus tricolor</i>	C	*		
Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>		X		
Franklin's Gull	<i>Leucophaeus pipixcan</i>	C	*		
Ring-billed Gull	<i>Larus delawarensis</i>		X	X	X
California Gull	<i>Larus californicus</i>		*	*	*
Lesser Black-backed Gull	<i>Larus fuscus</i>		*		
Caspian Tern	<i>Hydroprogne caspia</i>		X	*	*
Forster's Tern	<i>Sterna forsteri</i>		*		
Rock Pigeon	<i>Columba livia</i>		*	X	*
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>		X	X	X
White-winged Dove	<i>Zenaida asiatica</i>		X	X	X
Mourning Dove	<i>Zenaida macroura</i>		X	X	X
Greater Roadrunner	<i>Geococcyx californianus</i>		X	X	X
Barn Owl	<i>Tyto alba</i>		X	X	X
Great Horned Owl	<i>Bubo virginianus</i>		X	X	X
Long-eared Owl	<i>Asio otus</i>	E	X		
Lesser Nighthawk	<i>Chordeiles acutipennis</i>		X		X
Common Nighthawk	<i>Chordeiles minor</i>	D			*
Vaux's Swift	<i>Chaetura vauxi</i>		*	*	*
White-throated Swift	<i>Aeronautes saxatalis</i>	C	*	*	*
Black-chinned Hummingbird	<i>Archilochus alexandri</i>		X	X	X
Anna's Hummingbird	<i>Calypte anna</i>		X	X	X
Costa's Hummingbird	<i>Calypte costae</i>	C	X	X	X
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>				X
Rufous Hummingbird	<i>Selasphorus rufus</i>	C; E	X		*
Belted Kingfisher	<i>Megasceryle alcyon</i>		X	X	X

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>		X	X	X
Ladder-backed Woodpecker	<i>Picoides scalaris</i>		X	X	X
Hairy Woodpecker	<i>Picoides villosus</i>			X	
Northern Flicker	<i>Colaptes auratus</i>		X	X	X
American Kestrel	<i>Falco sparverius</i>		X	X	X
Merlin	<i>Falco columbarius</i>			X	X
Peregrine Falcon	<i>Falco peregrinus</i>	C	X	X	*
Prairie Falcon	<i>Falco mexicanus</i>	C	*	X	*
Olive-sided Flycatcher	<i>Contopus cooperi</i>	C; D; E	X		
Western Wood-Pewee	<i>Contopus sordidulus</i>		X		X
Willow Flycatcher	<i>Empidonax traillii</i>	A; B; C	X		
Hammond's Flycatcher	<i>Empidonax hammondi</i>		X		
Gray Flycatcher	<i>Empidonax wrightii</i>	C	X	X	X
Dusky Flycatcher	<i>Empidonax oberholseri</i>		X		X
Western Flycatcher (unidentified)	<i>Empidonax difficilis/occidentalis</i>		X		X
Black Phoebe	<i>Sayornis nigricans</i>		X	X	X
Say's Phoebe	<i>Sayornis saya</i>		X	X	X
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	A; B		X	
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>		X		X
Brown-crested Flycatcher	<i>Myiarchus tyrannulus</i>		X		
Western Kingbird	<i>Tyrannus verticalis</i>		X		X
Eastern Kingbird	<i>Tyrannus tyrannus</i>		X		
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>				X
Loggerhead Shrike	<i>Lanius ludovicianus</i>	D	X	X	X
Bell's Vireo	<i>Vireo bellii</i>	A; B; C	X		X
Plumbeous Vireo	<i>Vireo plumbeus</i>		X		
Cassin's Vireo	<i>Vireo cassinii</i>		X		
Warbling Vireo	<i>Vireo gilvus</i>		X	X	X
Common Raven	<i>Corvus corax</i>		X	X	X
Horned Lark	<i>Eremophila alpestris</i>	D	X	X	X
Tree Swallow	<i>Tachycineta bicolor</i>		X	X	*
Violet-green Swallow	<i>Tachycineta thalassina</i>		X	*	X
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>		X	*	X
Bank Swallow	<i>Riparia riparia</i>		*		
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>		X	X	X
Barn Swallow	<i>Hirundo rustica</i>		X	X	X
Verdin	<i>Auriparus flaviceps</i>		X	X	X

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Bushtit	<i>Psaltirparus minimus</i>		X	X	X
Red-breasted Nuthatch	<i>Sitta canadensis</i>			X	X
Brown Creeper	<i>Certhia americana</i>			X	
Rock Wren	<i>Salpinctes obsoletus</i>		X	X	X
Canyon Wren	<i>Catherpes mexicanus</i>		X	X	X
House Wren	<i>Troglodytes aedon</i>		X	X	X
Pacific Wren	<i>Troglodytes pacificus</i>			X	X
Marsh Wren	<i>Cistothorus palustris</i>		X	X	X
Bewick's Wren	<i>Thryomanes bewickii</i>		X	X	X
Cactus Wren	<i>Campylorhynchus brunneicapillus</i>			*	X
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>		X	X	X
Black-tailed Gnatcatcher	<i>Poliophtila melanura</i>		X	X	X
Golden-crowned Kinglet	<i>Regulus satrapa</i>			X	X
Ruby-crowned Kinglet	<i>Regulus calendula</i>		X	X	X
Western Bluebird	<i>Sialia mexicana</i>			X	
Mountain Bluebird	<i>Sialia currucoides</i>			X	
Hermit Thrush	<i>Catharus guttatus</i>		X	X	X
American Robin	<i>Turdus migratorius</i>		X	X	X
Crissal Thrasher	<i>Toxostoma crissale</i>		X	X	X
Northern Mockingbird	<i>Mimus polyglottos</i>		X	X	X
European Starling	<i>Sturnus vulgaris</i>		X	*	X
American Pipit	<i>Anthus rubescens</i>		X	X	X
Cedar Waxwing	<i>Bombycilla cedrorum</i>		*	X	X
Phainopepla	<i>Phainopepla nitens</i>	A	X	X	X
Ovenbird	<i>Seiurus aurocapilla</i>			X	
Black-and-white Warbler	<i>Mniotilta varia</i>				X
Orange-crowned Warbler	<i>Oreothlypis celata</i>		X	X	X
Lucy's Warbler	<i>Oreothlypis luciae</i>	C	X		X
Nashville Warbler	<i>Oreothlypis ruficapilla</i>		X	X	X
Virginia's Warbler	<i>Oreothlypis virginiae</i>	C; D; E			X
MacGillivray's Warbler	<i>Geothlypis tolmiei</i>		X	X	X
Common Yellowthroat	<i>Geothlypis trichas</i>		X	X	X
Hooded Warbler	<i>Setophaga citrina</i>		*		
Yellow Warbler	<i>Setophaga petechia</i>	B	X	X	X
Blackpoll Warbler	<i>Setophaga striata</i>			X	
Yellow-rumped Warbler	<i>Setophaga coronata</i>		X	X	X
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>		X	X	X

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Townsend's Warbler	<i>Setophaga townsendi</i>		X		X
Wilson's Warbler	<i>Cardellina pusilla</i>		X	X	X
Yellow-breasted Chat	<i>Icteria virens</i>		X	X	X
Green-tailed Towhee	<i>Pipilo chlorurus</i>	C	X		X
Spotted Towhee	<i>Pipilo maculatus</i>		X	X	X
Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>		X		
Canyon Towhee	<i>Pipilo fusca</i>		X		
Abert's Towhee	<i>Melospiza aberti</i>	C	X	X	X
Chipping Sparrow	<i>Spizella passerina</i>		X	X	X
Brewer's Sparrow	<i>Spizella breweri</i>	C	X	X	X
Vesper Sparrow	<i>Poocetes gramineus</i>		X		X
Lark Sparrow	<i>Chondestes grammacus</i>		X		X
Black-throated Sparrow	<i>Amphispiza bilineata</i>		X	*	*
Sagebrush Sparrow	<i>Artemisospiza nevadensis</i>	C	*	X	
Savannah Sparrow	<i>Passerculus sandwichensis</i>		X	X	X
Fox Sparrow	<i>Passerella iliaca</i>			X	
Song Sparrow	<i>Melospiza melodia</i>		X	X	X
Lincoln's Sparrow	<i>Melospiza lincolnii</i>		X	X	X
Swamp Sparrow	<i>Melospiza georgiana</i>			X	
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>		X	X	X
Dark-eyed Junco	<i>Junco hyemalis</i>		X	X	X
Summer Tanager	<i>Piranga rubra</i>	A; B			X
Western Tanager	<i>Piranga ludoviciana</i>		X		X
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>		X		X
Blue Grosbeak	<i>Passerina caerulea</i>	A	X	X	X
Lazuli Bunting	<i>Passerina amoena</i>		X	*	X
Indigo Bunting	<i>Passerina cyanea</i>		X		X
Red-winged Blackbird	<i>Agelaius phoeniceus</i>		X	X	X
Western Meadowlark	<i>Sturnella neglecta</i>		X	X	X
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>		X	X	X
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	D	X	X	*
Great-tailed Grackle	<i>Quiscalus mexicanus</i>		X	X	X
Brown-headed Cowbird	<i>Molothrus ater</i>		X	X	X
Bullock's Oriole	<i>Icterus bullockii</i>		X	X	X
Hooded Oriole	<i>Icterus cucullatus</i>		X	*	
House Finch	<i>Haemorhous mexicanus</i>		X	X	X
Red Crossbill	<i>Loxia curvirostra</i>			X	

Common Name	Scientific Name	Conservation Status	Breeding Season	Non-Breeding Season	Transitional
Pine Siskin	<i>Spinus pinus</i>	D	X	X	*
Lesser Goldfinch	<i>Spinus psaltria</i>		X	X	X
American Goldfinch	<i>Spinus tristis</i>		X	X	
House Sparrow	<i>Passer domesticus</i>		X	X	*
Species Richness	220	53	190	163	175
Conservation Priority Species Richness	53	53	45	36	40

Table 3. Average bird species richness along the Las Vegas Wash, by season and year, with numbers of weirs and revegetated acres.

Year	Breeding	Fall Transition	Non-Breeding	Winter Transition	COMBINED (avg # species/survey)	# Weirs	# Acres Reveg
Year 1	34.0	34.0	31.7	26.3	32.3	9	75
Year 2	32.9	40.0	30.3	32.7	32.5	10	135
Year 3	35.3	34.5	35.2	29.0	34.5	10	175
Year 4	33.8	39.5	31.2	39.3	34.0	11	195
Year 5	34.8	44.5	34.0	31.3	34.8	12	260
Year 6	33.1	45.5	33.9	30.7	34.2	12	280
Year 10	46.2	41.5	43.9	44.7	44.8	19	440
Year 11	45.9	47.5	48.1	50.0	47.3	19	470
Year 12	44.9	50.0	46.2	47.3	46.0	19	510
Year 13	41.8	54.7	51.0	45.7	46.5	21	505
COMBINED	38.3	43.2	38.6	37.7	38.7	14.2	304.5

Table 4. Average total bird abundance along the Las Vegas Wash, by season and year, with numbers of weirs and revegetated acres.

Year	Breeding	Fall Transition	Non-Breeding	Winter Transition	COMBINED (avg # birds per 40 ha/survey)	# Weirs	# Acres Reveg
Year 1	134.9	106.7	131.1	78.5	124.9	9	75
Year 2	132.3	123.8	126.2	114.7	127.5	10	135
Year 3	127.0	91.4	157.2	146.9	137.0	10	175
Year 4	143.8	109.3	151.9	156.3	145.4	11	195
Year 5	148.1	217.5	173.4	137.9	161.0	12	260
Year 6	131.3	141.7	192.1	121.4	152.0	12	280
Year 10	171.0	203.7	292.1	341.9	235.1	19	440
Year 11	193.2	167.4	302.7	452.9	259.1	19	470
Year 12	209.0	150.1	367.2	351.0	275.6	19	510
Year 13	156.7	198.3	386.4	291.7	247.8	21	505
COMBINED	154.7	151.0	228.0	219.3	186.5	14.2	304.5

Table 5. Estimated species-specific densities (birds per 40 ha) for survey visits overall, among seasons from the full dataset (2005-2018), and overall values by survey year. Species are in descending order of overall abundance. Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight). An “X” indicates the species was recorded, but not within 100 m of a point; no entry means that the species was not detected.

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
American Coot	20.4	7.4	35.1	2.2	8.7	10.1	5.4	4.8	3.7	34.8	43.1	45.1	45.6
Red-winged Blackbird	11.0	15.5	8.2	7.0	7.4	9.7	9.9	12.3	6.9	15.6	17.3	14.3	10.0
Abert's Towhee (C)	10.7	10.9	9.8	15.6	14.3	10.2	10.8	11.5	10.9	8.6	8.1	8.9	7.7
Yellow-rumped Warbler	10.6	1.5	24.9	6.2	3.2	11.5	10.7	13.7	14.4	13.3	8.6	10.1	13.8
Mallard	10.3	4.4	16.4	1.0	2.1	4.6	4.0	8.4	6.3	18.0	24.5	18.4	15.7
Gadwall	9.5	2.5	15.2	0.7	1.1	1.6	1.5	2.0	2.5	12.9	20.8	30.9	20.9
Song Sparrow	8.5	10.3	6.8	12.2	12.8	10.5	9.4	7.7	9.2	5.9	6.4	6.7	4.7
Marsh Wren	7.4	4.7	9.8	4.5	5.5	7.5	9.9	9.2	9.0	7.6	7.3	6.8	6.6
American Wigeon	7.2	2.7	12.4	X	0.1	0.2	0.2	0.3	0.7	11.2	21.5	22.2	15.5
White-crowned Sparrow	6.7	0.9	15.4	4.2	4.3	5.5	5.8	8.3	8.7	6.7	5.7	7.6	9.9
Great-tailed Grackle	5.5	8.4	2.7	0.7	1.5	3.7	4.1	4.3	3.3	7.8	10.7	10.8	8.3
Verdin	5.4	6.0	4.5	3.5	4.5	3.9	4.9	5.6	5.4	5.9	5.5	6.7	8.0
Bewick's Wren	5.4	5.4	4.7	7.4	8.0	4.9	6.8	6.7	5.4	4.6	4.0	3.3	2.7
Black-tailed Gnatcatcher	5.0	5.3	4.6	4.6	5.4	3.3	4.3	5.5	5.3	5.8	5.3	5.3	5.3
American Pipit	4.9	0.9	9.9	1.3	2.7	2.1	5.8	6.0	4.9	11.4	3.5	4.7	6.4
Common Yellowthroat	4.9	9.5	0.2	4.1	4.6	4.6	6.0	4.8	4.5	4.9	5.4	6.3	3.4
Gambel's Quail (C)	4.7	5.6	4.0	1.7	1.1	1.0	1.7	3.3	8.6	6.3	5.7	8.1	9.4
Black Phoebe	3.9	2.3	5.2	3.9	4.4	3.4	3.8	3.7	3.8	4.9	3.9	4.0	3.1
Ruby-crowned Kinglet	2.8	0.5	5.7	4.7	4.2	3.4	2.2	2.3	2.4	2.3	2.0	1.8	2.6
Brown-headed Cowbird	2.7	5.9	0.0	3.3	3.8	3.6	4.4	3.1	3.0	2.1	1.6	1.6	0.9
Orange-crowned Warbler	2.3	0.4	3.9	1.7	1.1	1.8	2.0	1.7	2.7	1.2	3.0	4.2	3.6
Lucy's Warbler (C)	2.2	4.7		5.0	3.2	2.5	2.9	1.8	1.6	1.2	1.3	1.5	0.9
Mourning Dove	2.0	3.8	0.2	5.1	1.8	1.7	1.4	2.2	2.1	1.2	0.7	1.3	2.8
Yellow-breasted Chat	1.8	3.9	0.0	3.2	2.9	2.2	3.4	1.1	1.5	1.0	1.5	0.8	0.8
House Finch	1.8	1.3	2.5	0.9	1.3	1.4	1.3	4.0	2.8	0.9	2.4	1.4	1.5
Yellow Warbler (B)	1.7	3.4	0.0	1.0	1.0	1.3	2.7	2.4	2.2	1.1	1.7	1.8	1.7

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
Crissal Thrasher	1.7	1.4	1.9	1.9	1.4	0.8	1.2	1.8	1.9	1.6	2.0	2.3	1.9
Blue Grosbeak (A)	1.4	2.8	0.0	2.3	1.7	1.6	1.7	1.0	1.0	0.9	1.2	1.6	0.9
Killdeer	1.1	1.3	0.8	1.7	0.9	0.3	0.8	0.9	0.3	2.1	1.3	0.7	1.5
Yellow-headed Blackbird	1.0	1.1	0.0	0.9	0.3	0.0	0.3	0.3	0.1	5.4	1.7	0.7	0.4
Say's Phoebe	1.0	0.7	1.3	0.5	0.6	0.3	1.0	1.7	1.1	0.8	1.1	1.1	1.3
Greater Roadrunner	0.9	1.2	0.5	0.7	0.6	0.6	0.6	0.5	0.6	1.0	1.4	2.0	1.3
Great Blue Heron	0.8	0.6	1.0	0.2	0.3	0.3	0.2	0.7	0.4	1.4	1.7	1.8	1.5
Northern Flicker	0.7	0.0	1.6	0.4	0.5	0.9	0.9	0.6	0.7	1.0	0.9	0.8	0.8
Lesser Goldfinch	0.7	0.4	0.7	0.4	0.7	0.3	0.6	1.1	2.8	0.3	0.4	0.2	0.2
Brewer's Sparrow (C)	0.7	0.5	0.1	0.3	0.5	1.0	1.0	2.0	0.9	0.2	0.4	0.2	0.2
Eared Grebe (C)	0.6	1.3	0.0	0.0		0.2		0.1	X	0.0	2.0	3.3	0.3
Double-crested Cormorant	0.6	0.3	0.9	0.0	0.1	0.6	0.2	0.1	0.0	0.7	0.6	2.2	1.4
Western Kingbird	0.6	1.1		0.2	0.3	0.6	0.4	0.5	0.4	1.1	0.6	1.2	0.3
Wilson's Warbler	0.6	1.1	0.0	1.1	0.8	0.6	0.5	0.5	0.2	1.0	0.1	0.2	0.7
Dark-eyed Junco	0.5	0.0	1.2	0.1	0.2	1.6	0.9	0.9	0.4	0.3	0.4	0.1	0.3
Anna's Hummingbird	0.5	0.6	0.4	0.1	0.0	0.0	0.0	0.1	0.0	0.6	1.0	1.5	1.8
Northern Pintail (C)	0.5	X	1.3	X	0.0		X	X	0.1	1.6	1.5	1.5	0.6
Lincoln's Sparrow	0.5	0.2	0.8	0.8	0.2	0.5	0.3	0.3	0.3	0.3	0.4	0.6	0.8
Spotted Sandpiper	0.4	0.5	0.3	0.3	0.6	0.1	0.3	0.6	0.2	0.8	0.6	0.5	0.3
Northern Mockingbird	0.4	0.5	0.4	0.0	0.2	0.2	0.1	0.2	0.2	0.5	1.1	1.2	0.6
Ring-billed Gull	0.4	0.2	0.7	X	0.6	1.2	X	0.0	X	0.1	0.9	0.0	1.2
Canada Goose	0.4	0.3	0.2		X	0.2		0.0	0.1	0.5	0.5	1.8	0.8
Least Sandpiper (C)	0.4	0.3	0.7					1.1	0.4	1.5	0.1	0.0	0.7
Loggerhead Shrike (D)	0.4	0.3	0.4	0.4	0.2	0.1	0.2	0.6	0.2	0.5	0.6	0.5	0.4
Black-chinned Hummingbird	0.4	0.7	0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5
Northern Shoveler	0.3	0.0	0.6	0.1	0.0			0.0	X	0.4	1.5	1.4	0.0
Bufflehead	0.3	0.0	0.7			0.2	0.3	0.0	0.1	0.7	1.1	0.4	0.6
Savannah Sparrow	0.3	0.2	0.4	0.1		0.3	0.5	0.3	0.3	0.2	0.5	0.6	0.4
Northern Rough-winged Swallow	0.3	0.6	X	0.2	0.2	0.2	1.0	0.4	0.1	0.1	0.4	0.3	0.2
Common Gallinule	0.3	0.3	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.5	0.4	0.6	0.6

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
Bushtit	0.3	0.0	0.6	0.6	0.4	0.2	0.0	1.2	0.5				
Pied-billed Grebe	0.3	0.2	0.4	0.1	0.1	0.5	0.2	0.1	0.1	0.1	0.5	0.8	0.5
Green-winged Teal	0.3	0.1	0.4		0.1	0.3	0.1	0.1	0.1	0.5	0.7	0.2	0.7
Green Heron	0.3	0.5	0.1	0.3	0.5	0.3	0.3	0.2	0.2	0.4	0.1	0.3	0.2
White-faced Ibis (C)	0.3	0.5	0.1	0.1	0.2	X	0.0	0.0	0.0	0.4	0.2	0.5	1.4
Greater Yellowlegs	0.3	0.1	0.4	0.3	0.3	0.1	0.2	0.2	0.3	0.5	0.6	0.1	0.3
Belted Kingfisher	0.2	0.1	0.4	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.4	0.3	0.2
Western Meadowlark	0.2	0.0	0.4	X	0.0		0.0	0.1	0.1	0.2	0.3	1.1	0.3
Blue-gray Gnatcatcher	0.2	0.2	0.1	0.4	0.5	0.2	0.6	0.1	0.1	0.2		0.0	0.1
Cooper's Hawk	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.4	0.4	0.5
White-winged Dove	0.2	0.4	0.0	0.3	0.2	0.3	0.3	0.4	0.2	0.2	0.0	X	X
Snowy Egret (C)	0.2	0.2	0.2	0.2	0.0	0.3	0.0	0.1	0.1	0.3	0.3	0.4	0.2
Common Merganser	0.2	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.4	0.6	0.2
Bullock's Oriole	0.2	0.3	0.0	0.0	0.1	0.1		0.1	0.2	0.2	0.4	0.4	0.2
Cinnamon Teal (C)	0.2	0.2	0.0	0.1	X	X	0.0	0.2		0.3	0.5	0.1	0.4
Black-crowned Night-Heron	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.1	0.4	0.4
Chipping Sparrow	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.7	0.1	X	0.0	0.1	0.1
Lesser Scaup (C)	0.1	0.0	0.2							0.2	0.0	0.5	0.7
Costa's Hummingbird (C)	0.1	0.2	0.0	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1
Barn Swallow	0.1	0.3	0.0	X	X	1.2	0.1	X	X	X	X	X	0.0
Rock Wren	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.3	0.3	0.0	0.1	0.0	0.0
Western Wood-Pewee	0.1	0.2		0.1	0.1	0.1	0.2	0.0	0.2	0.3	0.1	0.1	0.2
Sora	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.4	0.3
Great Egret	0.1	0.1	0.2	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.3	0.1
Osprey	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.2
Ring-necked Duck	0.1	X	0.2				X	X		0.1	0.4	0.1	0.5
Spotted Towhee	0.1	0.0	0.2	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.0		0.1
Phainopepla (A)	0.1	0.0	0.3	0.2	0.2	0.1	0.2	0.1	0.1	0.0	0.1	X	0.1
Red-tailed Hawk	0.1	0.0	0.2	0.1	0.0	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.1
Brewer's Blackbird (D)	0.1	0.0	0.3		X		0.4	0.1	0.4				0.0

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
American Kestrel	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.2
Warbling Vireo	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.2	0.0	0.1	0.2	0.1	0.1
Lazuli Bunting	0.1	0.1	X	0.1	0.1	0.0	0.2	0.0	X	0.0	0.0	0.0	0.4
Virginia Rail	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.1
Cliff Swallow	0.1	0.2	0.0	X	X	0.1	0.7	0.1	X	X	X	X	X
Indigo Bunting	0.1	0.2						0.1	0.1	0.1	0.2	0.3	0.1
Northern Harrier	0.1	0.0	0.2	0.0	0.1	0.3	0.1	0.0	X	0.0	0.1	0.1	0.1
American Avocet (C)	0.1	0.1	0.0	0.2				0.0	X	0.3	0.0	0.0	0.3
Sharp-shinned Hawk	0.1	0.0	0.2	0.2	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Horned Lark (D)	0.1	0.1	0.1	0.1		0.3	0.3	0.0	0.0	0.1		X	X
Hooded Merganser	0.1	0.0	0.1							0.0	0.3	0.2	0.3
Western Sandpiper (C)	0.1	0.2	0.0	0.4	0.0			0.2	0.1	0.1			X
Pine Siskin (D)	0.1	0.0	0.2	0.1		0.3			0.2		0.2		
House Wren	0.1	0.0	0.1	0.0	0.0			0.0		0.0	0.1	0.2	0.3
American White Pelican (C)	0.1	0.1	0.1				0.0	X	0.0	0.3	0.3	0.0	X
Western Tanager	0.1	0.1		0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2
Bell's Vireo (ABC)	0.1	0.1		0.2		0.1			0.1	0.1	0.2	0.0	0.0
Ladder-backed Woodpecker	0.1	0.0	0.1	0.0			0.0	0.0	0.2	0.1	0.1	0.1	0.0
Common Goldeneye	0.1	0.0	0.0			0.0	0.1	0.0	X	0.0	0.1	0.1	0.1
Long-billed Dowitcher (C)	0.1	0.1	0.0		0.1					0.1	0.1	0.2	0.1
Black-headed Grosbeak	0.1	0.1		0.1	0.1	0.0		0.0	0.1	0.0	0.0	0.0	0.1
American Robin	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0
Red-shouldered Hawk	0.0	0.0	0.1					X	0.0	0.0	0.1	0.2	0.2
Black-necked Stilt (C)	0.0	0.1		0.1	X			0.1	X	0.1	0.0	0.0	0.2
Hermit Thrush	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0		0.0	0.0		0.0
Ash-throated Flycatcher	0.0	0.1		0.1	0.0	0.1	0.0	X	0.1	0.1	0.0	0.1	
Great Horned Owl	0.0	0.0	0.0		0.0	0.0		0.1	0.1	0.0	0.1	0.0	0.1
Least Bittern (BC)	0.0	0.1	0.0	0.0	0.0	0.1	0.1	X	0.0	0.1	0.0	0.0	0.0
Lark Sparrow	0.0	0.1				0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1
Nashville Warbler	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
Common Raven	0.0	0.0	0.0	X	X	0.1	X	0.0	X	0.1	X	0.1	0.0
Western Flycatcher (Unidentified)	0.0	0.1		0.0	0.1	0.1	0.0		X	0.1		0.0	0.0
Neotropic Cormorant	0.0	0.0								0.0	0.2	X	0.0
Dusky Flycatcher	0.0	0.0		0.0	0.0	0.1		0.0		0.0			
Eurasian Collared-Dove	0.0	0.0	0.0					0.0	X	0.0	0.0	0.1	0.0
Gray Flycatcher (C)	0.0	0.0	0.0	0.0		0.1		0.0	0.0		0.0	0.0	
MacGillivray's Warbler	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.1	
Golden-crowned Kinglet	0.0		0.1	0.0		0.1	0.0	0.0	0.0				
Ruddy Duck	0.0	X	0.0						X	0.2	0.0		
Pacific Wren	0.0		0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0
Townsend's Warbler	0.0	0.0							0.1	0.1			0.0
Red-naped Sapsucker	0.0	0.0	0.0	0.0	0.1	0.0				0.0	0.0		0.0
Hooded Oriole	0.0	0.0	X			0.0						0.0	0.1
Horned Grebe	0.0	0.0	0.0							0.0	0.1	0.0	
Barn Owl	0.0	0.0	0.0	0.1	0.0	0.0		0.0		X		X	0.0
Cedar Waxwing	0.0	X	0.0	0.1	0.0			X					0.1
Lesser Nighthawk	0.0	0.0		X	0.0	X	X	0.0	X	0.0	0.0	0.1	X
Red-breasted Nuthatch	0.0		0.0			0.0	0.0			0.0	0.0		0.0
Wilson's Snipe	0.0	0.0	0.0					0.0	X	0.0	0.0		0.0
Black-throated Sparrow	0.0	0.0	X		0.0				0.1				
Olive-sided Flycatcher (CDE)	0.0	0.0		0.0		0.0			0.0	0.0	0.0	0.0	
Black-throated Gray Warbler	0.0	0.0	0.0					0.0				0.0	0.1
Solitary Vireo (Unidentified)	0.0	0.0		X	0.0	0.0	0.1						
Western Grebe (C)	0.0	0.0	0.0	X		0.0				0.0	0.0	X	
Vesper Sparrow	0.0	0.0						0.0	0.0	0.0			X
American Goldfinch	0.0	0.0	0.0					0.0		0.0			0.0
Lesser Yellowlegs	0.0	0.0	X					0.0		0.0	X		0.0
Violet-green Swallow	0.0	0.0	X		X	0.0	0.0	0.0	X	X	X		X
Plumbeous Vireo	0.0	0.0					0.0			0.0	0.0		0.0
Dunlin	0.0	0.0								0.1			

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
Tree Swallow	0.0	0.0	0.0			0.0	0.0	X	X	X	X	X	X
Semipalmated Sandpiper	0.0	0.0			0.1								
Canyon Wren	0.0	0.0	0.0	0.0	0.0	X	X			X			0.0
Green-tailed Towhee (C)	0.0	0.0					0.0	0.0				0.0	0.0
Sagebrush Sparrow (C)	0.0	X	0.0								0.0	0.0	
Willow Flycatcher (ABC)	0.0	0.0					0.0		0.0				
Western Bluebird	0.0		0.0	0.1	X			X					
Brown-crested Flycatcher	0.0	0.0		0.0				X					0.0
Merlin	0.0		0.0		0.0			0.0	X		0.0		X
Eastern Kingbird	0.0	0.0							0.0		0.0	0.0	
Wood Duck	0.0		0.0				0.0			X		X	0.0
Peregrine Falcon (C)	0.0	0.0	0.0	X	X	X	0.0	0.0	X	X	X	X	0.0
Redhead (C)	0.0	X	X				0.0		X	0.0	X	X	X
Rock Pigeon	0.0	X	0.0	X	X	0.0	0.0	X	X			X	X
Greater White-fronted Goose	0.0		0.0						X			0.0	
Swamp Sparrow	0.0		0.0										0.0
American Bittern	0.0	0.0			0.0			0.0				X	
House Sparrow	0.0	0.0	0.0	0.0		X				0.0			
Brown Creeper	0.0		0.0							0.0			0.0
Rufous Hummingbird (CE)	0.0	0.0						X	0.0				
Solitary Sandpiper	0.0	0.0											0.0
Black-and-white Warbler	0.0											0.0	X
Cactus Wren	0.0		X					X			0.0		
Caspian Tern	0.0	0.0	X				X			X	X		0.0
European Starling	0.0	0.0	X				X	X	0.0		0.0		
Turkey Vulture	0.0	0.0	X	X	X	X	0.0	X	X	X	X	0.0	X
Semipalmated Plover	0.0	0.0		0.0									
Canyon Towhee	0.0	0.0			0.0								
Fox Sparrow	0.0		0.0										0.0
Hairy Woodpecker	0.0		0.0		0.0								

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
Bonaparte's Gull	0.0	0.0								X	X		0.0
Cassin's Vireo	0.0	0.0											0.0
Sandhill Crane (C)	0.0	0.0	X						X		X		0.0
Swainson's Hawk (C)	0.0	0.0				X			X		X	X	0.0
Vermilion Flycatcher (AB)	0.0		0.0										0.0
Blackpoll Warbler	0.0		0.0								0.0		
Blue-winged Teal	0.0	X	0.0	X						X	0.0		X
Broad-tailed Hummingbird	0.0								0.0				
Cattle Egret	0.0	X								X	0.0		
Hammond's Flycatcher	0.0	0.0								0.0			
Mountain Bluebird	0.0		0.0				0.0						
Ovenbird	0.0		0.0						0.0				
Pectoral Sandpiper	0.0							0.0					
Prairie Falcon (C)	0.0	X	0.0	X	X			0.0	X	X	X	X	X
Red Crossbill	0.0		0.0								0.0		
Ross's Goose	0.0		0.0					X				0.0	
Rufous-crowned Sparrow	0.0	0.0				0.0							
Scissor-tailed Flycatcher	0.0								0.0				
Snow Goose	0.0	X	X	X				X	X		0.0		X
Summer Tanager (AB)	0.0			X						0.0			
Virginia's Warbler (CDE)	0.0					0.0							
Willet (C)	0.0	0.0								X	0.0		
Bank Swallow	X	X						X			X		
California Gull	X	X	X					X	X	X		X	X
Canvasback (C)	X		X								X		
Clark's Grebe (C)	X	X	X				X			X	X		
Common Nighthawk (D)	X												X
Forster's Tern	X	X									X		
Franklin's Gull (C)	X	X									X		
Graylag Goose	X	X	X					X	X	X			

Species (Conservation Status)	Overall	Breeding	Non-Breeding	Year1	Year2	Year3	Year4	Year5	Year6	Year10	Year11	Year12	Year13
Hooded Warbler	X	X								X			
Lesser Black-backed Gull	X	X								X			
Long-billed Curlew (C)	X	X									X	X	
Long-eared Owl (E)	X	X		X									
Marbled Godwit (C)	X										X		
Northern Goshawk (C)	X		X						X				
Short-billed Dowitcher	X	X											X
Snow Goose (x Domestic Goose?)	X		X										X
Stilt Sandpiper	X											X	
Tundra Swan (C)	X		X									X	
Vaux's Swift	X	X	X			X		X					X
Whimbrel	X	X								X			
White Ibis	X	X										X	
White-tailed Kite	X	X								X			
White-throated Swift (C)	X	X	X	X	X	X	X	X	X	X	X	X	X
Wilson's Phalarope (C)	X	X									X		X

Table 6. Breeding and non-breeding abundances (birds per 40 ha) by species for each of ten survey years (2005-2018). Species listed are in descending order of overall abundance. Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight). An “X” indicates the species was recorded, but not within 100 m of a point; no entry means that the species was not detected.

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
American Coot	1.2	1.4	5.5	3.3	1.3	1.1	10.5	17.5	20.4	12.3	4.5	16.8	9.6	6.0	7.7	6.7	61.1	58.6	82.9	97.1
Red-winged Blackbird	5.3	8.7	11.7	15.1	15.6	14.1	25.4	24.0	23.6	11.8	12.9	8.8	11.1	4.4	8.2	0.6	4.4	14.4	5.9	11.3
Abert's Towhee (C)	17.4	15.8	9.9	11.1	11.0	10.8	7.8	7.5	9.6	7.7	13.1	12.6	10.5	9.3	11.1	9.9	8.8	8.9	8.0	5.7
Yellow-rumped Warbler	0.3	1.1	1.7	0.7	0.9	0.4	1.2	1.7	3.1	3.8	16.8	6.1	25.3	27.1	32.3	39.6	32.0	19.0	21.0	29.9
Mallard	0.5	0.4	2.0	2.4	4.8	3.1	6.8	11.5	7.6	5.1	1.3	5.2	6.6	4.8	11.3	11.1	31.4	33.5	30.3	28.4
Gadwall	0.1	0.0	0.3	0.5	0.7	0.2	0.7	5.4	9.8	7.0	1.7	2.5	2.1	1.7	2.7	4.6	18.6	29.3	51.5	37.3
Song Sparrow	14.2	15.2	12.1	12.0	9.1	10.9	7.9	7.9	9.1	4.2	10.2	9.7	9.5	5.9	6.8	7.7	2.9	5.2	4.7	5.4
Marsh Wren	2.0	2.9	4.7	8.2	7.6	6.9	4.1	3.4	3.5	3.6	7.1	7.6	9.7	11.0	10.5	11.2	9.9	10.5	10.2	10.2
American Wigeon		X	0.1	0.3	X	X	2.5	12.0	7.0	5.2	X	X	0.3	0.1	0.3	0.6	17.5	23.9	44.1	37.4
White-crowned Sparrow	0.6	1.4	0.3	0.2	0.6	0.7	0.8	1.2	1.2	2.3	10.4	6.5	13.5	15.0	19.2	21.2	15.7	13.7	17.2	21.7
Great-tailed Grackle	0.6	2.0	5.2	5.9	7.2	4.4	13.4	17.0	16.9	11.0	1.2	1.2	2.6	2.8	1.2	2.9	2.8	3.2	3.7	5.8
Verdin	3.9	5.9	4.3	5.0	6.0	5.6	6.2	5.8	8.0	9.6	3.0	2.3	3.8	4.7	5.5	4.6	5.8	4.9	5.1	5.6
Bewick's Wren	7.1	9.0	4.8	7.0	6.6	3.8	4.6	5.0	3.9	2.5	6.8	6.1	4.7	7.0	5.0	6.9	3.5	2.5	2.2	2.5
Black-tailed Gnatcatcher	5.0	6.8	3.2	4.2	5.2	4.8	6.2	5.2	5.9	6.1	3.6	4.6	3.1	4.4	5.7	5.4	4.6	5.5	4.5	4.4
American Pipit	X	0.1	0.4	X	3.8	0.4	1.1	0.3	0.1	2.5	3.8	6.7	3.6	13.0	8.7	12.3	20.5	9.1	8.4	12.9
Common Yellowthroat	8.1	8.9	9.3	11.3	10.1	9.0	9.4	10.5	12.2	6.2	0.0		0.0	0.2		0.1	0.5	0.3	0.4	0.1
Gambel's Quail (C)	3.2	1.8	1.5	1.7	4.6	9.6	6.2	7.4	10.8	8.9	0.6	0.7	0.6	1.8	1.6	8.9	6.5	4.0	5.1	10.3
Black Phoebe	2.3	2.7	2.1	2.3	2.3	2.0	3.4	2.1	2.0	2.2	4.9	5.6	4.3	5.9	4.2	5.6	5.7	5.4	6.3	3.8
Ruby-crowned Kinglet	0.8	0.8	0.5	0.4	0.2	0.1	0.4	0.3	0.6	0.4	10.1	7.7	7.4	4.1	5.4	4.8	3.9	4.4	3.4	5.8
Brown-headed Cowbird	7.2	8.2	7.8	9.5	6.7	6.4	4.4	3.6	3.4	1.8		X		0.0			0.0			
Orange-crowned Warbler	0.4	0.4	0.4	0.1	0.3	0.4	0.2	0.3	0.8	0.7	2.9	2.0	3.1	4.0	2.6	4.5	1.4	4.9	8.0	6.1
Lucy's Warbler (C)	10.8	7.0	5.2	6.2	3.9	3.5	2.4	2.8	3.2	2.0										
Mourning Dove	10.5	3.5	3.1	2.8	4.3	4.5	2.3	1.2	2.8	3.1	0.3	X	0.3	0.1	0.2	X	0.4	0.3	0.0	0.1
Yellow-breasted Chat	6.8	6.1	4.6	6.9	2.4	3.2	2.1	3.3	1.7	1.6			0.0							
House Finch	1.3	1.1	0.9	1.1	4.3	1.6	0.7	0.6	0.7	0.8	0.3	1.9	2.6	1.9	1.2	4.1	1.6	5.5	2.9	2.6

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Yellow Warbler (B)	2.3	2.0	2.8	5.6	4.8	4.6	2.1	3.3	3.2	3.3							0.1		0.0	
Crissal Thrasher	1.5	1.7	0.5	1.0	1.7	1.4	1.8	1.5	2.2	1.0	2.4	0.9	1.0	1.5	2.0	2.2	1.3	2.4	2.6	2.7
Blue Grosbeak (A)	4.4	3.5	3.3	3.5	2.3	1.9	2.0	2.3	3.2	1.7						0.0				
Killdeer	2.3	1.0	0.4	0.4	1.6	0.5	2.2	1.4	0.8	2.0	1.1	0.4	0.2	1.0	0.2	0.1	2.0	1.2	0.6	1.3
Yellow-headed Blackbird	1.9	0.2	0.1	0.4	0.7	0.2	4.9	1.4	1.1	0.5	0.0			0.3	X			0.0	X	X
Say's Phoebe	0.4	0.7	0.5	1.1	1.2	0.7	0.9	0.4	0.4	0.9	0.6	0.5	0.2	1.2	2.3	1.1	1.0	1.9	1.9	2.1
Greater Roadrunner	0.9	1.0	1.0	0.7	0.7	0.9	1.7	1.6	2.4	1.5	0.4	0.1	0.2	0.4	0.2	0.1	0.4	0.9	1.4	1.1
Great Blue Heron	0.2	0.1	0.3	0.1	0.8	0.3	1.5	1.5	1.0	0.6	0.2	0.4	0.3	0.2	0.6	0.4	1.4	1.7	2.6	2.2
Northern Flicker	X		0.1	0.1		0.0	0.0	0.1	0.1	X	0.9	1.1	2.1	1.9	1.0	1.7	2.0	2.0	1.7	2.1
Lesser Goldfinch	0.1	0.4	0.2	0.1	0.5	1.8	0.3	0.1	0.2	0.1	0.2	0.1	0.2	0.8	0.6	3.6	0.3	0.3	0.4	0.1
Brewer's Sparrow (C)		0.7	1.7	0.3	0.6	1.2	0.2	0.0	0.1	0.4	0.3			0.5	0.4		0.0	0.3	X	
Eared Grebe (C)	0.0		0.5		0.1		X	4.4	7.1	0.7						X	0.1	X	0.1	
Double-crested Cormorant	0.0	0.1	0.2	0.1	0.2	0.0	0.5	0.5	0.8	0.2	X	0.1	1.3	0.1	0.1	X	0.3	0.9	3.5	2.7
Western Kingbird	0.4	0.7	1.2	0.8	0.9	0.5	2.3	1.0	2.5	0.4										
Wilson's Warbler	2.1	1.7	1.3	0.5	1.0	0.4	2.2	0.1	0.4	1.4	0.3							0.0		
Dark-eyed Junco	0.1			0.3			0.1				0.1	0.5	4.7	1.4	2.5	0.6	0.4	1.0	0.3	1.0
Anna's Hummingbird	0.2	0.1		0.1	0.1	0.0	0.7	1.2	1.9	1.9	0.0			0.0	0.1		0.3	0.6	1.0	1.7
Northern Pintail (C)							X		X		X			X	X	0.2	4.3	3.1	3.4	1.7
Lincoln's Sparrow	0.1	0.1	0.3	0.1	0.1	0.0	0.1	0.2	0.4	0.4	1.9	0.2	0.9	0.7	0.5	0.7	0.8	0.5	1.0	1.1
Spotted Sandpiper	0.4	0.9	0.1	0.5	0.7	0.2	1.0	0.8	0.5	0.0	0.2	0.2		0.1	0.2	0.2	0.5	0.5	0.5	0.6
Northern Mockingbird	0.1	0.3	0.2	0.0	0.2	0.2	0.8	1.2	1.1	0.7		0.2	0.0	0.1	0.3	0.2	0.4	0.8	1.4	0.3
Ring-billed Gull	X	X		X	X	X	0.0	X	X	1.5	X	1.8	3.1	X	0.1	X	0.2	1.0	0.0	0.8
Canada Goose			0.2		X	0.1	1.0	0.3	0.2	1.0			0.4		0.1	X	0.0	0.2	1.0	0.7
Least Sandpiper (C)					1.2	0.7	0.5	0.3	X	0.1					1.6	0.0	3.5	X	0.1	1.9
Loggerhead Shrike (D)	0.6	0.3	0.1	0.3	0.5	0.1	0.4	0.1	0.5	0.0	0.2	0.1	0.1	0.1	0.6	0.3	0.6	0.8	0.6	0.7
Black-chinned Hummingbird	0.3	0.7	0.7	0.5	0.7	0.6	0.6	1.0	1.0	0.9				0.0			0.1	0.0	0.0	
Northern Shoveler					0.1		0.1	0.1	0.1	X	0.2					X	0.6	1.6	4.0	0.1
Bufflehead			0.0				0.1	0.0	0.2				0.5	X	0.1	0.2	1.5	2.1	0.7	1.6
Savannah Sparrow	0.2		0.4	0.2	0.0	0.1	0.2	0.1	0.1	0.2			0.2	0.6	0.5	0.4	0.1	0.5	0.6	0.8
Northern Rough-winged Swallow	0.2	0.4	0.3	2.0	0.7	X	0.2	0.8	0.7	0.4	X			X	X	X	X	X	X	

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Common Gallinule	0.1	0.2	0.2	0.1	0.3	0.3	0.7	0.5	0.6	0.4	0.1	0.2		0.1	0.1	0.1	0.2	0.4	0.2	0.8
Bushtit	0.1					0.1					1.6	1.0	0.1		3.3					
Pied-billed Grebe		0.0	0.4	0.3	0.2	0.1	0.1	0.5	0.5	0.3	0.2	0.2	0.7	X	0.1	0.3	0.1	0.5	1.3	0.7
Green-winged Teal		0.0	X	0.1	X	0.1	0.2	0.2	0.0	0.2		0.3	0.3	0.1	0.2	0.1	0.3	1.2	0.4	0.8
Green Heron	0.5	0.8	0.4	0.5	0.4	0.4	0.9	0.3	0.4	0.4	0.1	0.2	0.1		0.0	0.1		X	0.1	X
White-faced Ibis (C)	0.1	0.5	X	0.0	0.0	0.1	0.7	0.2	0.6	2.9	X	X		X				X	0.5	0.1
Greater Yellowlegs	X	0.1		0.0	0.1	0.3	0.3	0.3	0.0	0.3	0.7	0.2	0.3	0.3	0.2	0.1	0.5	1.0	0.3	0.4
Belted Kingfisher	0.0	0.1	0.0	X	0.0	0.1	0.1	0.2	0.1	X	0.5	0.2	0.4	0.3	0.1	0.1	0.5	0.7	0.9	0.3
Western Meadowlark		0.0					0.1	X	0.1	X				0.0	0.3	0.1	0.2	0.8	1.8	0.7
Blue-gray Gnatcatcher	0.6	0.3	0.3	0.9					0.1	0.0	0.3			0.0	0.2	0.4	0.3			0.2
Cooper's Hawk	0.0		0.0	0.1	0.0	X	0.3	0.4	0.3	0.5	X	0.1	0.2	0.0	0.1	0.3	0.3	0.4	0.4	0.5
White-winged Dove	0.6	0.4	0.7	0.7	0.8	0.5	0.3	0.1	X	X	0.0									
Snowy Egret (C)	0.3	X	0.2	0.0	0.1	X	0.4	0.4	0.3	X	X	0.1	0.5	X	0.0	0.0	0.0	0.1	0.5	0.5
Common Merganser	0.1	X		0.0	X	X	0.2	0.2	0.5	X	X	0.0	0.1	0.0	X	0.0	0.2	0.5	0.6	0.2
Bullock's Oriole	0.0	0.3	0.2		0.1	0.2	0.4	0.7	0.8	0.4						0.0				
Cinnamon Teal (C)	0.2	X	X	0.1	0.1		0.1	1.0	0.2	0.6					0.1		0.3	X	X	
Black-crowned Night-Heron	0.1	0.1	0.0	0.0	X	0.0	0.2	0.1	0.3	0.1	X	0.2	0.1	0.0	X	0.3	0.3	0.1	0.4	0.8
Chipping Sparrow	0.1		0.2		1.0	0.2				0.1				0.1	0.5		X			
Lesser Scaup (C)							X	0.1	0.1	0.0							0.5	X	0.1	1.1
Costa's Hummingbird (C)	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.3			X	0.0		0.0	0.2	0.1	0.0	
Barn Swallow		X	2.6	X	X	X	X	X	X	0.1			X	X	X	X		X	X	0.1
Rock Wren	0.0	0.1	0.0	0.2	0.2	0.2	0.0	X			0.2	0.2	0.1	0.1	0.5	0.6	0.1	0.2	0.1	0.1
Western Wood-Pewee	0.1	0.1	0.1	0.2	0.0	0.4	0.5	0.1	0.1	0.3										
Sora		0.0	0.0	0.0		0.1	0.0	0.1	0.2	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.2	0.2	0.6	0.5
Great Egret	0.0	X	X	0.0	0.2	0.1	0.1	0.0	0.2	0.0	0.1	0.0	0.2	0.0	0.1	0.1	X	0.2	0.5	0.3
Osprey	X	0.1	0.0	X	0.1	0.0	0.2	0.3	0.2	X	X			0.0	X	X	0.5	0.1	0.1	0.3
Ring-necked Duck							X	X		X				X	X		0.1	0.6	0.3	1.4
Spotted Towhee	0.1		0.0	0.1		0.0				0.0	0.1	0.2	0.5	0.6	0.1	0.1	0.2	0.1		0.2
Phainopepla (A)						0.0	X		X	0.0	0.5	0.5	0.1	0.5	0.3	0.0	0.1	0.2	X	0.3
Red-tailed Hawk	X	0.0		0.0	X	X	0.1	X	X	X	0.2	X	0.2	0.1	0.1	0.4	0.4	0.2	0.3	0.5

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Brewer's Blackbird (D)					0.2					0.0		X		1.3	0.1	1.2				
American Kestrel	0.1	0.1	0.1		0.1	0.1	0.3	0.3	0.1	0.3	X	X		X	X	0.2	X	0.2	0.1	0.2
Warbling Vireo	0.2	0.1	0.1	0.1	0.3	0.1	0.2	0.0	0.1	0.1							X		0.1	
Lazuli Bunting	0.1	0.2	0.1	0.0	0.0	X	0.1	0.1	0.0	0.8		X								
Virginia Rail	0.0	0.0	0.0	0.0		0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	X	0.1	0.1	0.2
Cliff Swallow	X	X	0.2	1.5	0.0	X	X	X	X	X			X	X	0.0				X	
Indigo Bunting					0.2	0.1	0.2	0.5	0.6	0.2										
Northern Harrier		0.0	0.1	X	0.0	X	X	X	X	X	0.1	0.2	0.6	0.1	0.1	X	0.1	0.0	0.2	0.2
American Avocet (C)	0.4				0.1	X	0.3	X	X	0.6							0.0	X	X	
Sharp-shinned Hawk	X	X	X		0.0	X	X	X	X	X	0.4	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2
Horned Lark (D)	0.1		0.6	0.3	0.0		0.1		X				0.1	0.4		0.0				
Hooded Merganser							X	0.0	0.1	X							X	0.4	0.2	0.5
Western Sandpiper (C)	0.8				0.5	0.2	X			X						X	0.2			
Pine Siskin (D)	X							0.2			0.3		0.7			0.7		0.4		
House Wren		0.0					0.0		0.0		0.0				0.0		0.1	0.2	0.5	0.6
American White Pelican (C)				0.1		0.0	0.3	0.1								X	0.5	0.2	X	X
Western Tanager	0.1	0.0	0.1		0.1	0.1	0.0	0.1	0.0	0.4										
Bell's Vireo (ABC)	0.4		0.2			0.1	0.1	0.3	0.0	0.0										
Ladder-backed Woodpecker	0.0			0.0		0.1	0.1	X	0.1						0.1	0.3	0.1	0.3		0.1
Common Goldeneye							X	0.1	0.1	0.0			0.1		0.1	X	0.0	0.0	X	0.2
Long-billed Dowitcher (C)		0.1					0.2	0.1	0.3	X							X	X	0.1	0.2
Black-headed Grosbeak	0.2	0.1			0.1	0.1	0.0	0.1	0.1	0.2										
American Robin								0.0			0.1	0.0	0.3	0.2	0.1		0.1	0.1	0.2	0.1
Red-shouldered Hawk							X	0.0	0.0	0.1					X		0.0	0.2	0.2	0.2
Black-necked Stilt (C)	0.1	X			0.2	X	0.2	0.0	0.1	0.4										
Hermit Thrush	0.0	0.0									0.3	0.2	0.0	0.0				0.1		0.1
Ash-throated Flycatcher	0.1	X	0.2	0.0		0.2	0.1	0.1	0.1											
Great Horned Owl			0.0		0.1	0.1	0.0		0.1	0.1					0.0	0.0	X	0.2	0.0	0.1
Least Bittern (BC)	0.0		0.1	0.1	X	0.1	0.2	0.1	0.1	0.0		0.0	0.1						X	0.1
Lark Sparrow			0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.2										

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Nashville Warbler			0.1			0.0	0.1	X	0.0	X						0.0		0.0	0.0	
Common Raven	X	X		X	X	X	0.1	X	0.2	X	X	X	0.3	X	X	X	0.0	X	X	0.1
Western Flycatcher (Unidentified)		0.0	0.2	0.0		X	0.2		0.1	0.1										
Neotropic Cormorant							0.0	0.3	X	0.1										
Dusky Flycatcher	0.0	0.0	0.3				0.0													
Eurasian Collared-Dove					0.0	X	0.1	0.0	0.1	X								0.1	0.1	X
Gray Flycatcher (C)	0.0		0.2		0.1			0.0	0.0									0.0		
MacGillivray's Warbler	0.0		0.0			0.0	0.0		0.0										0.0	
Golden-crowned Kinglet											0.0		0.3	0.1	0.1	0.0				
Ruddy Duck							X									X	0.3	0.1		
Pacific Wren											0.1					0.1	0.0		X	0.1
Townsend's Warbler						0.2	0.1													
Red-naped Sapsucker	0.0										0.0	0.1	0.0				0.0	0.0		
Hooded Oriole			0.1						0.1	0.2			X							
Horned Grebe							0.0	0.1	0.1								0.0	0.1	X	
Barn Owl	0.1	0.1			0.0		X						0.0		X				X	0.1
Cedar Waxwing										X	0.0				X					0.3
Lesser Nighthawk	X	0.0	X	X	0.0	X	0.1	X	0.0	X										
Red-breasted Nuthatch														0.0				0.0		0.1
Wilson's Snipe					0.0	X	0.0	0.0										0.0		0.1
Black-throated Sparrow		0.0				0.2										X				
Olive-sided Flycatcher (CDE)	0.0		0.0			0.0	0.0	0.0	0.1											
Black-throated Gray Warbler									X	0.2					0.0					
Solitary Vireo (Unidentified)	X	0.0	0.0	0.2																
Western Grebe (C)							0.1	X	X		X		0.0				X	0.1		
Vesper Sparrow					0.1	0.0														
American Goldfinch					0.0		X								0.1		0.1			0.1
Lesser Yellowlegs							0.1			0.1					X					
Violet-green Swallow		X	0.1	0.1	X	X	X	X		X				X	X			X		
Plumbeous Vireo				0.0			0.0	0.0		0.1										

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Dunlin							0.2													
Tree Swallow				0.1	X	X	X	X	X	X			0.1			X			X	
Semipalmated Sandpiper		0.1																		
Canyon Wren	0.0			X						0.0		0.0								
Green-tailed Towhee (C)				0.0					0.0											
Sagebrush Sparrow (C)									X									0.1	0.1	
Willow Flycatcher (ABC)				0.1		0.0														
Western Bluebird											0.1	X			X					
Brown-crested Flycatcher	0.1				X					0.0										
Merlin												0.0			0.0	X		X		X
Eastern Kingbird						0.0		0.0	0.0											
Wood Duck														0.0			X		X	0.1
Peregrine Falcon (C)			X	0.0	X	X	X	X	X	0.0	X				0.0	X	X	X	X	X
Redhead (C)							X		X	X						X		X		
Rock Pigeon	X	X	X	X	X				X	X			0.1	0.0						
Greater White-fronted Goose																X			0.1	
Swamp Sparrow																				0.1
American Bittern		0.0																		
House Sparrow							0.0				0.0									
Brown Creeper																	0.0			0.1
Rufous Hummingbird (CE)						0.1														
Solitary Sandpiper										0.0										
Cactus Wren															X					
Caspian Tern				X			X	X		0.1								X		
European Starling								0.0							X	X		X		
Turkey Vulture		X	X	X	X	X	X	X	0.0	X								X	X	
Semipalmated Plover	0.0																			
Canyon Towhee		0.0																		
Fox Sparrow																				0.1
Hairy Woodpecker												0.0								

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Bonaparte's Gull							X	X		0.0										
Cassin's Vireo										0.0										
Sandhill Crane (C)										0.0						X				
Swainson's Hawk (C)			X			X		X	X	0.0										
Vermilion Flycatcher (AB)																				0.1
Blackpoll Warbler																		0.0		
Blue-winged Teal	X						X	X		X	X							0.0		
Cattle Egret							X													
Hammond's Flycatcher							0.0													
Mountain Bluebird														0.0						
Ovenbird																0.0				
Pectoral Sandpiper																				
Prairie Falcon (C)						X			X						0.0	X	X	X		X
Red Crossbill																		0.0		
Ross's Goose															X				0.0	
Rufous-crowned Sparrow			0.0																	
Snow Goose	X					X									X	X		X		X
Willet (C)							X	0.0												
Bank Swallow					X			X												
California Gull						X	X								X	X	X		X	X
Canvasback (C)																		X		
Clark's Grebe (C)				X				X									X	X		
Forster's Tern								X												
Franklin's Gull (C)								X												
Graylag Goose						X									X	X				
Hooded Warbler							X													
Lesser Black-backed Gull							X													
Long-billed Curlew (C)									X											
Long-eared Owl (E)	X																			
Marbled Godwit (C)																				

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Northern Goshawk (C)																X				
Short-billed Dowitcher										X										
Snow Goose (x Domestic Goose?)																				X
Tundra Swan (C)																			X	
Vaux's Swift			X							X					X					
Western/Clark's Grebe								X												
Whimbrel							X													
White Ibis									X											
White-tailed Kite							X													
White-throated Swift (C)	X	X	X	X	X	X	X	X	X	X		X							X	
Wilson's Phalarope (C)								X		X										

Table 7. Relative species abundance (percent of total bird abundance) for all ten years (overall), among seasons, and by survey year (2005-2018). Only species that represent at least 1% of the overall bird abundances in one or more periods are listed (in descending order of overall relative abundance). Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight). “X” indicates the species was only detected outside of the survey period or beyond 100 m of a point. No entry means that the species was not detected.

Species (Conservation Status)	Overall	Breeding	Non- Breeding	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13
American Coot	10.9	4.8	15.4	1.8	6.9	7.3	3.7	3.0	2.4	14.8	16.6	16.4	18.4
Red-winged Blackbird	5.9	10.0	3.6	5.6	5.8	7.1	6.8	7.6	4.6	6.6	6.7	5.2	4.0
Abert's Towhee (C)	5.7	7.0	4.3	12.5	11.2	7.5	7.4	7.1	7.2	3.7	3.1	3.2	3.1
Yellow-rumped Warbler	5.7	1.0	10.9	5.0	2.5	8.4	7.3	8.5	9.5	5.7	3.3	3.7	5.6
Mallard	5.5	2.9	7.2	0.8	1.7	3.3	2.8	5.2	4.1	7.6	9.5	6.7	6.3
Gadwall	5.1	1.6	6.7	0.6	0.8	1.2	1.0	1.3	1.7	5.5	8.0	11.2	8.4
Song Sparrow	4.6	6.6	3.0	9.7	10.0	7.7	6.4	4.8	6.0	2.5	2.5	2.4	1.9
Marsh Wren	4.0	3.0	4.3	3.6	4.3	5.5	6.8	5.7	5.9	3.2	2.8	2.5	2.7
American Wigeon	3.8	1.7	5.4	X	0.1	0.2	0.1	0.2	0.4	4.7	8.3	8.1	6.3
White-crowned Sparrow	3.6	0.6	6.8	3.4	3.4	4.0	4.0	5.2	5.7	2.9	2.2	2.8	4.0
Great-tailed Grackle	3.0	5.4	1.2	0.6	1.2	2.7	2.8	2.7	2.2	3.3	4.1	3.9	3.3
Verdin	2.9	3.9	2.0	2.8	3.5	2.9	3.4	3.5	3.6	2.5	2.1	2.4	3.2
Bewick's Wren	2.9	3.5	2.1	5.9	6.3	3.6	4.7	4.1	3.6	2.0	1.6	1.2	1.1
Black-tailed Gnatcatcher	2.7	3.4	2.0	3.7	4.3	2.4	2.9	3.4	3.5	2.4	2.0	1.9	2.2
American Pipit	2.6	0.6	4.3	1.1	2.1	1.5	4.0	3.7	3.2	4.8	1.4	1.7	2.6
Common Yellowthroat	2.6	6.1	0.1	3.3	3.6	3.4	4.1	3.0	3.0	2.1	2.1	2.3	1.4
Gambel's Quail (C)	2.5	3.6	1.8	1.4	0.9	0.7	1.1	2.1	5.7	2.7	2.2	2.9	3.8
Black Phoebe	2.1	1.5	2.3	3.1	3.4	2.5	2.6	2.3	2.5	2.1	1.5	1.5	1.3
Ruby-crowned Kinglet	1.5	0.3	2.5	3.7	3.3	2.4	1.5	1.4	1.6	1.0	0.8	0.6	1.0
Brown-headed Cowbird	1.5	3.8	0.0	2.7	3.0	2.6	3.0	1.9	2.0	0.9	0.6	0.6	0.4
Orange-crowned Warbler	1.2	0.3	1.7	1.4	0.9	1.3	1.4	1.1	1.8	0.5	1.1	1.5	1.5
Lucy's Warbler (C)	1.2	3.0		4.0	2.5	1.8	2.0	1.1	1.1	0.5	0.5	0.5	0.4

Species (Conservation Status)	Overall	Breeding	Non- Breeding	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13
Mourning Dove	1.1	2.5	0.1	4.1	1.4	1.2	0.9	1.4	1.4	0.5	0.3	0.5	1.1
Yellow-breasted Chat	1.0	2.5	0.0	2.5	2.2	1.6	2.3	0.7	1.0	0.4	0.6	0.3	0.3
House Finch	1.0	0.8	1.1	0.7	1.1	1.0	0.9	2.5	1.9	0.4	0.9	0.5	0.6
Yellow Warbler (B)	0.9	2.2	0.0	0.8	0.8	1.0	1.9	1.5	1.5	0.5	0.6	0.7	0.7
Crissal Thrasher	0.9	0.9	0.8	1.5	1.1	0.6	0.8	1.1	1.2	0.7	0.8	0.8	0.8
Blue Grosbeak (A)	0.7	1.8	0.0	1.9	1.3	1.1	1.2	0.6	0.6	0.4	0.5	0.6	0.4
Killdeer	0.6	0.8	0.4	1.4	0.7	0.3	0.5	0.6	0.2	0.9	0.5	0.3	0.6
Yellow-headed Blackbird	0.5	0.7	0.0	0.7	0.2	0.0	0.2	0.2	0.1	2.3	0.7	0.3	0.2
Say's Phoebe	0.5	0.5	0.6	0.4	0.5	0.3	0.7	1.0	0.7	0.3	0.4	0.4	0.5
Lesser Goldfinch	0.4	0.3	0.3	0.3	0.5	0.2	0.4	0.7	1.8	0.1	0.2	0.1	0.1
Brewer's Sparrow (C)	0.4	0.3	0.1	0.2	0.4	0.7	0.7	1.2	0.6	0.1	0.2	0.1	0.1
Eared Grebe (C)	0.3	0.8	0.0	0.0		0.2		0.0	X	0.0	0.8	1.2	0.1
Dark-eyed Junco	0.3	0.0	0.5	0.1	0.2	1.2	0.6	0.5	0.3	0.1	0.2	0.0	0.1

Table 8. Breeding and non-breeding relative species abundances (percent of total bird abundance) for each of ten survey years (2005-2018). Only species that represent at least 1% of the overall bird abundances in one or more periods are listed (in descending order of overall relative abundance). Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight). “X” indicates the species was only detected outside of the survey period or beyond 100 m of a point. No entry means that the species was not detected.

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
American Coot	0.9	1.0	4.4	2.3	0.9	0.8	6.1	9.1	9.8	7.8	3.4	13.3	6.1	4.0	4.4	3.5	20.9	19.4	22.6	25.1
Red-winged Blackbird	3.9	6.6	9.2	10.5	10.6	10.8	14.9	12.4	11.3	7.5	9.8	7.0	7.1	2.9	4.7	0.3	1.5	4.7	1.6	2.9
Abert's Towhee (C)	12.9	12.0	7.8	7.7	7.4	8.3	4.6	3.9	4.6	4.9	9.9	10.0	6.7	6.1	6.4	5.2	3.0	2.9	2.2	1.5
Yellow-rumped Warbler	0.2	0.8	1.4	0.5	0.6	0.3	0.7	0.9	1.5	2.4	12.8	4.8	16.1	17.9	18.6	20.6	11.0	6.3	5.7	7.7
Mallard	0.3	0.3	1.6	1.7	3.2	2.4	4.0	6.0	3.7	3.3	1.0	4.1	4.2	3.2	6.5	5.8	10.7	11.1	8.3	7.4
Gadwall	0.1	0.0	0.2	0.3	0.4	0.1	0.4	2.8	4.7	4.5	1.3	2.0	1.3	1.1	1.6	2.4	6.4	9.7	14.0	9.7
Song Sparrow	10.5	11.5	9.6	8.4	6.2	8.3	4.6	4.1	4.4	2.6	7.8	7.7	6.0	3.9	3.9	4.0	1.0	1.7	1.3	1.4
Marsh Wren	1.5	2.2	3.7	5.7	5.1	5.2	2.4	1.8	1.7	2.3	5.4	6.1	6.2	7.2	6.1	5.8	3.4	3.5	2.8	2.6
American Wigeon		X	0.1	0.2	X	X	1.5	6.2	3.3	3.3	X	X	0.2	0.1	0.2	0.3	6.0	7.9	12.0	9.7
White-crowned Sparrow	0.4	1.1	0.2	0.1	0.4	0.5	0.5	0.6	0.6	1.5	7.9	5.1	8.6	9.9	11.1	11.1	5.4	4.5	4.7	5.6
Great-tailed Grackle	0.4	1.5	4.1	4.1	4.9	3.4	7.9	8.8	8.1	7.0	0.9	1.0	1.7	1.9	0.7	1.5	1.0	1.1	1.0	1.5
Verdin	2.9	4.5	3.3	3.5	4.1	4.3	3.6	3.0	3.8	6.1	2.3	1.8	2.4	3.1	3.2	2.4	2.0	1.6	1.4	1.5
Bewick's Wren	5.3	6.8	3.8	4.9	4.5	2.9	2.7	2.6	1.9	1.6	5.2	4.9	3.0	4.6	2.9	3.6	1.2	0.8	0.6	0.6
Black-tailed Gnatcatcher	3.7	5.1	2.5	2.9	3.5	3.7	3.6	2.7	2.8	3.9	2.7	3.6	2.0	2.9	3.3	2.8	1.6	1.8	1.2	1.1
American Pipit	X	0.1	0.3	X	2.5	0.3	0.7	0.1	0.0	1.6	2.9	5.3	2.3	8.5	5.0	6.4	7.0	3.0	2.3	3.3
Common Yellowthroat	6.0	6.7	7.4	7.9	6.8	6.9	5.5	5.5	5.8	4.0	0.0		0.0	0.2		0.1	0.2	0.1	0.1	0.0
Gambel's Quail (C)	2.3	1.3	1.2	1.2	3.1	7.3	3.6	3.8	5.2	5.7	0.5	0.6	0.4	1.2	0.9	4.6	2.2	1.3	1.4	2.7
Black Phoebe	1.7	2.0	1.7	1.6	1.6	1.6	2.0	1.1	0.9	1.4	3.7	4.5	2.8	3.9	2.4	2.9	2.0	1.8	1.7	1.0
Ruby-crowned Kinglet	0.6	0.6	0.4	0.3	0.1	0.1	0.2	0.1	0.3	0.2	7.7	6.1	4.7	2.7	3.1	2.5	1.3	1.5	0.9	1.5
Brown-headed Cowbird	5.3	6.2	6.2	6.6	4.5	4.9	2.6	1.8	1.6	1.2		X		0.0			0.0			
Orange-crowned Warbler	0.3	0.3	0.3	0.1	0.2	0.3	0.1	0.2	0.4	0.5	2.2	1.6	2.0	2.7	1.5	2.3	0.5	1.6	2.2	1.6
Lucy's Warbler (C)	8.0	5.3	4.1	4.3	2.6	2.7	1.4	1.5	1.5	1.3										
Mourning Dove	7.8	2.6	2.5	1.9	2.9	3.4	1.4	0.6	1.4	2.0	0.2	X	0.2	0.1	0.1	X	0.1	0.1	0.0	0.0
Yellow-breasted Chat	5.0	4.6	3.6	4.8	1.6	2.4	1.2	1.7	0.8	1.0			0.0							
House Finch	0.9	0.8	0.7	0.7	2.9	1.3	0.4	0.3	0.3	0.5	0.3	1.5	1.7	1.2	0.7	2.1	0.6	1.8	0.8	0.7

Species (Conservation Status)	Breeding Season / Year										Non-Breeding Season / Year									
	1	2	3	4	5	6	10	11	12	13	1	2	3	4	5	6	10	11	12	13
Yellow Warbler (B)	1.7	1.5	2.2	3.9	3.2	3.5	1.2	1.7	1.5	2.1							0.0		0.0	
Crissal Thrasher	1.1	1.3	0.4	0.7	1.1	1.1	1.0	0.8	1.0	0.7	1.9	0.7	0.6	1.0	1.2	1.2	0.4	0.8	0.7	0.7
Blue Grosbeak (A)	3.3	2.6	2.6	2.4	1.5	1.5	1.1	1.2	1.5	1.1						0.0				
Killdeer	1.7	0.7	0.3	0.3	1.1	0.4	1.3	0.7	0.4	1.3	0.8	0.3	0.1	0.7	0.1	0.0	0.7	0.4	0.2	0.3
Yellow-headed Blackbird	1.4	0.1	0.1	0.3	0.5	0.2	2.9	0.7	0.5	0.3	0.0			0.2	X			0.0	X	X
Say's Phoebe	0.3	0.6	0.4	0.8	0.8	0.5	0.5	0.2	0.2	0.6	0.4	0.4	0.1	0.8	1.3	0.6	0.3	0.6	0.5	0.6
Greater Roadrunner	0.6	0.7	0.8	0.5	0.5	0.7	1.0	0.8	1.2	1.0	0.3	0.1	0.1	0.2	0.1	0.0	0.1	0.3	0.4	0.3
Northern Flicker	X		0.1	0.1		0.0	0.0	0.1	0.1	X	0.7	0.9	1.3	1.2	0.6	0.9	0.7	0.6	0.5	0.5
Lesser Goldfinch	0.1	0.3	0.2	0.1	0.3	1.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.4	1.9	0.1	0.1	0.1	0.0
Brewer's Sparrow (C)		0.5	1.3	0.2	0.4	0.9	0.1	0.0	0.0	0.2	0.2			0.3	0.2		0.0	0.1	X	
Eared Grebe (C)	0.0		0.4		0.1		X	2.3	3.4	0.4						X	0.0	X	0.0	
Western Kingbird	0.3	0.5	0.9	0.5	0.6	0.4	1.3	0.5	1.2	0.3										
Wilson's Warbler	1.5	1.3	1.0	0.4	0.7	0.3	1.3	0.1	0.2	0.9	0.3							0.0		
Dark-eyed Junco	0.1			0.2			0.0				0.1	0.4	3.0	0.9	1.4	0.3	0.1	0.3	0.1	0.2
Anna's Hummingbird	0.2	0.1		0.0	0.1	0.0	0.4	0.6	0.9	1.2	0.0			0.0	0.1		0.1	0.2	0.3	0.4
Northern Pintail (C)							X		X		X			X	X	0.1	1.5	1.0	0.9	0.4
Lincoln's Sparrow	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.2	1.4	0.2	0.6	0.5	0.3	0.4	0.3	0.2	0.3	0.3
Ring-billed Gull	X	X		X	X	X	0.0	X	X	0.9	X	1.4	1.9	X	0.1	X	0.1	0.3	0.0	0.2
Least Sandpiper (C)					0.8	0.5	0.3	0.1	X	0.1					0.9	0.0	1.2		0.0	0.5
Northern Shoveler					0.0		0.1	0.1	0.1	X	0.1						0.2	0.5	1.1	0.0
Northern Rough-winged Swallow	0.2	0.3	0.2	1.4	0.5	X	0.1	0.4	0.3	0.2	X			X	X	X	X	X	X	
Bushtit	0.1					0.1					1.2	0.8	0.1		1.9					
White-faced Ibis (C)	0.1	0.4	X	0.0	0.0	0.1	0.4	0.1	0.3	1.9	X	X		X				X	0.1	0.0
Barn Swallow		X	2.0	X	X	X	X	X	X	0.0			X	X	X	X		X	X	0.0
Cliff Swallow	X	X	0.2	1.0	0.0	X	X	X	X	X			X	X	0.0				X	

Table 9. Relative frequencies (percent of survey points with detections on any of 26 surveys) of bird species in each of the ten years of surveys in the Las Vegas Wash (February 2005 – August 2018). Number of survey points increased from 29 to 31 after the second year, and 32 during the 13th (see Methods; Table 1). Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight). Birds recorded incidentally, as fly-overs, or > 100 m from the survey point are excluded. Species listed in descending order of average frequency.

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Yellow-rumped Warbler	100	97	100	97	100	90	97	100	97	94	97
Black Phoebe	100	100	100	94	94	90	100	97	94	94	96
Abert's Towhee (C)	100	100	97	97	97	94	90	97	97	94	96
White-crowned Sparrow	93	100	97	97	97	84	94	97	100	88	95
Verdin	93	97	90	97	100	87	90	94	94	100	94
Song Sparrow	100	97	97	97	100	87	87	90	90	88	93
Common Yellowthroat	93	90	94	90	90	81	90	90	94	84	90
Black-tailed Gnatcatcher	93	97	94	90	100	81	84	84	90	81	89
Bewick's Wren	97	100	90	97	97	90	84	77	77	75	88
Brown-headed Cowbird	97	97	94	94	94	84	77	84	84	63	87
Red-winged Blackbird	72	86	97	94	94	84	81	90	81	84	86
Orange-crowned Warbler	93	83	77	87	74	81	68	90	94	91	84
Marsh Wren	93	83	81	87	81	81	77	87	74	81	82
Ruby-crowned Kinglet	100	97	94	87	90	74	68	71	74	69	82
Crissal Thrasher	90	83	77	77	90	77	61	61	68	72	76
American Coot	59	69	74	74	77	74	84	77	87	75	75
Blue Grosbeak (A)	97	86	81	84	74	68	68	61	65	63	75
Great-tailed Grackle	34	41	55	71	84	68	90	100	84	97	72
Gambel's Quail (C)	76	52	48	71	58	84	84	84	84	78	72
Greater Roadrunner	66	66	68	71	65	58	77	68	90	78	71
Mallard	31	45	81	68	81	71	81	77	84	81	70
Lucy's Warbler (C)	93	90	77	84	74	68	55	42	48	44	67
Mourning Dove	90	76	87	71	84	84	48	52	42	41	67
Say's Phoebe	52	48	35	68	97	77	68	71	81	72	67
Yellow Warbler (B)	59	48	55	61	74	68	55	74	84	75	65

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Yellow-breasted Chat	90	76	77	84	61	65	45	58	45	44	64
House Finch	59	76	68	68	68	68	42	68	61	66	64
Northern Flicker	59	66	65	77	55	52	58	58	45	50	58
American Pipit	59	62	77	61	52	65	52	45	68	41	58
Great Blue Heron	24	41	32	29	42	42	61	65	77	72	49
Wilson's Warbler	76	66	65	48	35	29	58	23	26	56	48
Gadwall	31	34	42	48	55	52	45	48	58	59	47
Lincoln's Sparrow	66	28	61	39	29	29	35	39	58	69	45
Killdeer	55	55	29	48	32	19	55	48	45	53	44
Western Kingbird	24	17	55	32	45	39	87	42	68	31	44
Loggerhead Shrike (D)	52	31	13	35	58	35	48	65	48	47	43
Brewer's Sparrow (C)	21	28	42	58	65	55	19	39	16	22	36
Spotted Sandpiper	31	34	10	32	32	29	45	55	52	31	35
Green Heron	21	55	32	29	19	29	52	29	35	25	33
Belted Kingfisher	38	28	26	29	32	23	35	39	48	28	33
Black-chinned Hummingbird	17	38	35	32	32	32	32	39	29	31	32
Northern Mockingbird	7	31	23	13	29	19	32	52	68	41	31
Lesser Goldfinch	24	34	32	39	45	48	39	19	13	16	31
Dark-eyed Junco	21	24	61	45	39	29	23	29	13	16	30
American Wigeon	0	3	19	13	13	13	42	68	55	66	29
Blue-gray Gnatcatcher	52	62	29	58	10	19	23	0	3	13	27
Common Gallinule	10	10	16	13	19	23	29	26	52	44	24
Anna's Hummingbird	24	3	3	10	16	6	35	39	48	53	24
Greater Yellowlegs	31	10	13	16	13	19	32	52	19	28	23
Double-crested Cormorant	3	14	35	23	19	3	29	26	42	28	22
Savannah Sparrow	14	0	19	16	19	32	19	29	32	38	22
Pied-billed Grebe	7	17	26	19	16	13	16	32	35	34	22
Cooper's Hawk	10	14	16	10	10	26	26	32	29	28	20
Bullock's Oriole	3	21	16	0	13	23	19	35	39	31	20
Northern Rough-winged Swallow	21	21	13	45	19	16	13	23	13	13	20

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Western Wood-Pewee	10	17	13	26	6	29	42	13	10	25	19
White-winged Dove	45	21	39	29	16	23	13	3	0	0	19
Yellow-headed Blackbird	10	7	10	16	10	6	35	32	26	16	17
Costa's Hummingbird (C)	14	17	26	16	6	23	19	16	6	16	16
Snowy Egret (C)	7	3	23	6	13	13	16	29	32	13	16
Black-crowned Night-Heron	10	10	13	3	3	10	23	19	35	25	15
Great Egret	14	7	13	6	13	16	13	26	26	16	15
American Kestrel	14	7	6	3	6	13	23	26	13	31	14
Spotted Towhee	17	14	16	39	13	10	16	10	0	6	14
Red-tailed Hawk	14	7	13	10	6	16	23	19	16	16	14
Sharp-shinned Hawk	24	7	10	19	23	13	13	10	10	9	14
Rock Wren	14	14	10	16	23	29	6	13	6	3	13
Warbling Vireo	17	14	10	10	19	6	10	19	16	13	13
Sora	3	7	6	10	3	10	13	19	29	31	13
Lazuli Bunting	17	24	6	29	3	0	6	6	3	34	13
Northern Harrier	7	14	35	19	6	0	10	13	13	13	13
Western Meadowlark	0	7	0	3	10	13	19	19	39	19	13
Phainopepla (A)	21	31	6	23	16	6	3	10	0	9	13
Eared Grebe (C)	3	0	3	0	6	0	6	42	45	19	13
Virginia Rail	14	7	6	6	6	23	10	16	16	19	12
Common Merganser	7	3	10	6	6	3	16	19	35	13	12
Green-winged Teal	0	17	13	6	6	6	19	19	10	19	12
Osprey	3	3	6	3	10	6	29	19	19	16	12
Indigo Bunting	0	0	0	0	16	10	16	26	39	9	12
White-faced Ibis (C)	7	7	0	3	6	6	16	16	23	25	11
Canada Goose	0	0	10	0	3	10	23	16	23	22	11
Chipping Sparrow	17	7	16	10	23	10	0	3	3	9	10
Western Tanager	10	3	6	3	10	10	3	13	6	28	9
Northern Pintail (C)	0	3	0	0	0	3	23	16	19	28	9
Bufflehead	0	0	6	3	3	3	19	13	23	19	9

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Bushtit	31	21	6	3	16	10	0	0	0	0	9
Black-headed Grosbeak	14	14	6	0	6	13	3	6	10	9	8
Ash-throated Flycatcher	14	3	16	3	0	13	13	10	10	0	8
Ladder-backed Woodpecker	3	0	0	3	6	23	10	23	10	3	8
Bell's Vireo (ABC)	21	0	10	0	0	6	13	16	6	6	8
American Robin	7	3	16	13	6	3	6	10	10	3	8
House Wren	7	3	0	0	3	0	3	13	16	28	7
Cinnamon Teal (C)	3	0	0	3	10	0	19	13	3	16	7
Hermit Thrush	14	28	3	3	3	0	3	6	0	6	7
Great Horned Owl	0	3	3	0	10	19	3	6	3	16	6
Solitary Sandpiper	0	0	0	0	0	0	0	0	0	6	6
Swamp Sparrow	0	0	0	0	0	0	0	0	0	6	6
Ring-billed Gull	0	3	16	0	3	0	6	13	3	13	6
Nashville Warbler	0	0	3	6	3	6	10	10	10	9	6
Western Flycatcher (Unidentified)	3	7	13	3	0	0	16	0	6	6	6
Least Bittern (BC)	3	3	6	6	0	6	6	6	6	9	5
Red-shouldered Hawk	0	0	0	0	0	3	6	16	16	13	5
Common Goldeneye	0	0	6	6	3	0	6	6	10	16	5
American Avocet (C)	7	0	0	0	6	0	13	3	3	19	5
Ring-necked Duck	0	0	0	0	0	0	6	19	6	16	5
Least Sandpiper (C)	0	0	0	0	3	10	19	3	3	6	4
Lark Sparrow	0	0	6	3	3	6	10	3	3	9	4
Northern Shoveler	3	3	0	0	6	0	6	13	6	3	4
Dusky Flycatcher	3	7	23	0	3	0	3	0	0	0	4
MacGillivray's Warbler	3	3	3	0	0	10	3	0	16	0	4
Pine Siskin (D)	7	0	6	0	0	13	0	10	0	0	4
Common Raven	0	0	10	0	3	0	6	0	13	3	4
Pacific Wren	7	3	0	0	0	3	3	3	6	6	3
Horned Lark (D)	3	0	10	6	3	3	6	0	0	0	3
Black-necked Stilt (C)	3	0	0	0	3	0	10	3	6	6	3

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Hooded Merganser	0	0	0	0	0	0	3	13	10	6	3
Lesser Scaup (C)	0	0	0	0	0	0	3	3	10	16	3
Bonaparte's Gull	0	0	0	0	0	0	0	0	0	3	3
Caspian Tern	0	0	0	0	0	0	0	0	0	3	3
Cassin's Vireo	0	0	0	0	0	0	0	0	0	3	3
Fox Sparrow	0	0	0	0	0	0	0	0	0	3	3
Sandhill Crane (C)	0	0	0	0	0	0	0	0	0	3	3
Swainson's Hawk (C)	0	0	0	0	0	0	0	0	0	3	3
Vermilion Flycatcher (AB)	0	0	0	0	0	0	0	0	0	3	3
Red-naped Sapsucker	7	10	3	0	0	0	3	3	0	3	3
Gray Flycatcher (C)	3	0	6	0	6	3	0	6	3	0	3
American White Pelican (C)	0	0	0	3	0	3	10	10	3	0	3
Eurasian Collared-Dove	0	0	0	0	3	0	10	6	6	3	3
Townsend's Warbler	0	0	0	0	0	13	13	0	0	3	3
Barn Owl	10	7	3	0	3	0	0	0	0	3	3
Western Sandpiper (C)	10	3	0	0	6	3	3	0	0	0	3
Long-billed Dowitcher (C)	0	3	0	0	0	0	6	6	3	6	3
Cliff Swallow	0	0	6	10	10	0	0	0	0	0	3
Red-breasted Nuthatch	0	0	3	3	0	0	3	6	0	9	3
Golden-crowned Kinglet	3	0	10	3	3	3	0	0	0	0	2
Olive-sided Flycatcher (CDE)	3	0	3	0	0	3	3	3	6	0	2
Solitary Vireo (Unidentified)	0	3	3	16	0	0	0	0	0	0	2
Horned Grebe	0	0	0	0	0	0	6	10	6	0	2
Hooded Oriole	0	0	6	0	0	0	0	0	6	9	2
Brewer's Blackbird (D)	0	0	0	3	10	3	0	0	0	3	2
Neotropic Cormorant	0	0	0	0	0	0	6	10	0	3	2
Wilson's Snipe	0	0	0	0	3	0	3	10	0	3	2
Cedar Waxwing	10	3	0	0	0	0	0	0	0	3	2
Lesser Nighthawk	0	3	0	0	3	0	3	3	3	0	2
Lesser Yellowlegs	0	0	0	0	3	0	6	0	0	6	2

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Plumbeous Vireo	0	0	0	3	0	0	3	3	0	6	2
Ruddy Duck	0	0	0	0	0	0	6	6	0	0	1
Vesper Sparrow	0	0	0	0	3	6	3	0	0	0	1
Violet-green Swallow	0	0	3	6	3	0	0	0	0	0	1
Western Grebe (C)	0	0	3	0	0	0	6	3	0	0	1
American Goldfinch	0	0	0	0	6	0	3	0	0	3	1
Green-tailed Towhee (C)	0	0	0	3	3	0	0	0	3	3	1
Barn Swallow	0	0	3	3	0	0	0	0	0	6	1
Black-throated Gray Warbler	0	0	0	0	3	0	0	0	3	6	1
Brown-crested Flycatcher	7	0	0	0	0	0	0	0	0	3	1
Canyon Wren	3	3	0	0	0	0	0	0	0	3	1
Black-throated Sparrow	0	3	0	0	0	6	0	0	0	0	1
Merlin	0	3	0	0	3	0	0	3	0	0	1
Eastern Kingbird	0	0	0	0	0	3	0	3	3	0	1
Sagebrush Sparrow (C)	0	0	0	0	0	0	0	3	6	0	1
Tree Swallow	0	0	6	3	0	0	0	0	0	0	1
Peregrine Falcon (C)	0	0	0	3	3	0	0	0	0	3	1
American Bittern	0	3	0	0	3	0	0	0	0	0	1
House Sparrow	3	0	0	0	0	0	3	0	0	0	1
Cactus Wren	0	0	0	0	0	0	0	6	0	0	1
European Starling	0	0	0	0	0	3	0	3	0	0	1
Redhead (C)	0	0	0	3	0	0	3	0	0	0	1
Rock Pigeon	0	0	3	3	0	0	0	0	0	0	1
Rufous Hummingbird (CE)	0	0	0	0	0	6	0	0	0	0	1
Turkey Vulture	0	0	0	3	0	0	0	0	3	0	1
Willow Flycatcher (ABC)	0	0	0	3	0	3	0	0	0	0	1
Brown Creeper	0	0	0	0	0	0	3	0	0	3	1
Wood Duck	0	0	0	3	0	0	0	0	0	3	1
Canyon Towhee	0	3	0	0	0	0	0	0	0	0	0
Hairy Woodpecker	0	3	0	0	0	0	0	0	0	0	0

Species (Conservation Status)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 11	Year 12	Year 13	Average Frequency
Semipalmated Plover	3	0	0	0	0	0	0	0	0	0	0
Semipalmated Sandpiper	0	3	0	0	0	0	0	0	0	0	0
Western Bluebird	3	0	0	0	0	0	0	0	0	0	0
Black-and-white Warbler	0	0	0	0	0	0	0	0	3	0	0
Blackpoll Warbler	0	0	0	0	0	0	0	3	0	0	0
Blue-winged Teal	0	0	0	0	0	0	0	3	0	0	0
Broad-tailed Hummingbird	0	0	0	0	0	3	0	0	0	0	0
Cattle Egret	0	0	0	0	0	0	0	3	0	0	0
Dunlin	0	0	0	0	0	0	3	0	0	0	0
Greater White-fronted Goose	0	0	0	0	0	0	0	0	3	0	0
Hammond's Flycatcher	0	0	0	0	0	0	3	0	0	0	0
Mountain Bluebird	0	0	0	3	0	0	0	0	0	0	0
Ovenbird	0	0	0	0	0	3	0	0	0	0	0
Pectoral Sandpiper	0	0	0	0	3	0	0	0	0	0	0
Prairie Falcon (C)	0	0	0	0	3	0	0	0	0	0	0
Red Crossbill	0	0	0	0	0	0	0	3	0	0	0
Ross's Goose	0	0	0	0	0	0	0	0	3	0	0
Rufous-crowned Sparrow	0	0	3	0	0	0	0	0	0	0	0
Scissor-tailed Flycatcher	0	0	0	0	0	3	0	0	0	0	0
Snow Goose	0	0	0	0	0	0	0	3	0	0	0
Summer Tanager (AB)	0	0	0	0	0	0	3	0	0	0	0
Virginia's Warbler (CDE)	0	0	3	0	0	0	0	0	0	0	0
Willet (C)	0	0	0	0	0	0	0	3	0	0	0
Long-eared Owl (E)	0	0	0	0	0	0	0	0	0	0	0

Table 10. Estimated densities (birds per 40 ha) and abundance ranks for Nevada Bird Count (NBC) Mojave lowland riparian transects within Clark County (2005-2014) and Warm Springs Natural Area (WSNA) long-term transects (2008-2016) compared to Las Vegas Wash breeding season data (2005-2018). Species are listed in descending order of abundance from the NBC data, and include the 50 most abundant species from each of the datasets. Conservation status includes priority species from multiple sources: A (Clark County 2000); B (Bureau of Reclamation 2006); C (GBBO 2010); D (Rosenberg et al 2016, Intermountain Partners in Flight); E (Rosenberg et al 2016, Continental Partners in Flight).

Species (Conservation Status)	NBC		WSNA		Las Vegas Wash	
	Abundance	Rank	Abundance	Rank	Abundance	Rank
Gambel's Quail (C)	7.68	1	21.69	1	5.55	9
Abert's Towhee (C)	7.49	2	11.69	3	10.86	2
Lucy's Warbler (C)	6.14	3	9.29	7	4.70	12
Mourning Dove	4.96	4	10.83	5	3.81	16
Brown-headed Cowbird	4.58	5	10.26	6	5.92	8
Yellow Warbler (B)	4.2	6	4.05	14	3.40	17
Verdin	3.97	7	7.52	9	6.03	7
House Finch	3.93	8	8.14	8	1.30	24
Red-winged Blackbird	3.88	9	12.03	2	15.55	1
Song Sparrow	3.62	10	3.06	17	10.26	3
Bewick's Wren	3.59	11	4.62	13	5.43	10
Yellow-breasted Chat	3.19	12	5.25	11	3.86	15
Phainopepla (A)	2.82	13	11.65	4	0.01	140
Northern Rough-winged Swallow	2.42	14	0.82	36	0.56	37
Black-tailed Gnatcatcher	2.24	15	0.84	34	5.25	11
Cliff Swallow	2.17	16			0.17	63
Black-throated Sparrow	2.14	17	0.09	74	0.02	106
Common Yellowthroat	2.05	18	5.93	10	9.51	4
Ash-throated Flycatcher	2.00	19	1.05	30	0.07	86
Crissal Thrasher	1.37	20	2.52	21	1.44	23
Blue Grosbeak (A)	1.32	21	1.24	27	2.79	18
Blue-gray Gnatcatcher	1.1	22	0.42	44	0.22	56
Bell's Vireo (ABC)	1.01	23	1.77	23	0.12	74
Lesser Goldfinch	0.98	24	2.54	20	0.39	46
Spotted Towhee	0.97	25	0.04	89	0.03	105
Great-tailed Grackle	0.96	26	0.65	40	8.36	5
Mallard	0.83	27	0.17	61	4.43	14
Say's Phoebe	0.78	28	0.34	51	0.72	33
Northern Mockingbird	0.75	29	4.85	12	0.47	42
Bullock's Oriole	0.74	30	3.51	16	0.31	48

Species (Conservation Status)	NBC		WSNA		Las Vegas Wash	
	Abundance	Rank	Abundance	Rank	Abundance	Rank
Brewer's Sparrow (C)	0.7	31	0.36	46	0.51	40
American Coot	0.64	32	0.00	108	7.44	6
White-winged Dove	0.62	33			0.41	45
Wilson's Warbler	0.6	34	0.83	35	1.10	29
Rock Wren	0.56	35			0.08	82
Black-chinned Hummingbird	0.54	36	0.16	63	0.72	34
Killdeer	0.53	37	0.06	84	1.27	26
White-crowned Sparrow	0.53	38	1.04	31	0.93	31
Western Scrub-Jay (Unidentified)	0.53	39	0.09	75		
White-faced Ibis (C)	0.52	40			0.52	38
Western Kingbird	0.52	41	3.89	15	1.07	30
Yellow-rumped Warbler	0.51	42	1.20	28	1.51	22
Lazuli Bunting	0.5	43	0.09	71	0.15	69
House Sparrow	0.49	44	0.00	113	0.00	158
Eurasian Collared-Dove	0.45	45	2.90	18	0.02	108
Western Meadowlark	0.44	46	0.98	32	0.02	112
Cactus Wren	0.43	47	0.00	109		
Black Phoebe	0.43	48	0.82	37	2.34	21
Canyon Wren	0.39	49			0.01	141
Common Raven	0.39	50	0.10	68	0.03	104
Marsh Wren	0.39	51	0.36	47	4.68	13
Greater Roadrunner	0.31	54	1.42	25	1.22	27
Ladder-backed Woodpecker	0.31	55	2.35	22	0.03	103
Anna's Hummingbird	0.24	60	0.03	94	0.61	36
Virginia Rail	0.21	63	0.54	43	0.07	88
Western Tanager	0.19	64	0.34	50	0.10	77
Turkey Vulture	0.18	66	1.18	29	0.00	162
Spotted Sandpiper	0.18	67			0.52	39
Loggerhead Shrike (D)	0.18	68	0.00	115	0.28	50
Canada Goose	0.17	69			0.29	49
Summer Tanager (AB)	0.17	70	0.89	33		
Warbling Vireo	0.16	76	0.35	48	0.13	72
Red-tailed Hawk	0.16	77	0.39	45	0.02	120
Yellow-headed Blackbird	0.16	78	0.03	106	1.15	28
Vermilion Flycatcher (AB)	0.13	81	2.55	19		
Orange-crowned Warbler	0.1	83			0.42	44
Brown-crested Flycatcher	0.07	89	1.31	26	0.01	132

Species (Conservation Status)	NBC		WSNA		Las Vegas Wash	
	Abundance	Rank	Abundance	Rank	Abundance	Rank
Ruby-crowned Kinglet	0.06	93	0.14	64	0.45	43
Green Heron	0.05	97	0.03	97	0.51	41
Great Blue Heron	0.05	100	0.04	88	0.64	35
Eared Grebe (C)	0.03	108			1.27	25
American Kestrel	0.03	109	0.61	42	0.14	70
Barn Swallow	0.01	136			0.26	53
American Pipit					0.87	32
American Wigeon					2.70	19
Common Gallinule					0.34	47
Gadwall					2.46	20

Table 11. Summary trends from negative binomial regression statistics for 20 species that were detected within 100 m of survey points at the Las Vegas Wash during at least 40 (of a total of 260) survey visits between February 2005 and August 2018. Species listed in descending order of detections. Dark gray shading indicates significantly negative trends (six species), and light gray shading indicates significantly positive trends (ten species).

Species	No. of Visits with Detections	Total No. of Birds Detected	Overall Density Estimate (Birds/40 ha)	Incident Rate Ratio	P
American Coot	229	12689	20.4	1.24	<0.001
Red-winged Blackbird	244	6821	11.0	1.06	0.001
Yellow-rumped Warbler	168	6569	10.6	1.04	0.051
Abert's Towhee	260	6534	10.7	0.95	<0.001
Mallard	227	6426	10.3	1.23	<0.001
Gadwall	135	5916	9.5	1.38	<0.001
Song Sparrow	260	5218	8.5	0.93	<0.001
Marsh Wren	258	4572	7.4	1.01	0.594
Verdin	260	3339	5.4	1.05	<0.001
Bewick's Wren	260	3315	5.4	0.93	<0.001
Black-tailed Gnatcatcher	259	3092	5.0	1.02	0.006
American Pipit	123	3054	4.9	1.09	0.003
Common Yellowthroat	158	2990	4.9	1.01	0.759
Gambel's Quail	220	2905	4.7	1.17	<0.001
Black Phoebe	257	2411	3.9	1.00	0.938
Ruby-crowned Kinglet	156	1705	2.8	0.95	0.002
Orange-crowned Warbler	172	1429	2.3	1.07	< 0.000
Lucy's Warbler	118	1329	2.2	0.90	<0.001
Yellow-breasted Chat	104	1120	1.8	0.90	<0.001
Crissal Thrasher	241	1038	1.7	1.03	0.001

Table 12. Comparison of species richness, total abundance and estimated densities (birds per 40 ha) of 41 species in three vegetation treatments (see Methods). Single survey point with “no treatment” included for reference. Species listed in descending order of statistical significance. Green shading indicates significantly higher values relative to recently cleared/completed sites; orange shading indicates significantly lower values.

Treatment	No Treatment (n=1)	Older Reveg (n=15)	Recent Reveg (n=11)	Recently Cleared/ Completed (n=4)	R ²	P
Abundance	147.40	159.30	427.08	205.51	0.477	0.0002
Richness	54.00	50.07	56.91	54.50	0.085	0.3006
American Coot	0.24	5.61	112.71	12.17	0.531	<0.0001
American Pipit	0.49	0.98	5.21	31.46	0.718	<0.0001
Abert's Towhee	16.16	11.75	3.10	7.56	0.461	0.0002
Verdin	17.38	11.32	2.52	2.93	0.461	0.0002
Black-tailed Gnatcatcher	15.92	8.55	1.29	1.27	0.466	0.0002
Marsh Wren	0.00	3.63	11.79	5.18	0.424	0.0006
Blue Grosbeak	0.73	1.83	0.34	1.59	0.397	0.0011
Red-winged Blackbird	0.49	6.18	21.73	9.29	0.385	0.0014
Gadwall	0.00	1.19	66.33	11.12	0.376	0.0017
Bewick's Wren	4.90	4.98	0.47	2.06	0.370	0.0019
Great-tailed Grackle	4.65	5.48	16.35	6.22	0.362	0.0023
Ruby-crowned Kinglet	2.45	3.54	0.63	1.34	0.310	0.0066
Mallard	0.00	2.84	38.17	17.36	0.303	0.0077
Northern Flicker	1.96	1.35	0.11	0.31	0.295	0.0089
Crissal Thrasher	3.43	3.16	0.53	2.32	0.257	0.0181
Lucy's Warbler	6.86	1.72	0.09	0.70	0.234	0.0271
Yellow-breasted Chat	0.00	1.22	0.16	0.77	0.191	0.0575
Brown-headed Cowbird	2.69	1.53	0.89	0.39	0.152	0.1082
Gambel's Quail	17.63	13.21	3.65	2.93	0.149	0.1131
Yellow-rumped Warbler	9.06	14.48	10.19	7.71	0.141	0.1277
Yellow Warbler	0.24	2.44	1.29	0.62	0.134	0.1429
White-crowned Sparrow	9.55	6.57	10.72	11.72	0.131	0.1504
Say's Phoebe	1.47	0.92	1.43	1.28	0.123	0.1707
Common Yellowthroat	0.49	3.81	6.22	5.77	0.120	0.1774
Greater Roadrunner	0.73	2.11	1.43	0.70	0.119	0.1801
Black Phoebe	2.69	4.38	2.68	3.63	0.062	0.4247
Mourning Dove	3.18	3.76	0.24	0.13	0.046	0.5320
Orange-crowned Warbler	3.18	4.24	3.77	3.54	0.038	0.5972
House Finch	0.73	1.65	1.22	1.71	0.033	0.6352
Song Sparrow	1.96	5.08	6.36	6.54	0.022	0.7458