



Avian Inventories for Six National Parks in the Southern Colorado Plateau Network

Aztec Ruins National Monument

El Malpaís National Monument

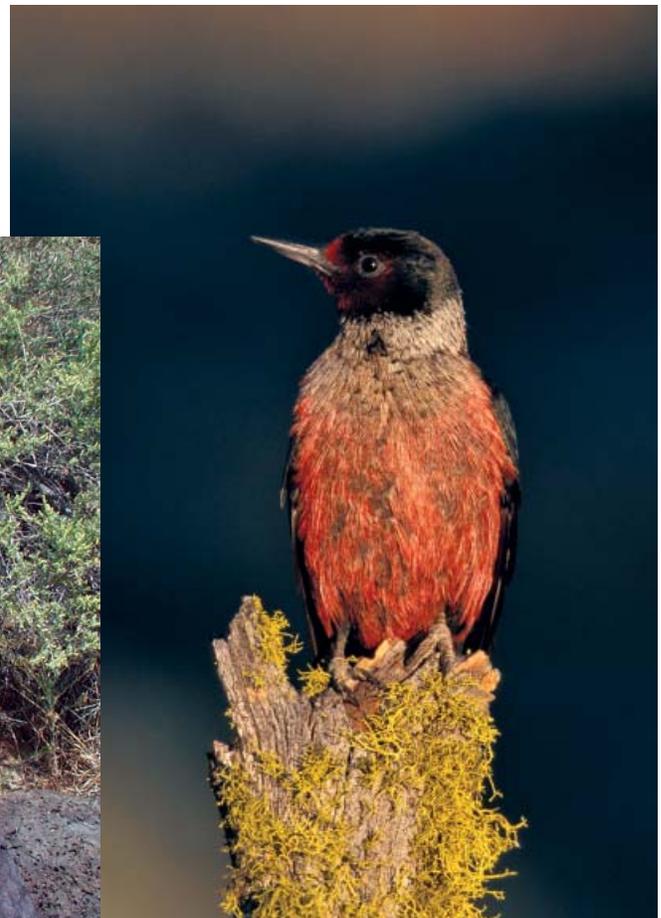
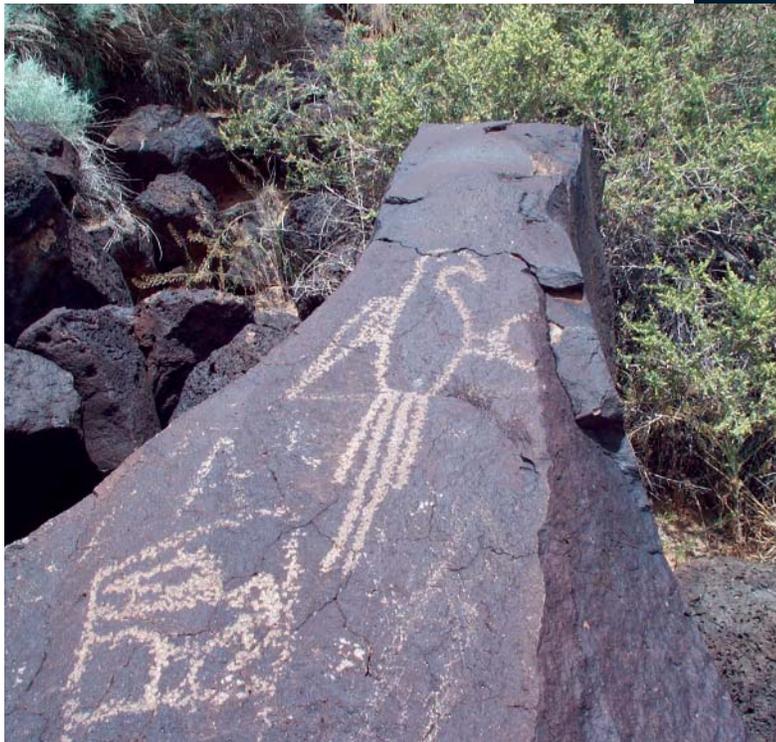
El Morro National Monument

Petroglyph National Monument

Salinas Pueblo Missions National Monument

Yucca House National Monument

Natural Resource Report NPS/SCPN/NRTR-2007/047



ON THE COVERS

Front left: Bird petroglyph, Boca Negra Arroyo, Petroglyph National Monument/National Park Service.

Front right: Lewis's woodpecker (*Melanerpes lewis*)/©Tom J. Ulrich, used with permission from VIREO.

Back: Grace's warbler (*Dendroica graciae*)/©J. Hoffman, used with permission from VIREO.

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Contents

Tables	v
Maps.....	vii
Photos	ix
Abstract.....	xi
Acknowledgements	xiii
Introduction.....	1
Objectives.....	2
Study areas and survey-point placement	2
Methods.....	5
Bird sampling methods	5
Data analysis	6
Identification of species and habitats of conservation concern	8
Results.....	9
Aztec Ruins National Monument.....	9
El Malpaís National Monument.....	12
El Morro National Monument	15
Petroglyph National Monument	18
Salinas Pueblo Missions National Monument.....	21
Yucca House National Monument.....	24
Discussion.....	29
Literature Cited	31
Tables	35
Appendices	80
Appendix A. Location of point-count survey stations for the parks included in the bird inventory.....	80
Appendix B. Definition and criteria of breeding and residency status.....	87
Appendix C. List of common and scientific names for bird species detected during the 2001–2003 avian inventories at AZRU, ELMA, ELMO, PETR, SAPU, and YUHO, and where they were found.	88

Tables

Table 1. Bird abundance by species across habitats, based on variable circular plot point counts, Aztec Ruins National Monument, 2001.	35
Table 2. List of species and number of individuals recorded for all habitat types during area searches and incidental observations, Aztec Ruins National Monument, 2001–2002.	37
Table 3. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, Aztec Ruins National Monument, 2001–2002.	38
Table 4. Comparison of observed number of species and first-order jackknife estimates of the total number of species, Aztec Ruins National Monument, 2001.	39
Table 5. Partners in Flight priority species that occur or are probably present in and around Aztec Ruins National Monument, and their associated priority habitats.	39
Table 6. Avian species detected during winter area-search surveys, Aztec Ruins National Monument, 2001 and 2002.	40
Table 7. Bird abundance by species across habitats, based on variable circular plot point counts, El Malpaís National Monument, 2002–2003.	41
Table 8. Bird abundance by species across pinyon-juniper and ponderosa pine habitats where lava is and is not a dominant habitat component, based on variable circular plot point counts, El Malpaís National Monument, 2001.	45
Table 9. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, El Malpaís National Monument, 2002–2003. ...	47
Table 10. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, El Malpaís National Monument National Monument, 2002–2003.	48
Table 11. Number of bird detections and estimated densities within all habitats during point-count surveys, El Malpaís National Monument, 2002–2003.	49
Table 12. Comparison of observed number of species and first-order jackknife estimates of the total number of species, El Malpaís National Monument, 2002–2003.	49
Table 13. Partners in Flight priority species that occur or are probably present in and around El Malpaís National Monument, and their associated priority habitats.	50
Table 14. Avian species detected during winter area-search survey, El Malpaís National Monument, 2003.	50
Table 15. Bird abundance by species across habitats, based on variable circular plot point counts, El Morro National Monument, 2001–2002.	51
Table 16. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, El Morro National Monument, 2001–2002.	54
Table 17. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, El Morro National Monument, 2001–2002.	55
Table 18. Number of bird detections and estimated densities within all habitats during point-count surveys, El Morro National Monument, 2001–2002.	56
Table 19. Comparison of observed number of species with first-order jackknife estimates of the total number of species, El Morro National Monument, 2001–2002.	56
Table 20. Partners in Flight priority species that occur or are probably present in and around El Morro National Monument, and their associated priority habitats.	57
Table 21. Bird abundance by species across habitats, based on variable circular plot point counts, Petroglyph National Monument, 2001.	58
Table 22. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, Petroglyph National Monument, 2001–2002. ...	60

Table 23. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, Petroglyph National Monument, 2001–2002.	61
Table 24. Number of bird detections and estimated densities within all habitats during point-count surveys, Petroglyph National Monument, 2001–2002.....	62
Table 25. Comparison of observed number of species with first-order jackknife estimates of the total number of species for Petroglyph National Monument, 2001–2002.	62
Table 26. Partners in Flight priority species that occur or are probably present in and around Petroglyph National Monument, and their associated priority habitats.	63
Table 27. Avian species detected during winter area-search surveys, Petroglyph National Monument, 2001 and 2003.....	63
Table 28. Bird abundance by species across habitats, based on variable circular plot point counts, Salinas Pueblo Missions National Monument, 2001.....	64
Table 29. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, Salinas Pueblo Missions National Monument, 2001–2002.	66
Table 30. Bird species list and breeding evidence based on data from bird inventory point count, incidental observation, and area-search surveys, Salinas Pueblo Missions National Monument, 2001–2002.....	67
Table 31. Number of bird detections and estimated densities within all habitats during point-count surveys, Salinas Pueblo Missions National Monument, 2001.....	68
Table 32. Comparison of observed number of species with first-order jackknife estimates of the total number of species, Salinas Pueblo Missions National Monument, 2001.....	68
Table 33. Partners in Flight priority species that occur or are probably present in and around Salinas Pueblo Missions National Monument, and their associated priority habitats.	68
Table 34. Avian species detected during winter area-search surveys, Salinas Pueblo National Monument, 2001–2003.	69
Table 35. Bird abundance by species across habitats, based on variable circular plot point counts, Yucca House National Monument, 2001–2003.....	70
Table 36. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, Yucca House National Monument, 2001–2003.....	74
Table 37. Bird species list and breeding evidence based on data from bird inventory point count, incidental observation, and area-search surveys, Yucca House National Monument, National Monument, 2001–2003.	75
Table 38. Number of bird detections and estimated densities within all habitats during point-count surveys, Yucca House National Monument, 2001–2002.	76
Table 39. Comparison of observed number of species with first-order jackknife estimates of the total number of species, Yucca House National Monument, 2001 and 2003.	76
Table 40. Partners in Flight priority species that occur or are probably present in and around Yucca House National Monument, and their associated priority habitats.	77
Table 41. Avian species detected during winter area-search surveys, Yucca House National Monument, February 10, 2002, and February 22, 2003.	78
Table 42. Partners in Flight priority species that occur or are probably present in and around the SCPN parks included in this inventory.	79

Maps

Map 1. National park units of the Southern Colorado Plateau Network.....	1
Map 2. Bird point-count stations in Aztec Ruins National Monument.....	10
Map 3. Bird point-count stations in El Malpaís National Monument.	13
Map 4. Bird point-count stations in El Morro National Monument.....	16
Map 5. Bird point-count stations in Petroglyph National Monument.....	19
Map 6. Bird point-count stations in Salinas Pueblo Missions National Monument.	22
Map 7. Bird point-count stations in Yucca House National Monument and vicinity.	25

Photos

View from big sagebrush shrubland toward West Ruin, Aztec Ruins National Monument.	9
Yellow-billed cuckoo (<i>Coccyzus americanus</i>).....	11
Ponderosa pine woodlands amid lava flows, El Malpaís National Monument.	12
Spotted towhee (<i>Pipilo maculatus</i>).....	14
Ponderosa pines growing against the base of box canyon cliffs, El Morro National Monument.....	15
Peregrine falcon (<i>Falco peregrinus</i>).	17
Shrubland habitat in Boca Negra Arroyo, Petroglyph National Monument.....	18
Lark sparrow (<i>Chondestes grammacus</i>).	20
Cottonwood-willow riparian habitat, Abó Unit, Salinas Pueblo Missions National Monument.....	21
Scott's oriole (<i>Icterus parisorum</i>).	23
Wetland habitat surrounding Aztec Spring, Yucca House National Monument.....	25
Black-throated gray warbler (<i>Dendroica nigrescens</i>).....	26

Abstract

This avian inventory project is one component of a suite of biological inventories that were conducted within the Southern Colorado Plateau Network as part of a new national emphasis of inventory and monitoring within the National Park Service. During the 2001, 2002, and 2003 breeding seasons, avian inventories were completed in the following parks: Aztec Ruins National Monument, El Malpais National Monument, El Morro National Monument, Petroglyph National Monument, Salinas Pueblo Missions National Monument, and Yucca House National Monument. The primary objective of the project was to provide a baseline inventory of avifauna in each park, with the goal of documenting at least 90% of species present. The inventory was designed to determine general abundance and distribution of species present and to identify park-specific species of special concern.

We conducted variable circular plot (VCP) point-count surveys using distance estimation, incidental observations (compiling lists of species) and area-search surveys (surveys of defined areas) at each of the six park units. Parks were visited on at least three occasions throughout the breeding seasons, for at least two breeding seasons, from mid-May to mid-July, 2001–2003. In addition, we completed area-search surveys at several park units during the non-breeding season (i.e., winter) from December through February 2001, 2002, and 2003, and recorded bird species using the parks' habitats in winter.

First-order jackknife estimates show that an average of 85.2% of the species present were detected at Aztec Ruins National Monument, 86% at El Malpais National Monument, 79% at El Morro National Monument, 85% at Petroglyph National Monument, 80% at Salinas Pueblo Missions National Monument, and 81% at Yucca House National Monument. These results suggest that we have detected most of the species commonly occurring within each park. In addition to measures of species richness and abundance, we obtained robust density estimates for a total of 15 species at five park units.

The results of this avian inventory show that each park has its own unique habitats, habitat features, and associated bird communities. The park units of the Southern Colorado Plateau Network provide resources for several species of conservation concern in the region.

Keywords: avian inventory, Colorado Plateau, bird species of conservation concern, national parks

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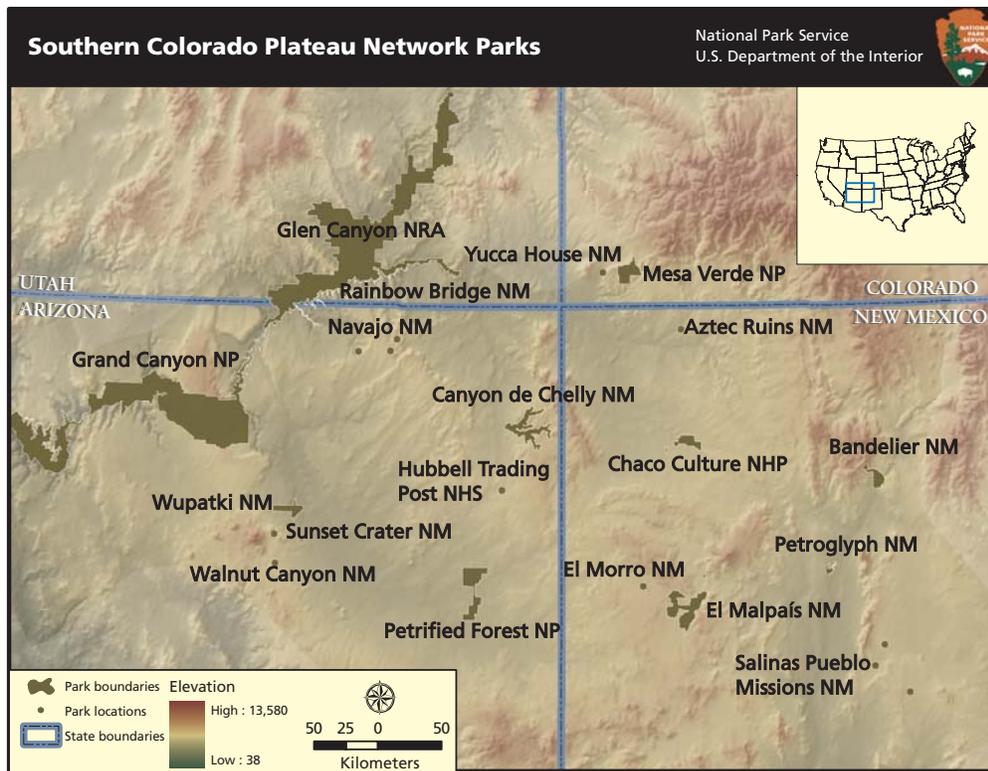
Introduction

This avian inventory project is one component of a suite of biological inventories that were conducted within park units of the Southern Colorado Plateau Network (SCPN) as part of a national emphasis on inventory and monitoring of resources within the National Park Service (NPS). An assessment at the initiation of this inventory found that the level of existing information on avifauna occurrence and abundance for several SCPN park units was minimal, and that species presence or absence had not been adequately determined for most of these parks.

The lack of baseline biological data and information on the occurrence of species of conservation concern impaired the ability of park officials to adequately manage the parks' avifauna resources. To address these issues, inventory surveys were conducted in Aztec Ruins National Monument (AZRU), El Malpaís National Monument (ELMA), El Morro National Monument (ELMO), Petroglyph National Monument (PETR), Salinas Pueblo Missions National Monument (SAPU), and Yucca House National Monument (YUHO) (Map 1).

The inventory focused on surveying breeding birds, and fieldwork was conducted during the 2001, 2002, and 2003 breeding seasons. In addition, surveys were conducted during the non-breeding season (i.e., winter) from December through February 2001, 2002, and 2003, to record bird species using park habitats in winter.

Researchers often study and monitor bird communities and species in hopes of gaining insight into physical and biological phenomena, such as changes in climate, habitat, human disturbance, or environmental contaminants. When justifying the use of birds as models for such inventory and monitoring, researchers typically argue that birds are good indicators of change because they respond quickly to habitat changes, are influenced by a suite of often subtle factors, and exhibit strong habitat selection (Cody 1985). Knowledge of the park units' bird resources is also important because bird species make up a portion of the endangered, threatened, or sensitive species that the NPS is mandated by federal and/or state regulations to manage and conserve.



Map 1. National park units of the Southern Colorado Plateau Network.

Information gained from this avian inventory contributes to knowledge of biological resources and provides baseline data on avian resources. This information can contribute to efforts to design efficient, effective monitoring programs in the network and provides baseline data for assessing the effects of management actions within park units. Significant changes in bird species or populations may alert us to look more closely for the factors responsible, including changes in the quality or quantity of habitats.

In this report, we first describe the objectives of the inventory and the general methodologies used to inventory park units. Next, we provide information on a park-by-park basis. Finally, we summarize the information across park units.

Objectives

The overall goals of the SCPN avian inventory for each park were to:

- 1) Document, through existing, verifiable data and field investigations, the occurrence of at least 90% of the bird species currently estimated to occur in the parks;
- 2) Document presence or absence of bird species, and their distribution and abundance in habitats that were historically under-sampled or not sampled, using systematic surveys;
- 3) Identify important habitats (i.e., document locations of key breeding and non-breeding habitats where current records are lacking);
- 4) Identify species of concern (i.e., document presence or absence of birds of special management and conservation concern that are known or expected to occur in the park units based on detections, habitat availability, or historic records);
- 5) Identify park-specific species of special concern, which could become part of future “vital signs” monitoring;
- 6) Summarize bird information in appropriate formats to contribute to the population of National Park Service servicewide databases including

NPSpecies, Dataset Catalog, NPBib, and ANCS+.

Study areas and survey-point placement

The methods employed to inventory birds within the SCPN park units depended on park unit size. Units that could not accommodate at least ten point counts placed 250 m (820 ft) apart were inventoried using area-search methods (described below). For park units large enough to accommodate variable circular plot (VCP) point-count sampling, stratification was conducted, and survey points were located, as per the *Biological Inventory of National Park Areas of the Southern Colorado Plateau* (Stuart 2000). Stratification here refers to the framework for planning sampling or organizing biological information. Stratification can be attentive to heterogeneity in logistics, such as cost of sampling, or to heterogeneity in the biological response of interest—in this case, species richness (Cochran 1977).

With respect to sample design, investigators (Stuart 2000) applied stratification in the following way: Upon detailed examination of the sampling environment, they determined whether stratification for logistical or biological reasons was appropriate to each NPS unit to be inventoried, and whether stratification should be by landform, hydrologic features, and/or some level of vegetation or geological classification. They used consistent descriptions of vegetation types and landforms to identify or map strata, classify sample points, or otherwise organize inventory information. All points were classified in the field to vegetation type and landform. Where relevant, they used the finest-resolution classes of the standard U.S. Geological Survey system on geological maps to describe geologic formations (Stuart 2000).

Through this process, each park unit was stratified according to vegetation type or other habitat features. Depending on park unit size and shape, VCP point-count stations were located at least 250 meters apart in each stratum and a 200-meter buffer was implemented between each habitat type/stratum. At ELMA, ELMO, PETR, and YUHO, habitat within the park was stratified according to slope, elevation, and aspect, and

random points were generated within each habitat type. For planning purposes, investigators (Stuart 2000) estimated the number of sample points required to achieve 90% completeness in each inventory based on the number of species estimated to be in an inventoried unit (S) and the number of species they expected to detect, on average, in a single plot (MS). They estimated S from species–area curves specific to birds. They estimated MS from the results of field studies and personal experience. The number of plots was estimated from the ratio of MS to S , assuming a natural-log (for vertebrates) or square-root (for plants) decay in the rate of

species detection with the additional sample points. Species–area models relate S to the natural-log transformed area of an inventoried unit (A), measured in hectares (ha). They used the following model for birds: $S = 28.7 + 6.43 \cdot \ln(A + 1)$ $n = 35$, $R^2 = 0.70$.

A subset of the random points generated was selected for accessibility and surveyability. Points that fell on steep, inaccessible slopes were moved whenever possible to the nearest contiguous terrain. The location of each point sampled was recorded in Global Positioning System (GPS) coordinates.

Methods

Bird sampling methods

The bird survey methods employed at each park unit depended on the size of the park unit (see above). We conducted variable circular plot point-count surveys (with distance estimation), incidental observations (compiling species lists), and area-search surveys (surveys of specific areas). Field methods were designed to provide the necessary data for a baseline avifauna inventory and to estimate species richness (i.e., number of species), relative abundance, and density of breeding birds, and to document the presence of wintering, non-breeding birds.

Variable circular plot point-count sampling

We used distance-sampling methods while conducting sampling using VCP point counts. This method has been used for more than 30 years and has been found to be a reliable technique for estimating relative abundance and population trends for many bird species (Fancy and Sauer 2002). It presumes that the distance between an observer and an object will affect the probability of detection; the further away an object is, the less likely it is to be detected. Distance sampling allows researchers to avoid some serious biases associated with traditional analysis of point-count data (i.e., detectability differences among habitats or years), but relies on three assumptions: all birds at distance = 0 are detected, distances of birds close to the point are measured accurately, and birds do not move in response to the observer's presence (Buckland et al. 2001). Distance sampling can be conducted using two different sampling methodologies: line transects and variable circular plot point counts.

We sampled larger parks using VCP point counts, as this is the preferred approach in patchy habitats where the objective is to correlate bird data to vegetation or other habitat information, and in dense, rugged, or hazardous terrain, where it is necessary to watch one's footing while walking. Using this method, the observer stands at a sampling station and records the horizontal distance between the observer and each bird detected. For many surveys, the majority of birds

are heard but not seen, so the observer estimates the distance to a tree, bush, or other object where s/he thinks the bird is located.

Three-to-four visits were conducted per breeding season (2001–2003) to cover the period in which the greatest number of passerine bird species would be exhibiting breeding behavior, such as territorial singing. Surveys were started at one-half hour after sunrise and were completed by 1000. Counting began one minute after an observer arrived at a point-count station. At each station, one observer recorded all individual birds seen or heard for seven minutes, during which counting was subdivided into three periods: 0–3 minutes, 3–5 minutes, and 5–7 minutes. The distance from the point to the bird (or the estimated location of the bird) was measured using laser rangefinders, accurate to within 1 m at distances greater than approximately 15 m. The distances to birds closer than approximately 15 m were estimated by eye or measured by pacing. Individuals flying over the site without perching during the point count were also recorded, but with no estimates of distance. Additional notes taken included whether the detection was aural, visual or both; whether detections were songs, calls, or other (e.g., drumming wings); and whether the bird was detected at a previous point-count station.

During each morning of point-count sampling, “incidental” observations also were conducted. Birds (e.g., previously undetected species, individuals exhibiting breeding behavior) encountered while walking between point-count stations were noted on incidental bird observations forms. Forms for point counts and incidental bird observations were modeled after those recommended by Ralph et al. (1995). During the final visit, habitat and vegetation data were collected at each point-count station. Data were entered onto standardized forms and GPS coordinates for the point-count location were recorded.

Additional breeding and non-breeding surveys

Smaller park units (e.g., AZRU, SAPU), where fewer than 10 random points could be placed, were sampled using area-search surveys. Area searches consisted of systematically covering the entire park and recording

all individual birds detected and the time of detection, taking care to avoid counting the same individuals more than once.

Area-search surveys also were performed in parks where VCP point counts were conducted in order to increase the probability of detecting rare and less commonly detected species and to survey unique habitats or features not sampled by VCP point counts during breeding periods.

During the non-breeding season (December–February), we attempted to make at least two visits, from 2001 to 2003, to conduct area searches at each park unit. We were unable to conduct some of the scheduled surveys due to poor weather conditions and time constraints. Non-breeding winter surveys were conducted between 0900 and 1500. Survey data collected included species encountered, habitat, location, dates, and general behavior.

Timing of breeding period surveys (2001, 2002, and 2003)

Three visits per park were scheduled so that surveys coincided with seasonal shifts in avifaunal activity patterns and could accommodate differences in breeding phenology of species. In 2001, four visits were made to AZRU, ELMO, PETR, SAPU, and YUHO. In 2002 and 2003, three visits, spread throughout the breeding season from mid-May until mid-July, were made to each park unit.

Sampling locale description and location documentation

Field crews recorded descriptive site information following a standardized format developed for use by all taxonomic groups in the Southern Colorado Plateau Network. Also, the SCPN data manager worked with GIS staff at the Colorado Plateau Research Station to define and describe the GPS protocol for use by field crews. GPS navigation units were used to record UTM coordinates, error values, datum reference (NAD27), and zone for all inventory sampling points, transects, and other relevant locations. In some situations, both UTM and latitude/longitude coordinate systems were recorded. All GPS coordinates used NAD27 as the datum (Appendix A).

Data mining

As opportunities arose, the field crew assisted with acquisition of existing information for each park, including bibliographic citations of pertinent material for inclusion in the NPBib database. The SCPN provided the principal investigator with a summary of existing avian information for each park. Field crews helped add to this information through visits with park personnel and by examining park files. Any new information recovered at the parks was noted and added to the NPSpecies list for each park, in cooperation with the SCPN data manager.

Voucher specimens

In general, bird specimens for SCPN parks are poorly represented within NPS and other museum collections. However, bird voucher specimens were not collected as part of this inventory effort, and no animals were found dead and in identifiable condition.

Coordination with the Northern Colorado Plateau Network

The Northern and Southern Colorado Plateau Networks have agreed to use comparable field methods and data management for biological inventories. To this end, we utilized standardized field forms and data-entry protocols across the two networks. The SCPN data manager helped design standardized field forms and data-entry screens. In cooperation with the Utah Division of Wildlife Resources, field crews for both networks received joint training prior to each field season.

Species lists

Lists of all the species encountered during the inventory are included in the results for each park and in Appendix C; definitions of the codes for breeding evidence are in Appendix B. The scientific name for each species is listed in Appendix C. In addition, updated NPSpecies lists, using results from the inventory, were developed for the network in coordination with NPSpecies guidelines and the SCPN data manager.

Data analysis

Species richness (number of species), total

number of detections per species, and relative abundance (average number of detections per point count) of species were summarized for each park unit and for each major habitat type surveyed within a park. These data are included, by park unit, in this report. When sample sizes allowed (see below), we also estimated density of specific species within park units.

Relative abundance of species

To obtain unbiased estimates of density using the DISTANCE program (Thomas et al. 1998), samples with a minimum of 60 or more detections per species are recommended (Buckland et al. 2001). When sample sizes of point-count data met this criterion, distance-sampling analysis followed Buckland et al. (2001), using DISTANCE (Thomas et al. 1998). The distance data from VCP point counts were used to model detection functions, which estimate the probability of detecting an object given its distance from the observer. This detection function was used to estimate bird density (number per unit area), and accounts for the fact that some birds may have gone undetected (Buckland et al. 2001).

Selections of detection functions were guided by Akaike's Information Criterion (Akaike 1973; Burnham and Anderson 1998), chi-square model-fit statistics, and visual inspection of detection probability and probability density plots (Buckland et al. 2001). Data were grouped for analyses to compensate for persistent rounding errors by observers of distance estimates greater than 25 m. Distances were truncated for some species with detections at large distances. Data were truncated for each individual species at various distances (5–10% cut points) developed by DISTANCE, the DISTANCE program was re-run, and models were selected as described above.

However, for most species sampled during the inventory, sample sizes did not meet the criteria for modeling density using the DISTANCE program (Thomas et al. 1998). Therefore, we report the number of detections for species per park unit and habitat. The number of detections is largely dependent on the amount of survey effort (e.g., time, area covered) within each habitat.

Because the area of habitat and the number of point counts conducted differed between habitats, we standardized point-count data by calculating each species's relative abundance (the average number of detections per point-count station) for each habitat. (All point-count stations within a park were equally sampled; thus, we did not standardize by the number of point counts.)

Species richness

A primary objective of this study was to provide a baseline inventory of avifauna in each park, with the goal of documenting 90% of species present. To evaluate progress toward this objective, we generated jackknife estimates using the PC-ORD 3.0 program (McCune and Mefford 1995). Jackknife estimates approximate the true number of species by repeatedly sampling the distribution of species among samples to generate a frequency distribution (Palmer 1990).

VCP point-count data were used as samples in generating jackknife estimates. Thus, we were only able to generate jackknife estimates for those parks where we conducted point-count surveys (i.e., parks that were too small to include many [or any] point-count stations were not included). In addition, jackknife estimates are highly sensitive to the number of rare species observed (e.g., species with one detection); therefore, most of the species detected only once during the two-year period were eliminated from these analyses. The only species included in the analyses that were detected only once during the surveys were those that have been confirmed as breeders within a park.

The first-order jackknife estimator (Palmer 1990) is:

$$Jack1 = S + rl(n-l)/n$$

where S = the observed number of species, rl = the number of species occurring in a sample unit, and n = the number of sample units (number of survey points of a habitat type). By comparing the jackknife estimate with the number of species detected (observed) per park or per habitat, we can determine the percent of species detected versus the estimated total number of species likely to be present (see calculations for each park,

below):

$$\frac{\text{Number of species observed} \div \text{jackknife estimate}}{\text{percent of species present detected}}$$

We also report the total number of species detected during point-count surveys, and the number detected in each habitat. The number of species detected is affected by survey effort (i.e., generally, the greater the number of surveys conducted, the more species detected). Park units and habitats were not sampled equally; thus, these numbers should be interpreted with caution.

Identification of species and habitats of conservation concern

Regional assessments have recently been completed that identify habitat and bird species of conservation concern on the Colorado Plateau and surrounding areas of the SCPN. These are the various Partners in Flight (PIF) bird conservation plans that pertain to the region (Latta et al. 1999; Biedleman 2000; Parrish et al. 2002; Rustay et al. 2003), The Nature Conservancy's assessment of the Colorado Plateau ecoregion (Tuhy et al. 2002), and the U.S. Fish and Wildlife Service's birds of conservation concern (U.S. Fish and Wildlife Service 2002).

Partners in Flight is a voluntary, international coalition of government agencies, conservation groups, academic institutions, private businesses, and citizens who have developed geographically based and state-based bird conservation plans (BCPs). These BCPs contain assessments of the significance of bird populations within the region and identify habitats and bird species that warrant conservation action. The PIF prioritization process ranks species based on their conservation "vulnerability." Species are scored according to the extent of their breeding and non-breeding distributions, relative abundance, the level of threats to their breeding and non-breeding habitats, and their population trend (Carter et al. 2000). The geographically based plans that pertain to SCPN parks

are those for the Colorado Plateau region and the Mesa and Plains region. The pertinent state BCPs are those of Utah (Parrish et al. 2002), Colorado (Biedleman 2000), New Mexico (Rustay et al. 2003), and Arizona (Latta et al. 1999).

In its assessment of the Colorado Plateau ecoregion (Tuhy et al. 2002), The Nature Conservancy (TNC) compiled a list of 16 "target" bird species based on examination of Natural Heritage Program ranks (see <http://www.natureserve.org/aboutUs/index.jsp>), PIF prioritization scores, expert opinion, and other knowledgeable sources. Target status was given to all globally imperiled bird species (e.g., Gunnison sage grouse and California condor). Species listed under the Endangered Species Act (ESA), including candidate species (e.g., western yellow-billed cuckoo), also were considered target species. The remaining target species were selected based on long-term declines or other signs of vulnerability (Tuhy et al. 2002). These same species were selected as high-priority species in the BCPs.

Beyond those already listed as federally threatened or endangered, the U.S. Fish and Wildlife Service (USFWS) has identified species, subspecies, and populations of migratory non-game bird species that represent their highest conservation priorities (USFWS 2002). Species are listed for each USFWS region; those that include SCPN park units are USFWS Region 6 and Region 2.

Using information provided by the PIF BCPs, the TNC assessment, and the USFWS lists of birds of conservation concern, we developed a table for each park unit that lists bird species of conservation concern and their associated priority habitat. For each park unit, we listed only those species identified in the PIF BCPs as pertaining to the state in which the park unit was found (i.e., Utah, Colorado, or New Mexico), or occurring in the USFWS region that included that particular park unit.

Results

The results of the avian inventory are reported for each park unit. Results include a brief description of each park, the state of knowledge about the park's avifauna prior to the inventory, and the results of the bird surveys associated with the inventory.

Aztec Ruins National Monument

Background

Aztec Ruins National Monument is located in the Animas River valley of northwestern New Mexico. The site includes riparian and upland areas. The natural resources of this site, including water, croplands, and riparian vegetation, were important to prehistoric inhabitants. Today, these same resources provide habitat for a variety of bird species.

Prior to this inventory, little systematic natural resource inventory work had been conducted at AZRU. Clark (1950) recorded plants of the Sonoran zone in the AZRU region, but did not provide a complete listing of the flora of the area. In the 1990s, a survey for sensitive, threatened, and endangered species of the AZRU area was conducted under contract by Ecosphere Environmental Services, Inc. (EES 1996). This survey, conducted on a 1.6-ha (4-acre) tract adjacent to the monument, recorded 35 species of grasses, forbs, trees, and shrubs. In all, 11 vegetation types were reported, ranging from pinyon-juniper woodland, to grasslands, to riparian vegetation types.

Wildlife species were not recorded during the Ecosphere Environmental Services (1996) survey, but the project report includes a hypothetical species list of plants and vertebrate animals for the AZRU area, including 18 bird species. In 1992, the monument compiled a checklist of birds with 74 species listed. Criteria used to compile the checklist are unknown.

Survey design

Point-count surveys. Point-count surveys were conducted in four habitat types: riparian, shrubland, mixed shrubland/riparian, and agricultural. We performed avian inventory surveys at AZRU during 2001 and



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View from big sagebrush shrubland toward West Ruin, Aztec Ruins National Monument.

2002. Due to its small size, no random points were generated in AZRU. Instead, in the initial year (2001), point-count stations were established (non-randomly) to survey the dominant habitat types.

Eleven point-count stations along two transects were placed in the four habitat types (Map 2). One transect was located in a riparian zone along the Animas River (four point-count stations), and the other in upland habitat (seven point-count stations). Five stations in the latter transect paralleled an irrigation ditch that provided a narrow strip of riparian vegetation on each side. Point-count stations were located 250 m (820 ft) apart. Orchards, which occur in small patches within the monument, were classified as agricultural habitat.

Incidental observations and area searches.

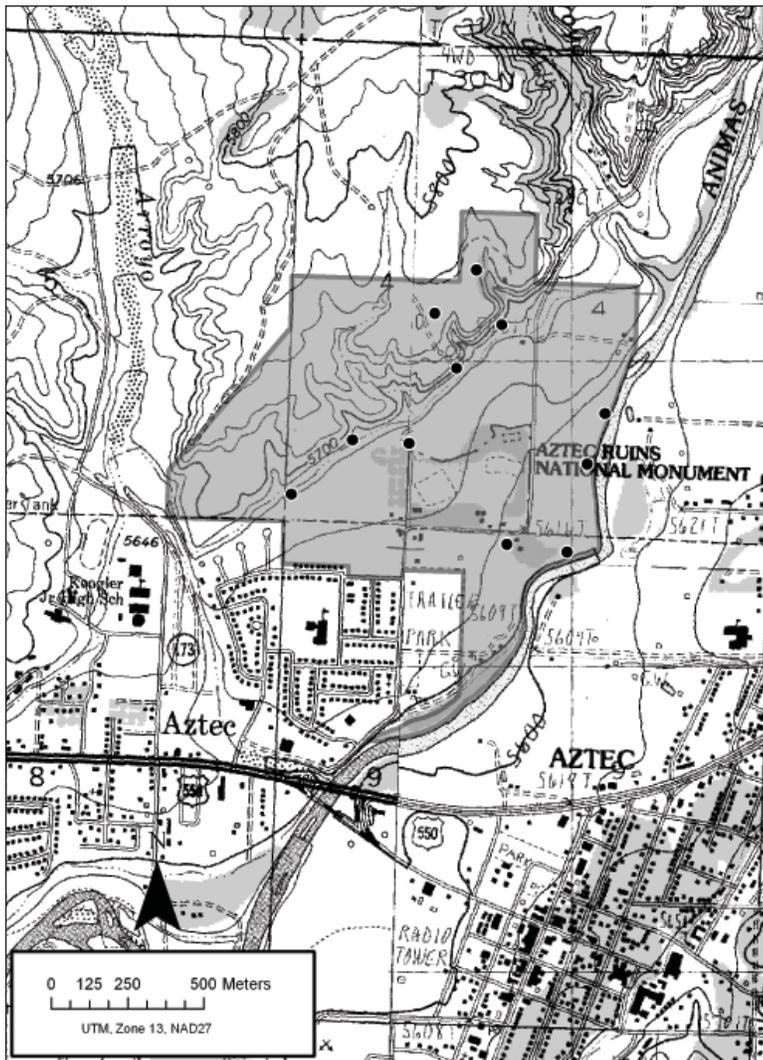
Also in 2001, incidental observations and area searches were conducted in survey habitats that were too small for transects, the intent being to thoroughly sample the entire range of habitats. These occurred in the orchard and upland habitat near the ruins and visitor center. During the 2002 field season, the entire monument was surveyed using area-search surveys. Due to the limited number of sample points that could be completed in the small acreage of the park (<202 ha; <500 acres), we chose not to continue VCP point counts during our second survey year.

Yellow-billed cuckoo surveys. Because a yellow-billed cuckoo (*Coccyzus americanus*)

was detected in 2001, we conducted yellow-billed cuckoo surveys (using standardized methodologies) in 2002.

Survey effort

During the 2001 breeding season (May 19–July 10), 44 point-count surveys (11 points surveyed four times across the breeding season) were conducted in the four habitat types listed above. During the 2002 breeding season, we conducted area-search surveys, each with two people who covered half the park unit; thus, the entire park unit was covered in one morning, three times across the breeding season. Yellow-billed cuckoo surveys were conducted three times in 2002. We conducted non-breeding winter bird surveys on December 21, 2001 and February 11, 2002.



Map 2. Bird point-count stations in Aztec Ruins National Monument.

Inventory results

Total number of individuals and species detected by all methods. We detected 505 birds of 42 species during point-count surveys in 2001, and recorded 891 birds of 62 species during area-search surveys and incidental observations in 2001 and 2002 (Tables 1, 2), for a total of 1,396 individuals of 68 different species. Twenty-six species were detected only during incidental observations and area-search surveys. A list of species detected at AZRU during the inventory, and any breeding evidence observed, is contained in Table 3.

Species distribution across habitats. Although species richness in riparian habitats (30 species; 71.4%) was similar to that of the shrubland/riparian habitat, seven species (common yellowthroat [*Geothlypis trichas*], eastern meadowlark [*Sturnella magna*], greater roadrunner [*Geococcyx californianus*], red-winged blackbird [*Agelaius phoeniceus*], spotted sandpiper [*Actitis macularius*], western wood-pewee [*Contopus sordidulus*], and yellow-billed cuckoo) were detected only within the riparian habitat type. Shrubland habitat, with five point-count stations, had the lowest number of species detected (14; 33.3%). No species were specific to either agricultural or shrubland habitats. Thirty-one species (73.8%) were detected in the mixed shrubland /riparian habitat, two of which were only detected in this habitat (black-throated sparrow [*Amphispiza bilineata*], and western bluebird [*Sialia Mexicana*]; Table 1). Although only one point count was located within agricultural habitat, 20 species (47.6%) were recorded.

Relative abundance across habitats. During point-count surveys, 34.5% of all birds detected were in the mixed shrubland/riparian habitat, and 34.3% were detected in pure riparian habitat. When standardized by effort (i.e., detections per point count), mixed shrubland/riparian habitats had the lowest relative abundance (Table 1). We detected fewer birds overall within pure shrubland and agricultural habitats (16.6% and 14.7%, respectively) because of the limited area and sampling of these habitats. Both had higher relative abundances (3.0 and 3.7 birds/point, respectively).

Species abundance (density estimates). We

were unable to generate density estimates for AZRU because we did not detect any species with large-enough sample sizes (i.e., >60 detections) during point-count surveys.

Jackknife estimators of species richness.

Over all habitat types, we detected 85.2% of the species estimated to be present at AZRU (Table 4). This percentage falls below the goal of documenting at least 90% of the species present. However, jackknife estimates do not utilize incidental records and area-search surveys, during which additional species were detected. The results of this calculation are presented in the last column of Table 4 (due to small sample size, we did not calculate a jackknife estimate for agricultural habitat within AZRU).

Species and habitats of conservation concern: Current surveys and previous records. In 2001, we detected 1 yellow-billed cuckoo in riparian habitat near the Animas River. The western subspecies of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a candidate species for listing under the Endangered Species Act (USFWS 2000), a USFWS species of concern (USFWS 2002), and a New Mexico state-sensitive species (NMGF 2006).

Fourteen of the species that occur or are probably present in AZRU and the surrounding area are PIF priority species (Table 5). One species, Lewis's woodpecker (*Melanerpes lewis*), is also a TNC target species (Tuhy et al. 2002). The majority of these species are associated with AZRU's upland habitats. The riparian habitat, despite its limited distribution within AZRU, provides important habitat for several priority species as well.

Non-breeding winter surveys. Each winter survey was conducted using the area-search methodology. We detected 27 species (Table 6).

Discussion

Methodology. The total number of species detected differed between the 2001 and 2002 inventory surveys due to a change in methodology, with 26 additional species detected during the breeding season in 2002. In 2001, we primarily used VCP survey methods. Due to the small acreage of this monument,



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Yellow-billed cuckoo (*Coccyzus americanus*).

however, we found that the area was better suited to area-search surveys and discontinued VCP surveys in 2002. The benefits of using area-search surveys over VCP surveys in smaller areas are reflected in the increase in the number of species and individuals detected in 2002.

Habitats with strong human influence.

Although not identified as a habitat type, much of AZRU is occupied or influenced by the ruins and park buildings. These features provide habitat for bird species associated with human-created habitat features (e.g., buildings, fields, fences). In fact, such species comprised six of the ten most abundant species at AZRU (Table 2), including European starling (*Sturnus vulgaris*), black-billed magpie (*Pica hudsonia*), house sparrow (*Passer domesticus*), American robin (*Turdus migratorius*), house finch (*Carpodacus mexicanus*), and Canada goose (*Branta canadensis*).

Habitat, relative abundance, and species richness. Although the number of species detected was similar between mixed shrubland/riparian habitat and riparian habitat, several species, such as common yellowthroat, red-winged blackbird, spotted sandpiper, and yellow-billed cuckoo, are more associated with (or are obligates of) riparian habitat than with habitats dominated by shrubs. The one species found only in the mixed shrubland/riparian habitat was the black-throated sparrow. Only one individual was detected; the species is rare at AZRU,

which may explain why it was not seen in the pure shrubland habitat. The number of species detected was relatively high (20 species) in the agricultural habitat; this is a relatively small habitat patch surrounded by shrubland and riparian areas, which influence the birds using the area.

The pattern of relative abundance of birds across habitats differs from species-richness patterns. Although the highest relative abundance occurred within agricultural habitat, this was mostly due to the large numbers of Canada geese and European starlings, both flocking species, detected during point-count surveys within that habitat type. The second-highest relative abundance occurred within shrubland habitat, which had the lowest species richness. The large numbers of mourning doves and violet-green swallows detected within this habitat contributed to high total abundance. The habitat with the highest number of species detected, mixed shrubland/riparian, had the lowest relative abundance. Eight species were found in all habitat types: black-billed magpie, black-capped chickadee (*Poecile atricapillus*), black-chinned hummingbird (*Archilochus alexandri*), black-headed grosbeak (*Pheucticus melanocephalus*), Bullock's oriole (*Icterus bullockii*), European starling, house finch, and western meadowlark (*Sturnella neglecta*).

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Ponderosa pine woodlands amid lava flows, El Malpaís National Monument.

El Malpaís National Monument

Background

El Malpaís National Monument was established relatively recently (in 1987), and encompasses 46,246 ha (114,277 acres) in the northwestern corner of New Mexico. Volcanic features such as lava flows, cinder cones, pressure ridges, and complex lava tube systems dominate the landscape. Prominent vegetation types are ponderosa pine and pinyon-juniper forests with grassland understories. Ecotones of the lava edge typically consist of pinyon-juniper and aspen woodlands, and some ancient Douglas-fir trees are found within lava fields.

Information on ELMA's avian resources existing prior to this survey includes a vegetation and wildlife inventory report (Lightfoot et al. 1994) with a list of plants and wildlife species, including birds, of ELMA in its appendix. A bird checklist by Hvenegaard (1989) includes codes for abundance, seasonal occurrence, and habitats. Several references indicate potential habitat in ELMA for the Mexican spotted owl (*Strix occidentalis lucida*).

Survey design

Point-count surveys were conducted in five habitat types: grassland, pinyon-juniper, ponderosa pine, mixed pinyon-juniper/ponderosa pine, and shrubland. The avian inventory in ELMA was initiated in 2002. That year, we established 39 point-count stations; 13 of the previously defined 100 random points were selected based on accessibility and surveyability. We were unable to access several random points in ELMA due to topography, so in addition to the 13 random points selected, we established 26 points along a marked trail through otherwise inaccessible lava fields, and in those habitats not represented by the random points. In 2003, 30 additional point-count stations were surveyed; 9 were random points and 21 were non-random points (Map 3).

Survey effort

We conducted avian inventory surveys at ELMA during the 2002 and 2003 breeding seasons (May 19–July 10). Three breeding-season surveys were conducted each year,

for a total of 207 point-count surveys at 69 point-count stations in the five habitat types (Table 7). **Incidental observations and area-search surveys** also were completed during three survey days of each breeding season, with an emphasis on habitat that was not adequately covered in point-count surveys. One day of a **non-breeding winter survey** was conducted on February 10, 2003.

Inventory results

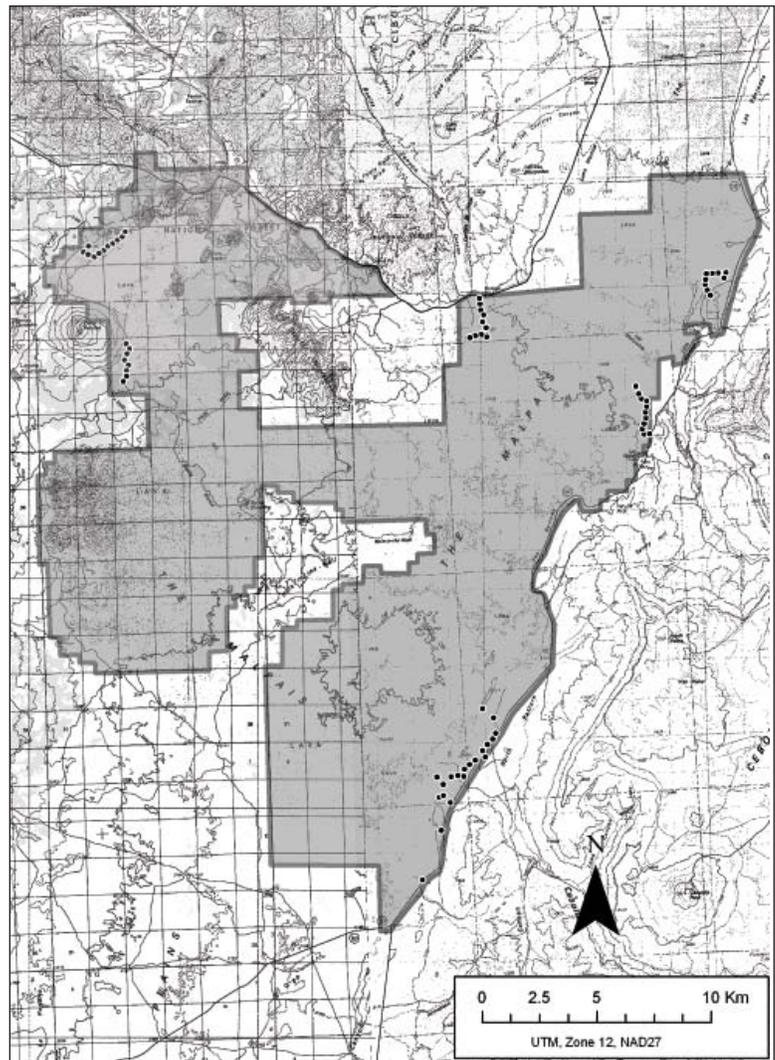
Total number of individuals and species detected by all methods. We detected 1,342 birds of 70 species during point-count surveys and 142 birds of 52 species during area-search surveys in 2002 and 2003 (Tables 7, 8, and 9), for a total of 1,484 birds of 75 different species. Five species were not detected during point counts; barn swallow (*Hirundo rustica*), common nighthawk (*Chordeiles minor*), curve-billed thrasher (*Toxostoma curvirostre*), greater roadrunner, and red-breasted nuthatch (*Sitta canadensis*) were detected only during incidental observations and area-search surveys. A list of species detected at ELMA during the inventory, and any breeding evidence observed, is contained in Table 10.

Species distribution across habitats. Of the 70 species recorded during point-count surveys, we detected the greatest number of species (57; 81.4%) in **ponderosa pine habitat**, eight of which were species that were only detected in this habitat type (Table 7). **Pinyon-juniper** and **mixed pinyon-juniper/ponderosa pine habitats** also had high species richness (47; 67.1% and 45; 64.3%, respectively). Within these habitats, three species, canyon towhee (*Pipilo fuscus*), dusky flycatcher (*Empidonax oberholseri*), and Gambel's quail (*Callipepla gambelii*), were specific to pinyon-juniper, while only one species, rufous-crowned sparrow (*Aimophila ruficeps*), was detected only within the mixed pinyon-juniper/ponderosa pine habitat.

Relative abundance across habitats. During point-count surveys, 12.4% of all species detected were found in grassland habitats, 27% in pinyon-juniper, 42.3% in ponderosa pine, 14.8% in mixed pinyon-juniper/ponderosa pine, and .04% in shrubland habitats. Table 7 shows each species's relative abundance across the dominant habi-

tats surveyed, adjusted for the number of point counts conducted in each habitat (i.e., weighted by effort).

Of the 16 species that were detected in only one of the five habitats, most were found in ponderosa pine. Seven species were found in all of the five habitats surveyed: ash-throated flycatcher (*Myiarchus cinerascens*), Cassin's kingbird (*Tyrannus vociferans*), lark sparrow (*Chondestes grammacus*), northern mockingbird (*Mimus polyglottos*), pinyon jay (*Gymnorhinus cyanocephalus*), rock wren (*Salpinctes obsoletus*), and Say's phoebe (*Sayornis saya*). For the most part, species reached their highest abundance in habitats with which they are commonly associated. For example, Grace's warbler (*Dendroica graciae*), a bird of ponderosa pine forests, was most common in the ponderosa pine habitat surveyed,



Map 3. Bird point-count stations in El Malpaís National Monument.



Spotted towhee (*Pipilo maculatus*).

but was also detected in mixed pinyon juniper/ponderosa pine forests.

The pinyon-juniper and ponderosa pine habitats in Table 7 are comprised of relatively monotypic stands of ponderosa pine or pinyon-juniper and areas in which lava is a dominant habitat feature. The areas dominated by lava usually have considerably more deciduous vegetation, such as a well-developed shrub layer and/or stands of aspen, than the ponderosa pine and pinyon-juniper habitats without a major lava component. When data for habitats with lava are separated out from data for the more homogeneous stands, it is apparent that the presence of deciduous vegetation, aspen, and a well-developed shrub layer influences the distribution and abundance of species normally associated with these attributes (e.g., spotted towhee [*Pipilo maculatus*], mountain bluebird [*Sialia currucoides*]; Table 8). Not surprisingly, rock wrens are considerably more abundant in habitats with lava.

Species abundance (density estimates).

We were able to calculate robust density estimates for two species, ash-throated flycatcher and Cassin's kingbird, using the

ELMA data (Table 11). Sample sizes were adequate because these species were detected in almost every habitat type sampled.

Jackknife estimators of species richness.

Over all habitat types, we detected 85.6% of the species estimated to be present at ELMA (Table 12). This percentage falls below the goal of documenting at least 90% of the species present. Because jackknife estimates do not take into account species detected outside of point counts, detecting 90% of the estimated total species at ELMA may not be possible without considerably more point-count surveys. The results of this calculation are presented in the last column of Table 12.

Species and habitats of conservation concern: Current surveys and previous records.

Three USFWS species of conservation concern (USFWS 2002) were detected in ELMA: gray vireo (*Vireo vicinior*), in pinyon-juniper habitat; black-throated gray warbler (*Dendroica nigrescens*), in pinyon-juniper, ponderosa pine, and mixed pinyon-juniper/ponderosa pine habitats; and Grace's warbler, in ponderosa pine and pinyon-juniper habitats. The gray vireo is also on the New Mexico list of threatened species (NMGF 2006).

Nineteen of the species that occur or are probably present in ELMA are PIF priority species (Table 13). Five species are also TNC target species (Tuhy et al. 2002). PIF species are associated with each of the habitats found in ELMA.

Non-breeding winter surveys. We were able to conduct only one winter survey at ELMA due to snowy weather that limited access. Table 14 reflects this; relatively few of the species likely to winter in ELMA were detected during the limited area-search survey.

Discussion

Geologic influence. Several of the five habitats surveyed are influenced by lava flows, which contribute to a high degree of habitat "patchiness" and the juxtaposition of numerous habitat types and features. The areas dominated by lava also usually have more deciduous vegetation, such as a well-developed shrub layer and/or aspen stands,

than more homogeneous ponderosa pine and pinyon-juniper stands without lava as a major component. This variety of landscapes and habitats contributes to a relatively diverse avifauna.

The presence of lava apparently affects plant species composition and structure. Pinyon-juniper and ponderosa habitats dominated by a lava ground cover usually had considerably more shrub cover, and often had more aspen cover than habitats without lava. This affected the abundance and distribution of some bird species. Every species detected in areas of mixed lava/pinyon-juniper habitat also was found in the pinyon-juniper habitat without the lava component but, for the species detected in both habitats, the relative abundance in the lava/pinyon-juniper habitat was often almost three times that of the pure pinyon-juniper habitat. Three species detected in lava/ponderosa pine were not found in pure ponderosa pine habitat (Say's phoebe, warbling vireo [*Vireo gilvus*], and western scrub jay [*Aphelocoma californica*]), even though twice as many surveys were conducted in the pure ponderosa pine habitat. Warbling vireo was detected only in the lava/ponderosa pine habitat type, likely due to the occurrence of aspen trees associated with lava-dominated areas.

Habitat and species richness. Three habitat types had relatively high numbers of species: ponderosa pine (57 species), pinyon-juniper (47 species), and mixed pinyon-juniper/ponderosa pine (45 species). Nine species were detected only in ponderosa pine habitat: Bullock's oriole, green-tailed towhee (*Pipilo chlorurus*), ladder-backed woodpecker (*Picoides scalaris*), Lincoln sparrow (*Melospiza lincolnii*), red-tailed hawk (*Buteo jamaicensis*), Steller's jay (*Cyanocitta stelleri*), Townsend's solitaire (*Myadestes townsendi*), yellow-rumped warbler (*Dendroica coronata*), and turkey vulture (*Cathartes aura*). Three species, canyon towhee, dusky flycatcher, and Gambel's quail, were specific to pinyon-juniper. Only one species, the rufous-crowned sparrow, was detected only within the mixed pinyon-juniper/ponderosa pine habitat. Not surprisingly, the black-throated sparrow was only detected in shrubland.

New finds. We detected two species that

were previously unrecorded within the park unit: black-throated sparrow and Gambel's quail.

El Morro National Monument

Background

El Morro National Monument, located in western New Mexico, is dominated by a sandstone monolith rising about 9 m (200 ft) above the valley floor. The dominant habitat type is pinyon-juniper woodland, with variable amounts of more open, grassy areas and patches of oaks and ponderosa pine. The area contains habitat features that are unique in the landscape, such as an historic pool and a box canyon.

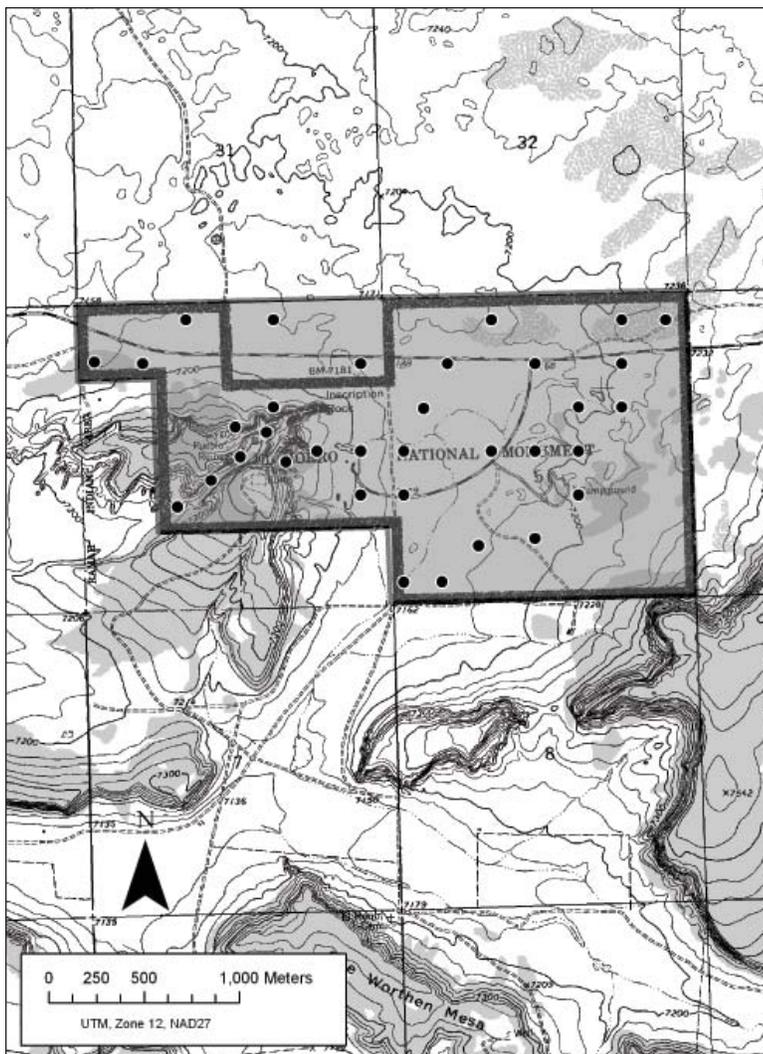
Information on biological resources prior to the avian inventory includes an electronic list of plant species; McCallum (1981) and Stolz (1986) are the primary references for this list. An historical look at the vegetation is provided in Schackel (1984) through the use of comparison photography; the photographs show 100 years of effects from human activity at the monument. In addition, ELMO has an herbarium collection.

The monument has a checklist of birds, compiled in 1999, that includes 117 observed species. There is also an electronic list of bird species, with most of citations attributable to "Cibola 1997." A few citations refer



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Ponderosa pines growing against the base of box canyon cliffs, El Morro National Monument.



Map 4. Bird point-count stations in El Morro National Monument.

to “FWS” and, several, “DGF 1996.” Other checklists include an annotated list by McCallum (1979) and a list by Stolz (1999). An Investigator’s Annual Report (IAR) describes a one-day survey for Mexican spotted owl that found no evidence of nesting and no vocal response to calls. The IAR notes that habitat may be marginal.

Survey design

Point-count surveys. Point counts were established in four dominant habitat types: grassland, oak/pinyon-juniper, pinyon-juniper, and pinyon-juniper/grassland. During the 2001 field season, seven random point-count stations each were established in grassland and pinyon-juniper habitats. A third transect of non-random points was established in a narrow strip of mixed de-

ciduous and pinyon-juniper woodland, with scattered oaks and ponderosa pine, along the base of the cliffs.

In 2002, 20 random point-count stations were selected from a pool of 100 random points (Map 4), for a total of 34 points overall. One hundred random points were generated and stratified according to habitat. Points that fell on steep, inaccessible slopes were relocated to nearby, contiguous terrain. From the pool of random points, points were selected for accessibility. Non-random points were established to fill in gaps between random points (i.e., when random points were >500 m [1,640 ft] apart, points were established on the bearing between random points at a minimum of 250 m [820 ft] apart). All point-count stations were located at least 250 m apart.

Area searches and incidental observations. Area searches were conducted around the visitor center, ruins, mesa-top trail, and campground, the intent being to thoroughly sample the entire range of habitats, including the box canyon. Incidental observations were recorded when newly detected species were encountered between point-count surveys.

Survey effort

We made four visits to conduct point counts per breeding season in 2001, and three per breeding season in 2002, at a total of 34 point-count stations in the four habitat types where stations were established (Table 15). **Incidental observations and area-search surveys** also were completed on three days during each breeding season, with an emphasis on habitats that were not adequately covered in point-count surveys (e.g., cliffs, deciduous/pinyon-juniper mix, ponderosa pine; Table 16). Scheduled **non-breeding winter surveys** were cancelled due to weather conditions that prevented them from being conducted.

Inventory results

Total number of individuals and species detected by all methods. We detected 892 birds of 56 species during point-count surveys, and 175 birds of 47 species during area-search surveys in 2001 and 2002 (Tables

15, 16), for a total of 1,067 birds of 63 different species. Seven species were detected only during area-search surveys: acorn woodpecker (*Melanerpes formicivorus*), common nighthawk, dusky flycatcher, great horned owl (*Bubo virginianus*), horned lark (*Eremophila alpestris*), warbling vireo, and western kingbird (*Tyrannus verticalis*). A list of species detected at ELMO during the inventory, and any breeding evidence observed, is contained in Table 17.

Species distribution across habitats. Of the 56 species detected during point-count surveys, the highest number (40 species, 71.4%) was detected in the **oak/pinyon-juniper habitat**, 11 of which were species that were only found in this habitat (Table 15). **Pinyon-juniper** and **pinyon-juniper/grassland habitats** also had high species richness (39; 69.6% and 28; 50%, respectively); both had four species that were only detected in each of these habitat types (Table 15). The lowest species richness was found in **grassland habitats**, which also had the lowest survey effort, with only five point-count stations.

Relative abundance across habitats. During point-count surveys, 15.2% of all species detected were found in grassland habitats, 30.7% in oak/pinyon-juniper, 36.3% in pinyon-juniper, and 17.7% in pinyon-juniper/grassland habitats. Table 15 shows each species's relative abundance across the dominant habitats surveyed, adjusted for the number of point counts conducted in each habitat (i.e., weighted by effort).

Several species (28; 50%) reached their highest relative abundance in oak/pinyon-juniper habitat, and seven species were detected only in this habitat. One species, the loggerhead shrike (*Lanius ludovicianus*), was detected only within the grassland habitat type.

Species abundance (density estimates). To determine density for species with >60 detections, we used the DISTANCE program. We obtained robust results (well-balanced variance sources and <3 parameters) in the detection-curve model that incorporated the complete datasets (i.e., when data from all habitats were combined), with coefficients of variation of <30% for three species at ELMO (Table 18). We were unable to obtain >60 detections for species within each habitat type



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Peregrine falcon (*Falco peregrinus*).

and thus were unable to stratify among types. In modeling, we attempted to optimize coefficients of variation by truncating outliers at various distances, decreasing the number of parameters included in the models, and balancing the two sources of variance: sample size and probability of detection.

Jackknife estimators of species richness. Over all habitat types, we detected 79.3% of the species estimated to be present at ELMO (Table 19). This percentage falls below the goal of documenting at least 90% of the species present. However, jackknife estimates do not take into account species detected outside of point-count sampling. The results of this calculation are presented in the last column of Table 19.

Species and habitats of conservation concern: Current surveys and previous records. We detected five USFWS species of conservation concern (USFWS 2002) in ELMO: peregrine falcon (*Falco peregrinus*), Lewis's woodpecker, loggerhead shrike, gray vireo, and Grace's warbler. We confirmed breeding by peregrine falcons (in a rock cliff) and Lewis's woodpecker (in a large ponderosa pine). The peregrine falcon and gray vireo are also on the New Mexico list of threatened species; the loggerhead shrike is considered a sensitive species in New Mexico (NMGF 2006). Nineteen of the

species that occur or are probably present in ELMO are PIF priority species (Table 20). Six species are also TNC target species (Tuhy et al. 2002).

Discussion

Species of conservation concern. In addition to conducting point counts in ELMO's four dominant habitat types, we performed area searches of habitats not sampled by point-count surveys, including areas with large ponderosa pines and snags of ponderosa pine with a fairly open understory comprised mostly of grass, which provide the habitat attributes required by several ponderosa pine associates of conservation concern (Table 19). In particular, such areas provide breeding habitat for Lewis's woodpeckers, which were found nesting (i.e., feeding nestlings) in a large ponderosa pine, and foraging in the open, grassy areas below a cliff with scattered ponderosa pine in a matrix of open pinyon juniper. The nesting Lewis's woodpeckers of ELMO are near or at the southern limit of their nesting range (see Tobalske 1997). We also documented breeding by peregrine falcons within the monument.

Influence of pinyon-juniper and oak in habitat types. Pinyon-juniper is a component of most ELMO habitats, and its close proximity to grassland habitats likely influences bird species composition and abundance in that habitat. The presence of oak in pinyon-juniper habitats apparently contrib-

utes to bird community diversity in ELMO. Half of the species detected during point-count surveys reached their highest relative abundance in the oak/pinyon-juniper habitat type, and seven species were detected only in this habitat type, including the gray vireo, a USFWS species of conservation concern (USFWS 2002).

Other habitat types. Several species were found in all habitats except the oak/pinyon-juniper habitat: Bewick's wren (*Thryomanes bewickii*), green-tailed towhee, lark sparrow, northern mockingbird, and vesper sparrow (*Pooecetes gramineus*). Lark sparrow, in particular, was detected often (1.9 birds/point) in all other habitats, probably because these habitats have a more open, grassy understory. Loggerhead shrike (a USFWS species of conservation concern) was the only species found specific to grassland; otherwise, there were no grassland obligates. Most birds found in grassland habitat were also detected in the pinyon-juniper habitat. Generalist species found in all habitats throughout ELMO included Cassin's kingbird, chipping sparrow (*Spizella passerina*), cliff swallow (*Petrochelidon pyrrhonota*), common raven (*Corvus corax*), mourning dove (*Zenaida macroura*), northern flicker (*Colaptes auratus*), western meadowlark, and western scrub jay.

Petroglyph National Monument

Background

Petroglyph National Monument is located in central New Mexico, within the city of Albuquerque, about three km (two mi) west of the Rio Grande River. The monument has five major volcanic cones and a 27-km escarpment that formed when the volcanoes erupted about 130,000 years ago. The monument is within a region that represents the transition zone between the Great Plains, the Great Basin, and Chihuahuan Desert grasslands.

The top of the mesa is southwestern grassland dominated by several species of grasses, forbs, and widely scattered junipers. The bottom of the mesa is plains-mesa sandscrub dominated by shrubs and forbs. Between these two habitats is the escarpment of rocky slopes. One intermittent stream flows for less than three km (two mi) within monument



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Shrubland habitat in Boca Negra Arroyo, Petroglyph National Monument.

boundaries. Residential and other forms of development borders much of the monument. Changes to these surrounding lands, including urban development and increasing numbers of exotic and invasive species, are likely to affect natural resources within monument boundaries.

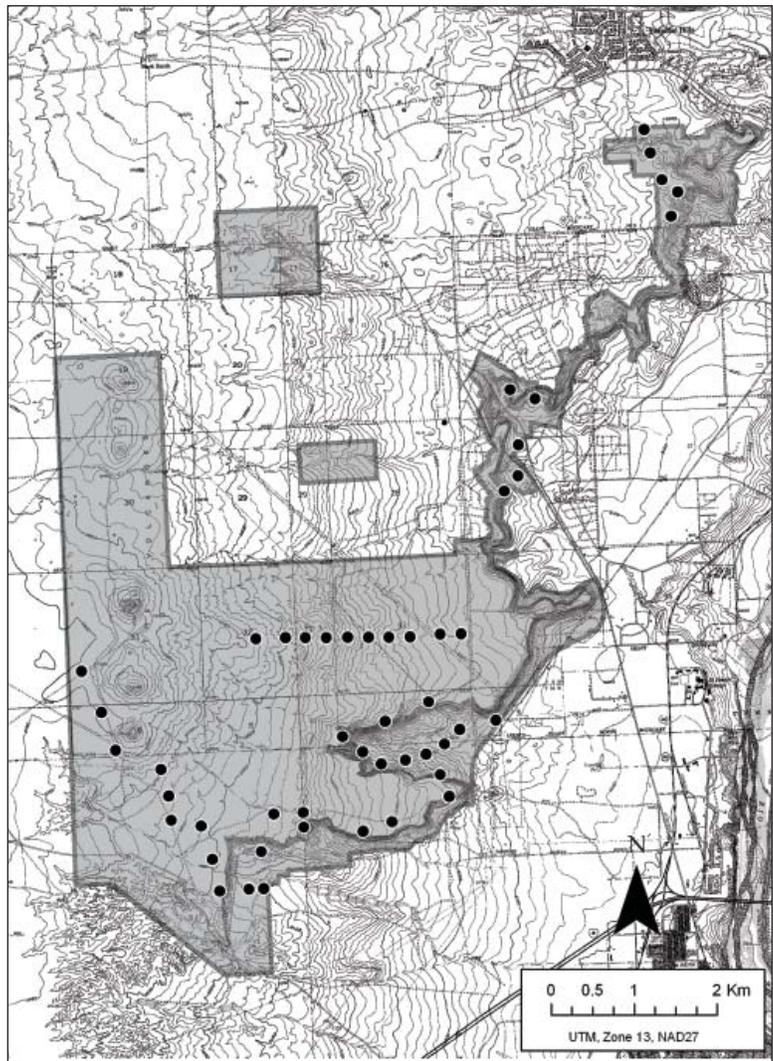
Existing information about PETR's birds prior to this inventory included a survey of biological resources conducted in the mid-1990s to provide baseline biological information on the monument (Parmenter et al. 1996). A bird checklist accompanied that report. In addition, neotropical bird specialist Hart R. Schwarz developed a bird checklist (Schwarz 1998) with 111 species detected within the monument, and has since added 15 species to this list (Schwarz 2002a).

Survey design

Point-count surveys were conducted in three main habitat types: grassland, shrubland, and urban. We established 49 point-count stations (Map 5). One hundred random points were generated by computer and stratified according to habitat. These random points were used whenever possible; however, selection of points was based on accessibility. Points falling on steep, inaccessible slopes were moved, whenever possible, to nearby contiguous terrain. Non-random points were established to fill in gaps between random points (i.e., when random points were >500 m [1,640 ft] apart, points were established on the bearing between random points at a minimum of 250 m [820 ft] apart). All point-count stations were located at least 250 m apart, with at least a 200-m (656-ft) buffer between different habitat types.

Survey effort

In 2001, point-count surveys were conducted on 29 points three times during the breeding season. In 2002, we surveyed an additional 20 points three times during the breeding season. **Incidental observations** and **area-search surveys** also were completed, with an emphasis on habitats that were not sampled by point-count surveys (e.g., the intermittent stream); they were conducted before, during, and after point-count surveys. **Non-breeding winter surveys** were conducted on three days: December 19 and



Map 5. Bird point-count stations in Petroglyph National Monument.

20, 2001, and February 9, 2003.

Inventory results

Total number of individuals and species detected by all methods. At PETR, we recorded 1,517 individuals of 38 species during point-count surveys and 117 detections of 29 species during area-search surveys in 2001 and 2002 (Tables 21, 22), for a total of 1,634 birds of 44 different species. We detected one species that was previously unrecorded in the park unit: black-headed grosbeak. This species also was recorded as new to PETR (during the second year of our inventories) by H. R. Schwarz (Schwarz 2002a). Six species were detected during incidental observations and area-search surveys that were not detected during point counts: American crow, common poorwill, Gambel's quail,



Lark sparrow (*Chondestes grammacus*).

green-tailed towhee, Swainson's hawk (*Buteo swainsoni*), and violet-green swallow (*Tachycineta thalassina*). A list of species detected at PETR, and any breeding evidence observed, is shown in Table 23.

Species distribution across habitats. Of the 38 species detected during point-count surveys, we recorded the greatest diversity of species in **shrubland** (32; 84.2%) and **grassland** (28; 73.7%) habitats. The lowest numbers of species were found in the **urban habitat** (19; 50%). Six species were detected only in shrubland habitats and three only in grassland habitats. These habitats each had features that contributed to their suitability for some species. Canyon wrens (*Catherpes mexicanus*), for instance, were detected at the shrubland habitat sites, located below and next to the rocky slopes of the escarpment. Orioles and mockingbirds were detected in the widely scattered trees of grassland areas. Eastern meadowlarks were common in grassland habitat; their high relative abundance likely reflects the fact that their song can be detected from large distances. The house sparrow was abundant in the few urban habitat surveys conducted, and also was much more common in the shrubland habitats, located next to urban areas, than in the grassland habitats, which are not adjacent to housing. The European starling was detected only during surveys in urban habitat.

Relative abundance across habitats. During point-count surveys, 43.3% of all species detected were found in grassland habitats,

44.1% in shrubland, and 12.5% in urban habitats. Table 21 shows each species's relative abundance across the dominant habitats surveyed, adjusted for the number of point counts conducted in each habitat (i.e., weighted by effort).

Of the 13 most widely distributed species found in all three habitat types, 11 species (84.6%) were relatively more abundant in urban habitat. Many of these are associated with human development, including house sparrow, house finch, and barn swallow, or are attracted by the landscape plants and water associated with housing developments (e.g., western kingbird, northern mockingbird, mourning dove).

Sixteen species were most abundant in shrubland habitat. Many of these species are shrubland associates, including black-throated sparrow and crissal thrasher (*Toxostoma crissale*). In addition, these species include those that use rocky slopes and cliffs for nesting, due to the close proximity of the escarpment to the shrubland habitat surveyed.

Five species were most abundant in grassland habitats. Of these, horned lark and eastern meadowlark were considerably more abundant in grassland than the other predominant habitat types.

Species abundance (density estimates). To determine density for species with >60 detections, we used the DISTANCE program. We obtained robust results (well-balanced variance sources and <3 parameters) in the detection-curve model that incorporated the complete datasets (i.e., when data from all habitats were combined), with coefficients of variation of <30% for four species (Table 24). We also were able to calculate density estimates for two species in grassland habitat: eastern meadowlark and horned lark.

Jackknife estimators of species richness. Over all the habitat types, we detected 85% of the species estimated to be present at PETR (Table 25). This percentage falls below the goal of documenting at least 90% of the species present, due primarily to sample-size limitations. Also, jackknife estimates do not take into account species detected outside of point-count sampling. The results of this calculation are presented in the last column

of Table 25.

Species and habitats of conservation concern: Current surveys and previous records.

No USFWS species of conservation concern were detected in PETR during this survey.

Seven of the species that occur or are probably present in PETR are PIF priority species (Table 26). Two species are also TNC target species (Tuhy et al. 2002). PIF species are associated with each of the habitats found in PETR.

Non-breeding winter surveys. A total of 12 species was detected; two were found only during winter or migration season (Table 27).

Discussion

Influence of urban development. The bird community of PETR is comprised of species commonly found in grassland and shrubland habitats. It is also influenced by urban development, primarily housing, that borders the park, mostly on its eastern side. This urban habitat increases the number of buildings, landscape plants, water, and bird feeders in the area, providing resources for several species that are more common in human-modified habitats. For example, house sparrow, house finch, barn swallow, and European starling nest in or around buildings; other species are attracted by the landscape plants and water associated with housing developments (e.g., western kingbird, northern mockingbird, mourning dove). Overall, 17 species were most abundant in urban habitat, and the effects of urban development on the bird community extend beyond those habitats. Of the species that were most abundant in urban habitat, most were also widespread across the park, detected in every habitat.

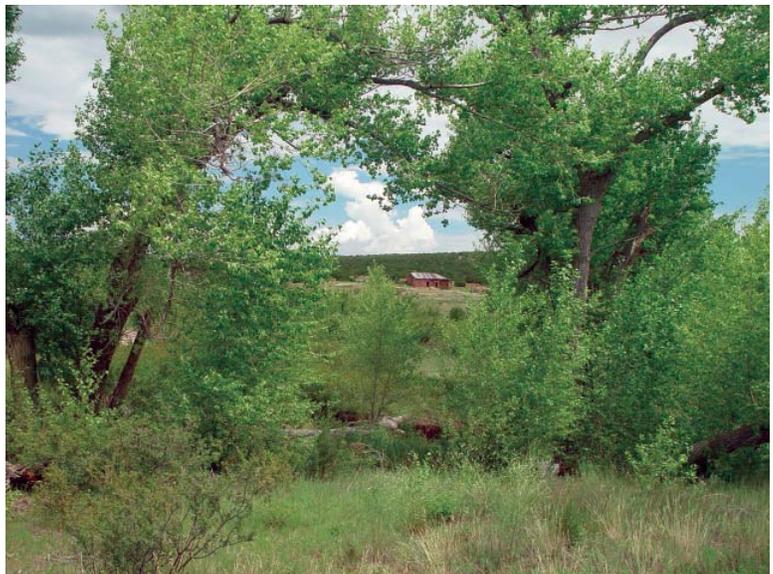
Salinas Pueblo Missions National Monument

Background

Salinas Pueblo Missions National Monument is located near the Cibola National Forest in central New Mexico. The monument comprises approximately 430 ha (1,062 acres) and consists of three units: Abó, Quarai, and Gran Quivira. The monument contains prehistoric Native American pueblos and Franciscan mission ruins.

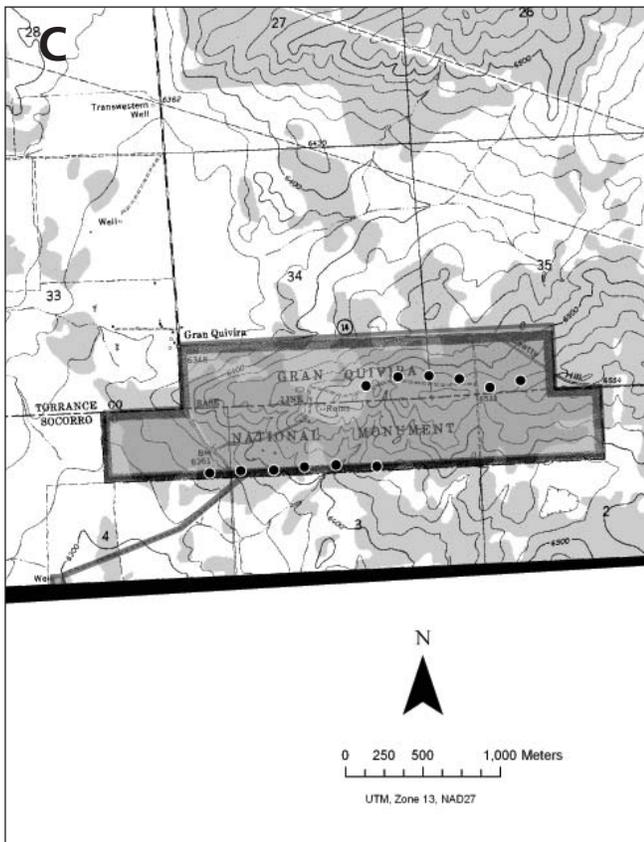
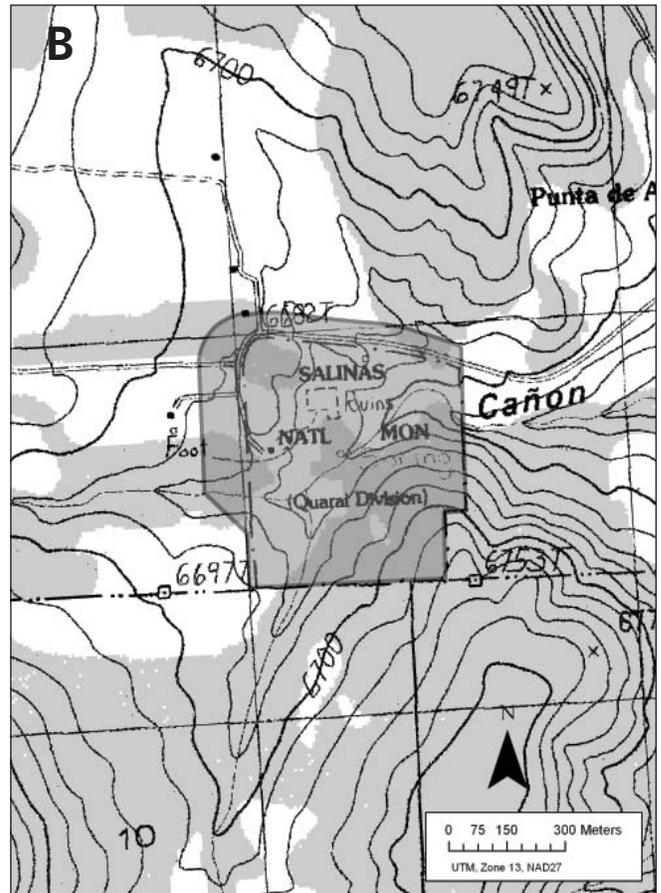
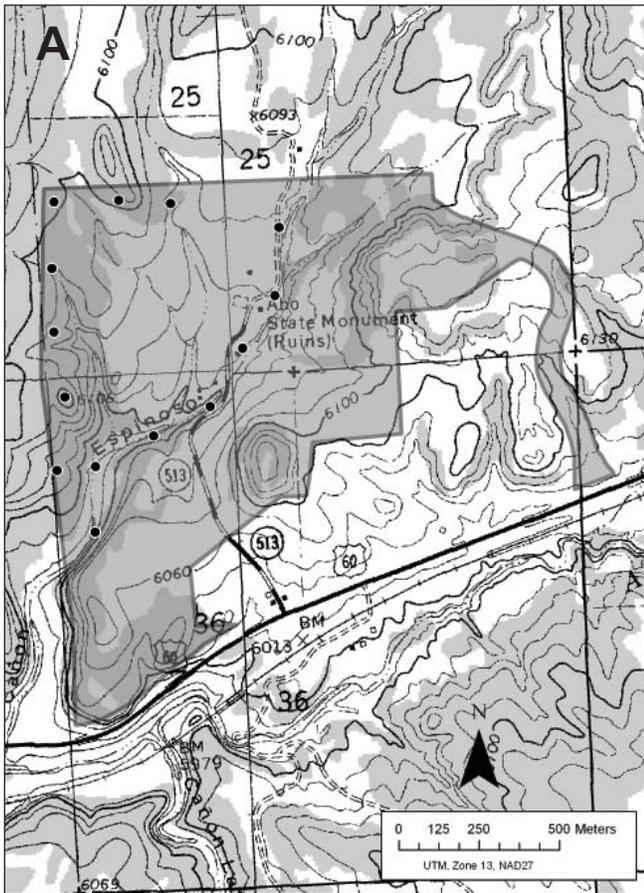
The units of SAPU are situated at the foothills and to the southeast of the Manzano Mountains. Dominant vegetation types are pinyon-juniper and associated desert shrubland, and the flora is primarily Chihuahuan Desert and southern Great Plains. The Quarai unit has a perennial water source (one drainage with two mapped springs) that supports a more diverse vegetative community than the other units, including considerable riparian habitat, many berry-laden plants, and, consequently, a considerably diverse avifauna that includes several migrant species, such as gray catbird (*Dumetella carolinensis*). Abó also has some riparian vegetation, with two pools that hold water year-round.

The predominant vegetation types for the Abó unit consist of pinyon-juniper woodlands, salix-cottonwood riparian, oak brush, and tamarisk. Efforts have been made to control tamarisk both inside and outside this unit. Riparian communities have been described as cottonwood-willow, typha wetland, rose-horsetails, and pseudoriparian meadows. The Quarai uplands consist of pinyon-juniper-berberis woodlands, oak/pinyon woodlands, open, early successional pinyon woodland, ponderosa pine, sagebrush-horsebrush stands, and various disturbed meadows and apple orchards remnant of historic occupation.



Cottonwood-willow riparian habitat, Abó Unit, Salinas Pueblo Missions National Monument.

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Map 6. Bird point-count stations in Salinas Pueblo Missions National Monument.

- 6A: Abó unit.
- 6B: Quarai unit.
- 6C: Gran Quivira unit.

Considerable information exists regarding bird records for SAPU due to recent work by H. R. Schwarz. A study by Scott (1979) included a bird list, but a letter from the New Mexico Department of Game and Fish (Hubbard 1980) criticized the bird portion of this report. Aside from some observations in park records, a 1956 checklist (author unknown) seems to be the only other historical source. In 1996, the monument compiled a checklist of birds. Since then, this list has been supplemented with records from Schwarz (2002b), who conducted breeding bird surveys at Gran Quivira (Schwarz 2002c) and spring counts at Quarai (1998–2002) for International Migratory Bird Day. Schwarz provided us with information on previously unreported species and new breeding records, which we used to update the NPSpecies lists for SAPU.

Survey design

Point-count surveys were conducted in two habitat types: pinyon-juniper and riparian/shrubland. Due to the small size of each of SAPU's three units, no random points were computer-generated. Instead, we initially (in 2001) established a total of 26 point-count stations along transect lines in two habitat types: pinyon-juniper and riparian/shrubland (Map 6). We placed one transect with seven points in the riparian habitat at the Abó site. We established three transects in the pinyon-juniper habitats, one at the Abó site (with seven points) and two at the Gran Quivira site (with six points each). All point-count stations were located at least 250 m (820 ft) apart, with a minimum 200-m (656-ft) buffer between habitat types. Due to its small size, we were unable to set up transects at the Quarai site; therefore, area-search surveys were conducted, covering the entire site. In addition, area searches were conducted in and around the ruins at each site.

In 2002, as there were ongoing Breeding Bird Surveys at the Gran Quivira site (conducted by H. R. Schwarz), the inventory included only the Quarai and Abó sites. In 2002, area searches were conducted that covered each dominant habitat type in the two sites, including the ruins.



Scott's oriole (*Icterus parisorum*).

Survey effort

We conducted avian inventory surveys at SAPU during the 2001 and 2002 breeding seasons (May 19–July 10). In 2001, we conducted 26 **point-count surveys** in two habitat types: 19 points in pinyon-juniper and seven points in riparian/shrubland habitat in Abó and Gran Quivira. All points were surveyed four times throughout the season. **Incidental observations and area-search surveys** also were completed (including area searches at Quarai) four times during the breeding season, with an emphasis on habitat that was not adequately covered in point-count surveys. In 2002, point-count surveys were not conducted. Instead, we conducted area searches in Quarai and Abó, during three visits distributed across the breeding season. At SAPU, four **non-breeding winter surveys** were conducted, on December 12 and 18, 2001, January 26, 2002, and February 8, 2003.

Inventory results

Total number of individuals and species detected by all methods. We detected a total of 776 individuals of 37 species during point-count surveys and 1,441 individuals of 73 species during area-search surveys (Tables 28, 29), for a total of 2,217 birds of 75 different species. Many more species were detected during area searches than during point counts, largely because no point counts were conducted at Quarai. A list of species detected at SAPU during the inventory, and any

breeding evidence observed, is contained in Table 30.

Species distribution across habitats. Of the 37 species recorded during point-count surveys, we detected 31 species (83.8%) in **pinyon-juniper habitat** and 28 species (75.7%) in **riparian/shrubland habitat** (Table 28). Nine species of birds were found only in the pinyon-juniper type, and six were detected only in the riparian/shrubland type. The majority of species (22; 59.5%) were noted in both of the dominant habitat types surveyed using point counts.

Relative abundance across habitats. During point-count surveys, 66.8% of all species detected were found in pinyon-juniper habitats, and 33.2% in riparian/shrubland habitats (Table 28). Because we examined relative abundance using point-count data, the data refer only to the Abó and Gran Quivira sites for one year (2001).

Of the 22 species found in both habitat types (i.e., pinyon juniper and riparian/shrubland), 15 species (68.2%) had a higher relative abundance in riparian/shrubland than in pinyon-juniper habitats. The species that were more abundant in pinyon-juniper were generally those most often associated with pinyon-juniper woodlands, for instance, juniper titmouse (*Baeolophus ridgwayi*).

Species abundance (density estimates). To determine density for species with >60 detections, we used the DISTANCE program. We obtained robust results (well-balanced variance sources and <3 parameters) in the detection-curve model that incorporated the complete datasets (i.e., when data from all habitats were combined), with coefficients of variation of <30% for two species at SAPU (Table 31). We also were able to calculate density estimates for one species, the juniper titmouse, within pinyon-juniper habitat.

Jackknife estimators of species richness. Over all habitats, close to 80% of the estimated species richness was documented. These analyses were conducted with point-count data from 2001; they do not account for species detected during area-search surveys. The results of this calculation are presented in the last column of Table 32.

Species and habitats of conservation concern: Current surveys and previous records. One USFWS species of conservation concern (USFWS 2002) was detected in SAPU during these surveys: black-throated gray warbler.

Thirteen of the species that occur or are probably present in SAPU (NPSpecies) are PIF priority species (Table 33). Three species are also TNC target species (Tuhy et al. 2002). PIF species are associated with each of the habitats found in SAPU.

Non-breeding winter surveys. A total of 25 species was detected during non-breeding winter surveys. Nine species use the area during winter or migration but do not breed there. The results are shown in Table 34.

Discussion

Habitat diversity. Perennial water resources at SAPU support relatively diverse riparian habitat, including stands of large cottonwoods and densely vegetated shrub layers. Quarai also has many fruiting shrubs that provide food resources for several migrating, wintering, and breeding species. This habitat diversity supports a highly diverse bird community; the majority of species detected during this inventory were found primarily in riparian habitat, especially migrant species such as gray catbird, MacGillivray's warbler (*Oporornis tolmiei*), and yellow warbler (*Dendroica petechia*). SAPU provides habitat for 13 species of conservation concern, including migrants and breeding birds (Table 33). In particular, recent spring surveys for International Migratory Bird Day (Schwarz 2002d; NPSpecies) found that Quarai provides important stopover habitat for migrant birds in the region.

Yucca House National Monument

Background

Yucca House National Monument, located in southwestern Colorado, was established to protect a 14-ha (35-acre) area containing an archeological site. The monument is located on the edge of an extensive farming and ranching area, much of which is irrigated. Neighboring lands support a variety of habitats. Areas west of the monument consist of

pinyon-juniper woodland; to the north and east, scattered shrubland areas, including big sagebrush (*Artemisia tridentata*), are interspersed with agricultural land. The area has perennial water in the form of springs, seeps, ponds, irrigation canals, and some trees and shrubs often associated with riparian habitats. We have called the areas of perennial waters (ponds, irrigation canals) “riparian-type,” because they support vegetation normally associated with natural riparian streams.

Our avian inventory included 469 ha (1,159 acres) of surrounding agricultural and range land. A portion of this area is southeast of the monument, on the east side of the highway west of Mesa Verde National Park. It is comprised of pinyon-juniper habitat.

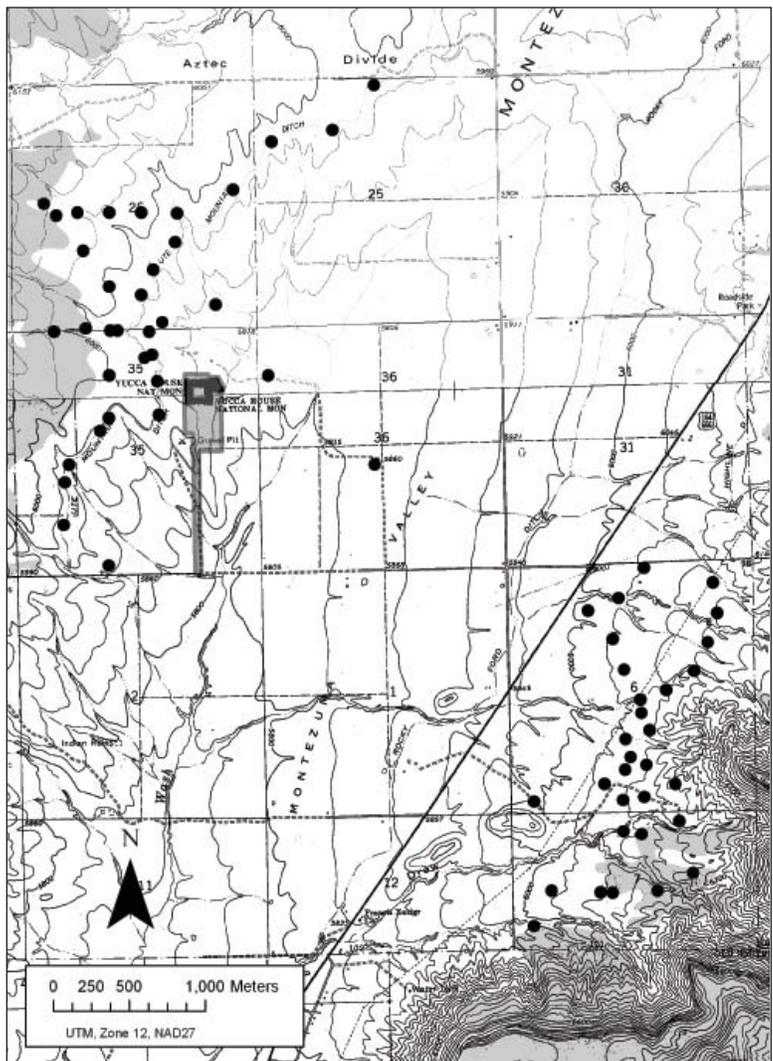
Because protection and research of cultural resources is YUHO’s primary charge, research on plant and animal species has been limited, and data have been lacking. Richert and Brandegee (1941) provided an early bird list for YUHO, including common and scientific names and relative frequency. A current list has been compiled by Marilyn Colyer (Mesa Verde NP staff) from in-house records and observations; it includes indications of habitat, relative abundance, residency, and nativity status. Other available recent information consists only of informal lists, including a narrative list by Versaw (1991).

Survey design

Point-count surveys. Point counts were conducted in four habitat types: agricultural, pinyon-juniper, riparian-type/upland, and shrubland. Over a three-year period, we established a total of 66 point-count stations (Map 7). In the initial year (2001), no random points were computer-generated. Instead, point-count stations were established along transects with random starts and positioned to sample the dominant habitat types. We established a transect in pinyon-juniper habitat with 14 points. One transect with 10 points was set up in the shrubland habitat. Within the riparian-type zones, we established a transect along a small patch of willow (with four points) and one (with 12 points) along an irrigation ditch bordered by riparian vegetation.



Wetland habitat surrounding Aztec Spring, Yucca House National Monument.



Map 7. Bird point-count stations in Yucca House National Monument and vicinity.



Black-throated gray warbler (*Dendroica nigrescens*).

For the 2002 and 2003 field season, we used randomly selected points, stratified by habitat, slope, and aspect. Non-random points were established in habitats not represented by the random points, or to fill in gaps between random points (i.e., if random points were >500 m (1,640 ft) apart, we established stations along the bearing of the direct route between random points, such that all point-count stations were located at least 250 m (820 ft) apart, with a 200-m (656-ft) buffer between different habitat types).

Area searches and incidental observations. In all years, area searches were conducted to survey other habitats that were not sampled by point-count surveys, including in and around the ruins. Additional, previously unrecorded species and species exhibiting breeding behavior were recorded during incidental observations.

Survey effort

We conducted avian inventory surveys at YUHO during the 2001–2003 breeding seasons (May 19–July 10). We made four visits during the breeding season in 2001, and three visits each during 2002 and 2003, to a total of 66 **point-count** stations located in the four habitat types (Table 35). **Incidental observations** and **area-search surveys** were conducted on each of the mornings when point-count surveys were conducted. In 2001, we were unable to conduct a scheduled **non-breeding winter bird survey** at YUHO due to a winter storm. Non-breeding winter

area-search surveys were conducted on February 10, 2002, and February 22, 2003.

Inventory results

Total number of individuals and species detected by all methods. We detected a total of 2,054 individuals of 74 species during point-count surveys and recorded 577 birds of 62 species during area-search and incidental surveys in 2001–2003 (Tables 35, 36), for a total of 2,631 birds of 81 different species. Eight species were detected only during area-search surveys: bald eagle (*Haliaeetus leucocephalus*), house sparrow, olive-sided flycatcher (*Contopus borealis*), peregrine falcon, red-necked phalarope (*Phalaropus lobatus*), western bluebird, and yellow warbler. A list of species detected at YUHO during the inventory, and any breeding evidence observed, is contained in Table 37.

Species distribution across habitats. The habitats did not have equal survey effort, but 54 species (73%) were detected in **riparian-type/upland habitat**, 52 species (70.3%) in **shrubland**, 49 species (66.2%) in **pinyon-juniper**, and 20 species (27%) in **agricultural habitat** (Table 35). Within these habitats, nine species were specific to riparian-type/upland, seven species to shrubland, five species to pinyon-juniper, and three species to agricultural habitats.

Relative abundance across habitats. During point-count surveys, 3.8% of all species detected were found in agricultural habitats, 35% in pinyon-juniper, 38.1% in riparian-type/upland, and 23.1% in shrubland habitats. Table 35 shows each species's relative abundance across the dominant habitats surveyed, adjusted for the number of point counts conducted in each habitat (i.e., weighted by effort).

Thirty-two species were most abundant in riparian-type/upland habitat; 16 were most abundant in pinyon-juniper. The shrubland and agricultural habitat types each had 12 species that were relatively more abundant there compared to other habitats. Fourteen species were detected in all four habitat types surveyed.

Species abundance (density estimates). To determine density for species with >60 de-

tections, we used the DISTANCE program. We obtained robust results (well-balanced variance sources and <3 parameters) in the detection-curve model that incorporated the complete datasets (i.e., when data from all habitats were combined), with coefficients of variation of <30% for eight species at YUHO (Table 38). We were able to calculate density estimates for two species within specific habitat types: the lesser goldfinch (*Carduelis psaltria*) within riparian-type/upland habitat, and the spotted towhee within riparian-type/upland and pinyon-juniper habitat.

Jackknife estimators of species richness. Over all habitat types, we detected 80.9% of the species estimated to be present at YUHO (Table 39). This percentage falls below the goal of documenting at least 90% of the species present. However, jackknife estimates do not take into account species detected outside of point-count sampling. The results of this calculation are presented in the last column of Table 39.

Species and habitats of conservation concern: Current surveys and previous records. We detected five USFWS species of conservation concern (USFWS 2002) during the inventory surveys in the area surrounding YUHO: northern harrier (*Circus cyaneus*), peregrine falcon, loggerhead shrike, gray vireo, and black-throated gray warbler. The peregrine falcon also is considered a species of special concern by the State of Colorado (CDW 2006). Seventeen of the species that occur or are probably present in YUHO are PIF priority species (Table 40). Two species are also TNC target species (Tuhy et al. 2002).

Non-breeding winter surveys. We detected a total of 16 species (8 in 2002 and 12 in 2003; Table 41) during non-breeding winter surveys.

Discussion

Species of conservation concern. YUHO and its surrounding area are comprised of a variety of habitat types in a complex landscape, with some surface water available year-round. This variety of habitats supports a relatively diverse bird community of migrants, breeding birds, and wintering species. Riparian-type habitat had the greatest species diversity and abundance, although its area is relatively limited. The area provides habitat for several species of concern. Of these, we were able to estimate density for the gray vireo (coefficients of variation <40%), which was most commonly found in both the pinyon-juniper and shrubland habitats and less commonly detected within riparian-type/upland habitats. Breeding is not confirmed for this species in the park but is likely, considering the number detected ($n = 48$) during the breeding season during multiple years.

We also detected the willow flycatcher (*Empidonax traillii*) on three occasions during point-count surveys in riparian-type/upland habitat. This species is considered to be an unconfirmed breeder within the park. It is unclear whether these detections were of the endangered subspecies of willow flycatcher (*Empidonax traillii extimus*), as they were located near the geographic boundaries of three subspecies: *E. t. extimus*, *E. t. brewsteri*, and *E. t. traillii* (see range map at <http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wifrang.asp>).

New find. We detected one species not previously reported for this park unit, the red-necked phalarope, a migrant.

Discussion

Jackknife analyses indicated that we documented from 79.3% (at ELMO) to 85.2% (at AZRU) of the bird species present; close to our goal of documenting 90% of species present. These results suggest that we have detected most of the species commonly occurring within each park. The inventories also provided information on bird species richness, distribution, and abundance in the major habitats of the parks. We obtained robust density estimates for a total of 15 species at five park units.

Each park unit has its own unique habitats, habitat features, and associated bird communities. Certain habitat features, such as the presence of aspen, cottonwood, oak, or ponderosa pine trees and snags, contribute to bird community diversity. For example, riparian vegetation provides habitat for several species, some which are found only in riparian habitats (e.g., common yellowthroat, red-winged blackbird, spotted sandpiper, and yellow-billed cuckoo). Similarly, half of the species in ELMO reached their highest abundance in pinyon-juniper habitat that also contained oak trees, and several species were detected only in this habitat type. Al-

though not identified as a habitat type per se, human-created habitat features such as park buildings, ruins, and surrounding development can influence park bird communities. In the case of smaller parks such as AZRU, with many human-made features, species associated with such features (e.g., European starling, black-billed magpie, house sparrow, American robin, house finch, and Canada goose) can be the most abundant species within a park.

The parks provide resources for bird species of conservation concern in the region. We documented 43 species of conservation concern (based on the PIF BCPs, TNC assessments, and USFWS lists of birds of conservation concern) that use at least one of the parks inventoried (Table 42). Together, these inventory data on the distribution and abundance of birds, including species of concern, provide baseline information for developing monitoring strategies and assisting in the development of a coordinated network data management effort, resulting in increased accessibility of biological resource information to resource managers, scientists, and the public.

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Tables

Table 1. Bird abundance by species across habitats, based on variable circular plot point counts, Aztec Ruins National Monument, 2001.

Common name	Agricultural (n = 1)		Riparian (n = 3)		Shrubland (n = 2)		Mixed shrubland/ riparian (n = 5)		All habitats (n = 11)	
	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station
American kestrel	1	1					1	0.2	2	0.18
American robin	5	5	1	0.3			1	0.2	7	0.64
Ash-throated flycatcher	2	2					4	0.8	6	0.55
Barn swallow	2	2					3	0.6	5	0.45
Bewick's wren	1	1	1	0.3			4	0.8	6	0.55
Black-billed magpie	3	3	9	3.0	2	1.0	31	6.2	45	4.09
Black-capped chickadee	1	1	3	1.0			1	0.2	5	0.45
Black-chinned hummingbird	2	2	3	1.0	4	2.0	11	2.2	20	1.82
Black-headed grosbeak	2	2	21	7.0	1	0.5	12	2.4	36	3.27
Black-throated sparrow							1	0.2	1	0.09
Brown-headed cowbird	1	1	8	2.6			3	0.6	12	1.09
Bullock's oriole	1	1	4	1.3	1	0.5	17	3.4	23	2.09
Canada goose	14	14	9	3.0					23	2.09
Cassin's kingbird	1	1	5	1.7					6	0.55
Cliff swallow			10	3.3	4	2.0	6	1.2	20	1.82
Common raven	1	1					1	0.2	2	0.18
Common yellowthroat			1	0.3					1	0.09
Eastern meadowlark			1	0.3					1	0.09
European starling	18	18	14	4.7	1	0.5	16	3.2	49	4.45
Gambel's quail					3	1.5	3	0.6	6	0.55
Greater roadrunner			1	0.3					1	0.09
House finch	5	5	3	1.0	9	4.5	6	1.2	23	2.1
House sparrow							16	3.2	16	1.4
Killdeer	6	6	10	3.3			2	0.4	18	1.6
Lark sparrow					6	3.0	3	0.6	9	0.8
Lazuli bunting	2	2	2	0.7			2	0.4	6	0.5

Table 1. Bird abundance by species across habitats, based on variable circular plot point counts, AZRU, 2001, cont.

Common name	Agricultural (n = 1)		Riparian (n = 3)		Shrubland (n = 2)		Mixed shrubland/ riparian (n = 5)		All habitats (n = 11)	
	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station	No. de- tections	Avg./pt. ct. station
Lesser goldfinch	3	3	11	3.7					14	1.3
Mallard			1	0.3			3	0.6	4	0.4
Mourning dove			12	4.0	35	17.5	5	1.0	52	4.7
Northern flicker			1	0.3			3	0.6	4	0.4
Northern rough-winged swallow			1	0.3			5	1.0	6	0.5
Red-winged blackbird			18	6.0					18	1.6
Ring-necked pheasant			1	0.3	1	0.2			2	0.2
Spotted sandpiper			3	1.0					3	0.3
Turkey vulture					2	1.0			2	0.2
Unknown species			2	0.7					2	0.2
Unknown bluebird			2	0.7					2	0.2
Violet-green swallow					10	5.0	3	0.6	13	1.2
Western bluebird							1	0.2	1	0.1
Western kingbird					2	1.0	1	0.2	3	0.3
Western meadowlark	3	3	10	3.3	4	2.0	7	1.4	24	2.2
Western wood-pewee			2	0.7					2	0.2
Yellow warbler			1	0.3			1	0.2	2	0.2
Yellow-billed cuckoo			2	0.7					2	0.2
Total number of detections/habitat (relative abundance)	74		173		84		174		505	
Percent of total	14.7%		34.3%		16.6%		34.5%		--	
Average no. detections/pt. ct. station	3.7		1.8		3.0		1.1		--	
Species richness/habitat (species distribution)	20		30		14		31		42	
Percent of total found	47.6%		71.4%		33.3%		73.8%		--	

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)
n = number of point-count stations in each habitat

Table 2. List of species and number of individuals recorded for all habitat types during area searches and incidental observations, Aztec Ruins National Monument, 2001–2002.

Common name	Number of records	Common name	Number of records
European starling	89	Common raven	3
Black-billed magpie	61	Great horned owl	3
Bullock's oriole	47	Western kingbird	3
House sparrow	46	Wilson's warbler	3
Mourning dove	44	Common nighthawk	2
American robin	40	Evening grosbeak	2
House finch	39	White-crowned sparrow	2
Black-headed grosbeak	36	Yellow warbler	2
Gambel's quail	34	Barn swallow	1
Canada goose	32	Black-crowned night heron	1
Black-chinned hummingbird	31	Brewer's sparrow	1
Brown-headed cowbird	24	Ladder-backed woodpecker	1
Bewick's wren	23	Mountain chickadee	1
Cliff swallow	21	Prairie falcon	1
Blue grosbeak	20	Red-necked phalarope	1
Western meadowlark	19	Red-tailed hawk	1
Lesser goldfinch	16	Spotted towhee	1
Mallard	16	Virginia's warbler	1
Northern rough-winged swallow	16	Western bluebird	1
Ash-throated flycatcher	15	Western tanager	1
Black-capped chickadee	15	White-breasted nuthatch	1
Pinyon jay	13	Yellow-rumped warbler	1
American kestrel	12	Total number of records	891
Red-winged blackbird	12	Total number of species	63
Turkey vulture	12		
Cassin's kingbird	11		
Lark sparrow	11		
Northern mockingbird	11		
Chipping sparrow	10		
Juniper titmouse	10		
Killdeer	10		
Violet-green swallow	9		
Northern flicker	8		
American crow	7		
Black-throated sparrow	7		
Spotted sandpiper	7		
Lazuli bunting	5		
Say's phoebe	5		
Western scrub jay	5		
Western wood-pewee	5		
Brewer's blackbird	3		

Table 3. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, Aztec Ruins National Monument, 2001–2002.

Common name	Breeding status	Evidence code	Common name	Breeding status	Evidence code
American crow	CONFIRMED	FL**	Northern flicker	OBSERVED	O
American kestrel	OBSERVED	O	Northern mockingbird	POSSIBLE	X
American robin	CONFIRMED	FL**	Northern rough-winged swallow	PROBABLE	N
Ash-throated flycatcher	POSSIBLE	X	Pinyon jay	OBSERVED	O
Barn swallow	OBSERVED	O	Prairie falcon	OBSERVED	O
Bewick's wren	POSSIBLE	X	Red-necked phalarope	OBSERVED	O
Black-billed magpie	POSSIBLE	X	Red-tailed hawk	OBSERVED	O
Black-capped chickadee	PROBABLE	S	Red-winged blackbird	POSSIBLE	X
Black-chinned hummingbird	POSSIBLE	X	Ring-necked pheasant	POSSIBLE	X
Black-crowned night heron	OBSERVED	O	Say's phoebe	OBSERVED	O
Black-headed grosbeak	POSSIBLE	X	Spotted sandpiper	PROBABLE	C
Black-throated sparrow	POSSIBLE	X	Spotted towhee	OBSERVED	O
Blue grosbeak	PROBABLE	P	Turkey vulture	OBSERVED	O
Brewer's blackbird	OBSERVED	O	Violet-green swallow	OBSERVED	O
Brewer's sparrow	OBSERVED	O	Virginia's warbler	OBSERVED	O
Brown-headed cowbird	OBSERVED	O	Western bluebird	OBSERVED	O
Bullock's oriole	PROBABLE	S	Western kingbird	OBSERVED	O
Canada goose	OBSERVED	O	Western meadowlark	POSSIBLE	X
Cassin's kingbird	OBSERVED	O	Western scrub jay	OBSERVED	O
Chipping sparrow	POSSIBLE	X	Western tanager	OBSERVED	O
Cliff swallow	POSSIBLE	#	Western wood-pewee	POSSIBLE	X
Common nighthawk	OBSERVED	O	White-breasted nuthatch	OBSERVED	O
Common raven	POSSIBLE	#	White-crowned sparrow	OBSERVED	O
Common yellowthroat	POSSIBLE	X	Wilson's warbler	OBSERVED	O
Eastern meadowlark	POSSIBLE	X	Yellow warbler	POSSIBLE	X
European starling	CONFIRMED	ON**	Yellow-billed cuckoo	OBSERVED	O
Evening grosbeak	OBSERVED	O	Yellow-rumped warbler	OBSERVED	O
Gambel's quail	PROBABLE	S			
Great horned owl	OBSERVED	O			
Greater roadrunner	OBSERVED	O			
House finch	PROBABLE	S			
House sparrow	CONFIRMED	CN**			
Juniper titmouse	OBSERVED	O			
Killdeer	POSSIBLE	X			
Ladder-backed woodpecker	OBSERVED	O			
Lark sparrow	POSSIBLE	X			
Lazuli bunting	POSSIBLE	X			
Lesser goldfinch	POSSIBLE	X			
Mallard	OBSERVED	O			
Mountain chickadee	POSSIBLE	X			
Mourning dove	POSSIBLE	X			

* New confirmed breeding record for NPS list

** New evidence of breeding for NPS list

Breeding status and evidence codes are defined in Appendix B.

Table 4. Comparison of observed number of species and first-order jackknife estimates of the total number of species, Aztec Ruins National Monument, 2001.

Habitat	<i>n</i>	Number of observed species	Jackknife estimate	% increase of estimate from observed	% species observed vs. estimate
All habitats	11	42	49.3	14.8	85.2
Riparian	3	30	39.3	23.7	76.3
Shrubland	2	14	18.0	22.2	77.8
Mixed Shrubland/ Riparian	5	31	39.0	20.5	79.5

n = sample effort (number of point counts)

Table 5. Partners in Flight priority species that occur or are probably present in and around Aztec Ruins National Monument, and their associated priority habitats.

Priority species	Priority habitat	Detected during this survey
Black-chinned hummingbird	Pinyon-juniper	X
Brewer's sparrow	Shrubland/Grassland	X
Cassin's kingbird	Pinyon-juniper	X
Gambel's quail	Shrubland/Grassland	X
Horned lark	Shrubland/Grassland	
Juniper titmouse	Pinyon-juniper	X
Lazuli bunting	Riparian	X
Lewis's woodpecker	Riparian	
Loggerhead shrike	Shrubland/Grassland	
Pinyon jay	Pinyon-juniper	X
Prairie falcon	Cliff/Cave/Rock	X
Violet-green swallow	Mixed conifer	X
Wilson's warbler	Riparian	X
Yellow-billed cuckoo	Riparian	X

Bolded species are also target species for The Nature Conservancy.

Table 6. Avian species detected during winter area-search surveys, Aztec Ruins National Monument, 2001 and 2002.

Species	Status	2001	2002
American goldfinch	W	X	X
American robin	R	X	X
Black-billed magpie	R	X	X
Black-capped chickadee	R		X
Canada goose	R	X	X
Cedar waxwing	W		X
Common raven	R	X	X
Dark-eyed junco	W	X	X
European starling	R	X	X
Gambel's quail	R	X	X
Great blue heron	W, M		X
Hairy woodpecker	R		X
House finch	R	X	X
House sparrow	R	X	X
Juniper titmouse	R	X	
Loggerhead shrike	R	X	
Mallard	R	X	X
Mountain bluebird	W		
Northern flicker	R	X	X
Red-tailed hawk	R		X
Ruby-crowned kinglet	W		X
Song sparrow	W	X	X
Sharp-shinned hawk	W	X	
Townsend's solitaire	W		X
White-breasted nuthatch	R	X	
White-crowned sparrow	W, M	X	X
Yellow-rumped warbler	R, M		X

R = year-round resident

W = winter resident

M = migrant

X = indicates whether a species was detected during a particular year

Table 7. Bird abundance by species across habitats, based on variable circular plot point counts, El Malpais National Monument, 2002–2003.

Common name	Grassland (n = 9)		Pinyon-juniper (PJ) (n = 18)		Ponderosa pine (n = 29)		PJ/ Ponderosa pine (n = 10)		Shrubland (n = 3)		All habitats (n = 69)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Acorn woodpecker					1	0.03	1	0.10			2	0.03
American kestrel			3	0.17			2	0.20			5	0.07
American robin	1	0.1	1	0.05	9	0.07	7	0.70			18	0.26
Ash-throated flycatcher	4	0.4	34	1.89	21	0.72	7	0.70	2	0.67	68	0.99
Bewick's wren			18	1.00	4	0.14					22	0.32
Black-chinned hummingbird	1	0.1	3	0.17	4	0.14	1	0.10			9	0.13
Black-headed grosbeak			2	0.11	6	0.21	5	0.50			13	0.19
Black-throated gray warbler			2	0.11	5	0.17	2	0.20			9	0.13
Black-throated sparrow									1	0.33	1	0.01
Blue-gray gnatcatcher			3	0.17			1	0.10			4	0.06
Broad-tailed hummingbird					3	0.10	3	0.30			6	0.09
Brown creeper					1	0.03	1	0.10			2	0.03
Brown-headed cowbird			2	0.11	4	0.14	1	0.10			7	0.10
Bullock's oriole					1	0.03					1	0.01
Bushtit	1	0.1	11	0.61	17	0.59	4	0.40			35	0.51
Canyon towhee			3	0.17							3	0.0
Cassin's kingbird	7	0.8	29	1.61	26	0.90	13	1.30	1	0.33	76	1.1
Chipping sparrow			15	0.83	25	0.86	12	1.20			52	0.7
Cliff swallow	1	0.1	26	1.44	6	0.21			1	0.33	34	0.5
Common raven	10	1.1	19	1.05	4	0.14	1	0.10			34	0.5
Cordilleran flycatcher					1	0.03	1	0.10			2	0.0
Dark-eyed junco					21	0.72	2	0.20			23	0.3
Dusky flycatcher			2	0.11							2	0.0

Table 7. Bird abundance by species across habitats, based on variable circular plot point counts, ELMA, 2002–2003, cont.

Common name	Grassland (n = 9)		Pinyon-juniper (PJ) (n = 18)		Ponderosa pine (n = 29)		PJ/ Ponderosa pine (n = 10)		Shrubland (n = 3)		All habitats (n = 69)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Eastern meadowlark	24	2.7	3	0.17					3	1.00	30	0.4
Gambel's quail			1	0.05							1	0.0
Grace's warbler					3	0.10	1	0.10			4	0.1
Gray flycatcher			8	0.44	5	0.17	2	0.20			15	0.2
Gray vireo			11	0.61							11	0.2
Green-tailed towhee					1	0.03					1	0.0
Hairy woodpecker			2	0.11	11	0.38	5	0.50			18	0.3
Hepatic tanager	1	0.1	6	0.33	16	0.55	6	0.60			29	0.4
Horned lark	21	2.3	1	0.05					2	0.67	24	0.3
House finch			4	0.22	4	0.14	2	0.20			10	0.1
House wren					1	0.03	1	0.10			2	0.0
Juniper titmouse	1	0.1	17	0.94	9	0.31	3	0.30			30	0.4
Ladder-backed woodpecker					1	0.03					1	0.0
Lark sparrow	17	1.9	13	0.72	7	0.24	3	0.30	3	1.00	43	0.6
Lesser goldfinch			5	0.28	3	0.10			1	0.33	9	0.1
Lincoln sparrow					1	0.03					1	0.0
Mountain bluebird			6	0.3					2	0.7	8	0.1
Mountain chickadee			6	0.3	19	0.7	4	0.4			29	0.4
Mourning dove	5	0.6	13	0.7	34	1.2	6	0.6			58	0.8
Northern flicker					9	0.3	2	0.2			11	0.2
Northern mockingbird	10	1.1	21	1.2	11	0.4	10	1.0	4	1.3	56	0.8
Pinyon jay	9	1.0	7	0.4	34	1.2	15	1.5	1	0.3	66	1.0
Plumbeous vireo			1	0.1	17	0.6	2	0.2			20	0.3
Pygmy nuthatch			1	0.1	17	0.6	3	0.3			21	0.3
Red crossbill			1	0.1	32	1.1					33	0.5
Red-tailed hawk					1	0.0					1	0.0
Rock wren	9	1.0	15	0.8	20	0.7	13	1.3	8	2.7	65	0.9

Table 7. Bird abundance by species across habitats, based on variable circular plot point counts, ELMA, 2002–2003, cont.

Common name	Grassland (n = 9)		Pinyon-juniper (PJ) (n = 18)		Ponderosa pine (n = 29)		PJ/ Ponderosa pine (n = 10)		Shrubland (n = 3)		All habitats (n = 69)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Rufous-crowned sparrow							3	0.3			3	0.0
Say's phoebe	6	0.7	8	0.4	1	0.0	2	0.2	3	1.0	20	0.3
Scott's oriole			2	0.1	2	0.1	1	0.1			5	0.1
Spotted towhee	4	0.4	9	0.5	23	0.8	4	0.4			40	0.6
Steller's jay					9	0.3					9	0.1
Townsend's solitaire					1	0.0					1	0.0
Turkey vulture					1	0.0					1	0.0
Vesper sparrow	19	2.1	1	0.1					11	3.7	31	0.4
Violet-green swallow			7	0.4	20	0.7	17	1.7			44	0.6
Virginia's warbler					3	0.1	4	0.4			7	0.1
Warbling vireo					1	0.0					1	0.0
Western bluebird	2	0.2			22	0.8	5	0.5			29	0.4
Western kingbird					1	0.0	3	0.3			4	0.1
Western meadowlark	11	1.2	4	0.2					4	1.3	19	0.3
Western scrub jay	2	0.2	4	0.2	4	0.1	3	0.3			13	0.2
Western tanager			2	0.1	3	0.1	2	0.2			7	0.1
Western wood-pewee			2	0.1	34	1.2	9	0.9			45	0.6
White-breasted nuthatch			1	0.1	19	0.6	4	0.4			24	0.3
White-throated swift			8	0.4	6	0.2					14	0.2
Yellow-rumped warbler					2	0.1					2	0.0

Table 7. Bird abundance by species across habitats, based on variable circular plot point counts, ELMA, 2002–2003, cont.

Total number of detections/habitat (relative abundance)	166	363	567	199	47	1,342
Percent of total	12.4%	27%	42.3%	14.8%	.04%	--
Average no. detections/pt. ct. station	18	20	33	19	15	--
Species richness/habitat (species distribution)	22	47	57	45	15	70
Percent of total	31.8%	67.1%	81.4%	64.3%	21.4%	--

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)
n = number of point-count stations in each habitat

Table 8. Bird abundance by species across pinyon-juniper and ponderosa pine habitats where lava is and is not a dominant habitat component, based on variable circular plot point counts, El Malpais National Monument, 2001.

Common name	Lava/PJ (n = 1) Avg./pt. ct. station	PJ (n = 15) Avg./pt. ct. station	Lava/PP (n = 9) Avg./pt. ct. station	PP (n = 20) Avg./pt. ct. station
Acorn woodpecker				0.05
American kestrel		0.20		
American robin		0.07		0.45
Ash-throated flycatcher	4.00	1.87	0.67	0.75
Bewick's wren		1.00		0.20
Black-chinned hummingbird		0.13		0.20
Black-headed grosbeak		0.07	0.33	0.15
Black-throated gray warbler		0.13		0.25
Blue-gray gnatcatcher		0.20		
Broad-tailed hummingbird				0.15
Brown creeper				0.05
Brown-headed cowbird		0.13		0.20
Bullock's oriole				0.05
Bushtit		0.80	1.11	0.35
Canyon towhee		0.20		
Cassin's kingbird	1.00	1.87	0.33	1.15
Chipping sparrow		1.00	0.11	1.20
Cliff swallow		1.60	0.11	0.25
Common raven	2.00	1.13	0.11	0.15
Cordilleran flycatcher				0.05
Dark-eyed junco				1.05
Dusky flycatcher		0.13		
Eastern meadowlark		0.20		
Gambel's quail		0.07		
Grace's warbler				0.15
Gray flycatcher		0.40	0.44	0.05
Gray vireo		0.73		
Green-tailed towhee				0.05
Hairy woodpecker		0.13	0.33	0.40
Hepatic tanager		0.33	0.22	0.70
Horned lark		0.07		
House finch		0.20	0.22	0.10
House wren				0.05
Juniper titmouse		1.00	0.78	0.10
Ladder-backed woodpecker				0.05
Lark sparrow		0.87		0.35
Lesser goldfinch		0.33	0.11	0.10
Lincoln sparrow				0.05
Mountain bluebird	2.00	0.27		

Table 8. Bird abundance by species across pinyon-juniper and ponderosa pine habitats where lava is and is not a dominant habitat component, based on variable circular plot point counts, ELMA, 2001, cont.

Common name	Lava/PJ (n = 1) Avg./pt. ct. station	PJ (n = 15) Avg./pt. ct. station	Lava/PP (n = 9) Avg./pt. ct. station	PP (n = 20) Avg./pt. ct. station
Mountain chickadee		0.40		0.95
Mourning dove	1.00	0.80	0.56	1.45
Northern flicker				0.45
Northern mockingbird	1.00	1.33		0.55
Pinyon jay		0.33	0.78	1.35
Plumbeous vireo		0.07		0.85
Pygmy nuthatch		0.07		0.85
Red crossbill		0.07		1.60
Red-tailed hawk				0.05
Rock wren	3.00	0.80	1.56	0.30
Say's phoebe	1.00	0.33	0.11	
Scott's oriole		0.13		0.10
Spotted towhee	1.00	0.53		1.15
Steller's jay				0.45
Townsend's solitaire				0.05
Turkey vulture				0.05
Unknown species		0.80		0.20
Vesper sparrow		0.07		
Violet-green swallow		0.47	0.11	0.95
Virginia's warbler				0.15
Warbling vireo			0.11	
Western bluebird			0.11	1.05
Western kingbird				0.05
Western meadowlark		0.27		
Western scrub jay		0.20	0.44	
Western tanager		0.13		0.15
Western wood-pewee		0.13		1.70
White-breasted nuthatch		0.07		0.95
White-throated swift		0.53	0.22	0.20
Yellow-rumped warbler				0.10

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)

n = number of point-count stations in each habitat

Habitat codes: Lava/PJ (Lava/Pinyon-juniper), PJ (Pinyon-juniper), Lava/PP (Lava/Ponderosa pine), PP (Ponderosa pine)

Table 9. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, El Malpaís National Monument, 2002–2003.

Common name	Number of records	Common name	Number of records
Hepatic tanager	12	Greater roadrunner	1
Mourning dove	8	House wren	1
Ash-throated flycatcher	7	Ladder-backed woodpecker	1
Chipping sparrow	7	Mountain bluebird	1
Pinyon jay	7	Northern flicker	1
White-breasted nuthatch	7	Red-breasted nuthatch	1
House finch	5	Say's phoebe	1
American kestrel	4	Scott's oriole	1
Cassin's kingbird	4	Vesper sparrow	1
Hairy woodpecker	4	Virginia's warbler	1
Rock wren	4	Black-throated gray warbler	1
Western wood-pewee	4	Total number of records	142
Bewick's wren	3	Total number of species	52
Black-chinned hummingbird	3		
Bushtit	3		
Gray flycatcher	3		
Pygmy nuthatch	3		
Spotted towhee	3		
Violet-green swallow	3		
Western scrub jay	3		
Acorn woodpecker	2		
Barn swallow	2		
Black-headed grosbeak	2		
Broad-tailed hummingbird	2		
Curve-billed thrasher	2		
Dark-eyed junco	2		
Grace's warbler	2		
Juniper titmouse	2		
Lark sparrow	2		
Mountain chickadee	2		
Northern mockingbird	2		
Turkey vulture	2		
Western bluebird	2		
American robin	1		
Brown-headed cowbird	1		
Canyon towhee	1		
Cliff swallow	1		
Common nighthawk	1		
Common raven	1		
Cordilleran flycatcher	1		
Eastern meadowlark	1		

Table 10. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, El Malpaís National Monument National Monument, 2002–2003.

Common name	Breeding status	Evidence code	Common name	Breeding status	Evidence code
Acorn woodpecker	POSSIBLE	X	Lesser goldfinch	POSSIBLE	X
American kestrel	OBSERVED	O	Lincoln sparrow	POSSIBLE	X
American robin	CONFIRMED	CF*	Mountain bluebird	POSSIBLE	X
Ash-throated flycatcher	PROBABLE	C	Mountain chickadee	POSSIBLE	X
Barn swallow	POSSIBLE	X	Mourning dove	POSSIBLE	X
Bewick's wren	POSSIBLE	X	Northern flicker	POSSIBLE	X
Black-chinned hummingbird	POSSIBLE	X	Northern mockingbird	POSSIBLE	X
Black-headed grosbeak	PROBABLE	P	Pinyon jay	POSSIBLE	X
Black-throated gray warbler	POSSIBLE	X	Plumbeous vireo	POSSIBLE	X
Black-throated sparrow	POSSIBLE	X	Pygmy nuthatch	POSSIBLE	X
Blue-gray gnatcatcher	POSSIBLE	X	Red crossbill	POSSIBLE	X
Broad-tailed hummingbird	POSSIBLE	X	Red-breasted nuthatch	OBSERVED	O
Brown creeper	POSSIBLE	X	Red-tailed hawk	OBSERVED	O
Brown-headed cowbird	OBSERVED	O	Rock wren	CONFIRMED	CF**
Bullock's oriole	OBSERVED	O	Rufous-crowned sparrow	POSSIBLE	X
Bushtit	POSSIBLE	X	Say's phoebe	POSSIBLE	X
Canyon towhee	POSSIBLE	X	Scott's oriole	POSSIBLE	X
Cassin's kingbird	POSSIBLE	X	Spotted towhee	POSSIBLE	X
Chipping sparrow	POSSIBLE	X	Steller's jay	OBSERVED	O
Cliff swallow	OBSERVED	O	Townsend's solitaire	OBSERVED	O
Common nighthawk	OBSERVED	O	Turkey vulture	OBSERVED	O
Common raven	POSSIBLE	#	Vesper sparrow	POSSIBLE	X
Cordilleran flycatcher	POSSIBLE	X	Violet-green swallow	POSSIBLE	X
Curve-billed thrasher	OBSERVED	O	Virginia's warbler	PROBABLE	P
Dark-eyed junco	POSSIBLE	X	Warbling vireo	OBSERVED	O
Dusky flycatcher	POSSIBLE	X	Western bluebird	CONFIRMED	NY**
Eastern meadowlark	POSSIBLE	X	Western kingbird	OBSERVED	O
Gambel's quail	POSSIBLE	X	Western meadowlark	POSSIBLE	X
Grace's warbler	POSSIBLE	X	Western scrub jay	OBSERVED	O
Gray flycatcher	POSSIBLE	X	Western tanager	POSSIBLE	X
Gray vireo	POSSIBLE	X	Western wood-pewee	POSSIBLE	X
Greater roadrunner	OBSERVED	O	White-breasted nuthatch	CONFIRMED	NY**
Green-tailed towhee	POSSIBLE	X	White-throated swift	POSSIBLE	X
Hairy woodpecker	CONFIRMED	CF, NY**	Yellow-rumped warbler	POSSIBLE	X
Hepatic tanager	PROBABLE	P			
Horned lark	POSSIBLE	X			
House finch	POSSIBLE	X			
House wren	POSSIBLE	X			
Juniper titmouse	POSSIBLE	X			
Ladder-backed woodpecker	CONFIRMED	CF**			
Lark sparrow	CONFIRMED	CN**			

Breeding status and evidence codes are defined in Appendix B.

Table 11. Number of bird detections and estimated densities within all habitats during point-count surveys, El Malpaís National Monument, 2002–2003.

Common name	Habitat	Truncation % distance (m)	<i>n</i>	D	CI	D CV
Ash-throated flycatcher	All	5% (70)	50	0.67	0.42 1.08	23.9
Cassin's kingbird	All	10% (77)	64	0.17	0.12 0.24	17.6

Distance (m) = maximum radius of circular plot for this species analysis
n = number of individual detections used in analysis (may be <60)
D = estimated density/hectare
CI = 95% confidence interval
D CV = percent coefficient of variation of the distance estimate

Table 12. Comparison of observed number of species and first-order jackknife estimates of the total number of species, El Malpaís National Monument, 2002–2003.

Habitat*	<i>n</i>	Number of observed species	Jackknife estimate	% increase of estimate from observed	% species observed
All habitats	69	70	81.8	14.4	85.6
Grassland	9	22	29.1	24.4	75.6
Juniper/Shrubland	2	13	18.5	29.7	70.3
Lava/Ponderosa pine	9	22	30.0	26.7	73.3
Pinyon-juniper	15	47	56.3	16.5	83.5
Ponderosa pine	20	54	70.2	73.1	76.9
Pinyon-juniper/Ponderosa pine	10	45	59.4	24.2	75.8
Sagebrush	3	15	21.0	28.6	71.4

* Data used differ slightly from those shown in Table 7 because some habitats were reclassified into broader categories to make Table 7.
n = sample effort (number of point counts)

Table 13. Partners in Flight priority species that occur or are probably present in and around El Malpaís National Monument, and their associated priority habitats.

Priority species	Priority habitat	Detected during this survey
Bendire's thrasher	Shrubland/Grassland	
Black-throated gray warbler	Pinyon-juniper	X
Blue grouse	Mixed conifer	
Burrowing owl	Shrubland/Grassland	
Cassin's sparrow	Shrubland/Grassland	
Flammulated owl	Ponderosa pine	
Grace's warbler	Ponderosa pine	X
Gray flycatcher	Pinyon-juniper	X
Gray vireo	Pinyon-juniper	X
Lewis's woodpecker	Ponderosa pine	
Loggerhead shrike	Shrubland/Grassland	
Mexican spotted owl	Ponderosa pine	
Northern goshawk	Ponderosa pine	
Peregrine falcon	Cliff/Cave/Rock	
Prairie falcon	Cliff/Cave/Rock	
Red-naped sapsucker	Riparian	
Sage thrasher	Shrubland/Grassland	
Scott's oriole	Pinyon-juniper	X
Virginia's warbler	Montane shrubland	X

Bolded species are also target species for The Nature Conservancy.

Table 14. Avian species detected during winter area-search survey, El Malpaís National Monument, 2003.

Species	Residency status
Common raven	R
Dark-eyed junco	R
Hairy woodpecker	R
Juniper titmouse	R
Mountain chickadee	R
Western scrub jay	R
Townsend's solitaire	W, M
White-breasted nuthatch	R

R = year-round resident
W = winter resident
M = migrant

Table 15. Bird abundance by species across habitats, based on variable circular plot point counts, El Morro National Monument, 2001–2002.

Common name	Grassland (n = 5)		Oak/Pinyon-juniper (n = 8)		Pinyon-juniper (n = 14)		Pinyon-juniper/ Grassland (n = 7)		All habitats (n = 34)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
American crow	1	0.13	1	0.07	1	0.07	2	0.1	2	0.1
American kestrel	6	0.75	1	0.07	1	0.07	7	0.2	7	0.2
American robin	3	0.38	11	0.79	1	0.14	15	0.4	15	0.4
Ash-throated flycatcher	1	0.2	15	1.88	27	1.93	43	1.3	43	1.3
Bewick's wren	2	0.4	14	1.00	2	0.29	18	0.5	18	0.5
Black-chinned hummingbird	2	0.4	4	0.50	2	0.14	9	0.3	9	0.3
Black-headed grosbeak			2	0.25	1	0.07	3	0.1	3	0.1
Black-throated sparrow					2	0.29	2	0.1	2	0.1
Broad-tailed hummingbird	1	0.2	1	0.07	1	0.07	2	0.1	2	0.1
Brown-headed cowbird					1	0.14	1	0.0	1	0.0
Bullock's oriole					1	0.07	1	0.0	1	0.0
Bushtit			2	0.25			2	0.1	2	0.1
Canyon wren			4	0.50			4	0.1	4	0.1
Cassin's kingbird	13	2.6	1	0.13	20	1.43	8	1.14	42	1.2
Chipping sparrow	6	1.2	10	1.25	43	3.07	17	2.43	76	2.2
Cliff swallow	2	0.4	8	1.00	3	0.21	1	0.14	14	0.4
Common raven	8	1.6	19	2.38	14	1.00	11	1.57	52	1.5
Cordilleran flycatcher			3	0.38			3	0.1	3	0.1
Gambel's quail					1	0.07	1	0.0	1	0.0
Grace's warbler			1	0.13			1	0.0	1	0.0
Gray vireo			1	0.13			1	0.0	1	0.0
Greater roadrunner							1	0.14	1	0.0
Green-tailed towhee	11	2.2	8	0.6	21	3.0	40	1.2	40	1.2
Hepatic tanager			3	0.4	1	0.1	5	0.1	5	0.1
House finch			2	0.2	7	0.5	11	0.3	11	0.3
Juniper titmouse			1	0.1	6	0.4	7	0.2	7	0.2
Ladder-backed woodpecker					1	0.1	1	0.0	1	0.0

Table 15. Bird abundance by species across habitats, based on variable circular plot point counts, ELMO, 2001–2002, cont.

Common name	Grassland (n = 5)		Oak/Pinyon-juniper (n = 8)		Pinyon-juniper (n = 14)		Pinyon-juniper/ Grassland (n = 7)		All habitats (n = 34)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Lark sparrow	20	4.0			27	1.9	18	2.6	65	1.9
Lesser goldfinch					1	0.1	1	0.1	2	0.1
Lewis's woodpecker			5	0.6	1	0.1			6	0.2
Loggerhead shrike	1	0.2							1	0.0
MacGillivray's warbler			1	0.1					1	0.0
Mountain bluebird			1	0.1					1	0.0
Mountain chickadee			9	1.1	9	0.6			18	0.5
Mourning dove	7	1.4	5	0.6	18	1.3	9	1.3	39	1.1
Northern flicker	1	0.2	11	1.4	3	0.2	6	0.9	21	0.6
Northern mockingbird	2	0.4			8	0.6	3	0.4	13	0.4
Peregrine falcon					3	0.2			3	0.1
Pinyon jay	14	2.8	2	0.2	4	0.3			20	0.6
Plumbeous vireo					1	0.1			1	0.0
Pygmy nuthatch			6	0.7	1	0.1			7	0.2
Red-winged blackbird			1	0.1					1	0.0
Rock wren			2	0.2	1	0.1			3	0.1
Say's phoebe	1	0.2	4	0.5	1	0.1	1	0.1	7	0.2
Spotted towhee	4	0.8	5	0.6	21	1.5	14	2.0	44	1.3
Tree swallow			1	0.1					1	0.0
Unknown species	2	0.4	3	0.4	4	0.3	3	0.4	12	0.3
Unknown woodpecker			1	0.1					1	0.0
Vesper sparrow	11	2.2			5	0.4	6	0.9	22	0.6
Violet-green swallow			16	2.0					16	0.5
Western bluebird			18	2.2	7	0.5	1	0.1	26	0.8
Western meadowlark	25	5.0	3	0.4	16	1.1	21	3.0	65	1.9
Western scrub jay	1	0.2	3	0.4	19	1.4	2	0.3	25	0.7
Western tanager			5	0.6			1	0.1	6	0.2

Table 15. Bird abundance by species across habitats, based on variable circular plot point counts, ELMO, 2001–2002, cont.

Common name	Grassland (n = 5)		Oak/Pinyon-juniper (n = 8)		Pinyon-juniper (n = 14)		Pinyon-juniper/ Grassland (n = 7)		All habitats (n = 34)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Western wood-pewee			13	1.6	5	0.4	1	0.1	19	0.6
White-breasted nuthatch	1	0.2	7	0.9	2	0.1			10	0.3
White-throated swift			65	8.1	5	0.4	1	0.1	71	2.1
Wilson's warbler			1	0.1					1	0.0
Total number of detections/ habitat (relative abundance)		136		274		324		158		892
Average no. detections/pt. ct. station		15.2%		30.7%		36.3%		17.7%		--
Species richness/habitat (species distribution)		27		34		23		22		--
Percent of total		21		40		39		28		56
		37.5%		71.4%		69.6%		50%		--

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)
n = number of point-count stations in each habitat

Table 16. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, El Morro National Monument, 2001–2002.

Common name	Number of records	Common name	Number of records
House finch	18	Horned lark	1
White-breasted nuthatch	11	MacGillivray's warbler	1
Violet-green swallow	9	Northern mockingbird	1
Ash-throated flycatcher	8	Warbling vireo	1
Lark sparrow	8	Western scrub jay	1
Mourning dove	8	Total number of records	175
Rock wren	7	Total number of species	47
Western meadowlark	6		
White-throated swift	6		
Black-chinned hummingbird	5		
Mountain chickadee	5		
Western bluebird	5		
Wilson's warbler	5		
American kestrel	4		
American robin	4		
Cassin's kingbird	4		
Common nighthawk	4		
Lewis's woodpecker	4		
Mountain bluebird	4		
Spotted towhee	4		
Western wood-pewee	4		
Broad-tailed hummingbird	3		
Cliff swallow	3		
Green-tailed towhee	3		
Northern flicker	3		
Say's phoebe	3		
Acorn woodpecker	2		
Bewick's wren	2		
Brown-headed cowbird	2		
Hepatic tanager	2		
Juniper titmouse	2		
Western kingbird	2		
Black-headed grosbeak	1		
Black-throated sparrow	1		
Bullock's oriole	1		
Canyon wren	1		
Chipping sparrow	1		
Common raven	1		
Cordilleran flycatcher	1		
Dusky flycatcher	1		
Gray vireo	1		
Great horned owl	1		

Table 17. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, El Morro National Monument, 2001–2002.

Common name	Breeding status	Evidence code	Common name	Breeding status	Evidence code
Acorn woodpecker	OBSERVED	O	Peregrine falcon	OBSERVED	O
American crow	OBSERVED	O	Pinyon jay	POSSIBLE	X
American kestrel	OBSERVED	O	Plumbeous vireo	POSSIBLE	X
American robin	POSSIBLE	X	Pygmy nuthatch	POSSIBLE	X
Ash-throated flycatcher	POSSIBLE	X	Red-winged blackbird	OBSERVED	O
Bewick's wren	POSSIBLE	X	Rock wren	POSSIBLE	X
Black-chinned hummingbird	PROBABLE	C	Say's phoebe	POSSIBLE	X
Black-headed grosbeak	POSSIBLE	X	Spotted towhee	PROBABLE	S
Black-throated sparrow	POSSIBLE	X	Tree swallow	OBSERVED	O
Broad-tailed hummingbird	POSSIBLE	X	Vesper sparrow	POSSIBLE	X
Brown-headed cowbird	OBSERVED	O	Violet-green swallow	OBSERVED	O
Bullock's oriole	OBSERVED	O	Warbling vireo	POSSIBLE	X
Bushtit	OBSERVED	O	Western bluebird	POSSIBLE	X
Canyon wren	POSSIBLE	X	Western kingbird	OBSERVED	O
Cassin's kingbird	POSSIBLE	X	Western meadowlark	PROBABLE	P, S
Chipping sparrow	CONFIRMED	FY	Western scrub jay	POSSIBLE	X
Cliff swallow	CONFIRMED	ON	Western tanager	POSSIBLE	X
Common nighthawk	OBSERVED	O	Western wood-pewee	POSSIBLE	X
Common raven	CONFIRMED	NY	White-breasted nuthatch	POSSIBLE	X
Cordilleran flycatcher	POSSIBLE	X	White-throated swift	PROBABLE	N
Dusky flycatcher	OBSERVED	O	Wilson's warbler	POSSIBLE	X
Gambel's quail	POSSIBLE	X			
Grace's warbler	OBSERVED	O			
Gray vireo	POSSIBLE	X			
Great horned owl	OBSERVED	O			
Greater roadrunner	POSSIBLE	#			
Green-tailed towhee	POSSIBLE	X			
Hepatic tanager	POSSIBLE	X			
Horned lark	OBSERVED	O			
House finch	CONFIRMED	CN			
Juniper titmouse	POSSIBLE	X			
Ladder-backed woodpecker	OBSERVED	O			
Lark sparrow	CONFIRMED	CF			
Lesser goldfinch	OBSERVED	O			
Lewis's woodpecker	CONFIRMED	CF, ON			
Loggerhead shrike	OBSERVED	O			
MacGillivray's warbler	OBSERVED	O			
Mountain bluebird	POSSIBLE	X			
Mountain chickadee	POSSIBLE	X			
Mourning dove	POSSIBLE	X			
Northern flicker	POSSIBLE	X			
Northern mockingbird	POSSIBLE	X			

Breeding status and evidence codes are defined in Appendix B.

Table 18. Number of bird detections and estimated densities within all habitats during point-count surveys, El Morro National Monument, 2001–2002.

Common name	Habitat	Truncation % distance (m)	<i>n</i>	D	CI	D CV
Chipping sparrow	All	10% (108)	64	0.96	0.57 1.62	27.0
Lark sparrow	Grassland, Pinyon-juniper, and Pinyon-juniper/Grassland	5% (176)	62	0.51	0.30 0.86	27.0
Western meadowlark	All	10% (200)	59	0.23	0.15 0.37	23.5

Distance (m) = maximum radius of circular plot for this species analysis
n = number of individual detections used in analysis (may be <60)
D = estimated density/hectare
CI = 95% confidence interval
D CV = percent coefficient of variation of the distance estimate

Table 19. Comparison of observed number of species with first-order jackknife estimates of the total number of species, El Morro National Monument, 2001–2002.

Habitat	<i>n</i>	Number of observed species	Jackknife estimate	% increase of estimate from observed	% species observed
All habitats	34	56	70.6	20.7	79.3
Grassland	5	21	29.0	27.6	72.4
Oak/Pinyon-juniper	8	40	51.4	22.2	77.8
Pinyon-juniper	14	38	51.0	25.5	74.5
Pinyon-juniper/Grassland	7	28	40.0	30.0	70.0

n = sample effort (number of point counts)

Table 20. Partners in Flight priority species that occur or are probably present in and around El Morro National Monument, and their associated priority habitats.

Priority species	Priority habitat	Detected during this survey
Black-throated gray warbler	Pinyon-juniper	
Dusky flycatcher	Mixed conifer	X
Ferruginous hawk	Shrubland/Grassland	
Flammulated owl	Ponderosa pine	
Grace's warbler	Ponderosa pine	X
Gray flycatcher	Pinyon-juniper	
Gray vireo	Pinyon-juniper	X
Hammond's flycatcher	Riparian	
Lewis's woodpecker	Ponderosa pine	X
Loggerhead shrike	Shrubland/Grassland	X
MacGillivray's warbler	Riparian	X
Northern goshawk	Ponderosa pine	
Olive-sided flycatcher	Ponderosa pine	
Peregrine falcon	Cliff/Cave/Rock	X
Prairie falcon	Cliff/Cave/Rock	
Red-naped sapsucker	Riparian	
Sage thrasher	Shrubland/Grassland	
Virginia's warbler	Montane shrubland	
Williamson's sapsucker	Mixed conifer	

Bolded species are also target species for The Nature Conservancy.

Table 21. Bird abundance by species across habitats, based on variable circular plot point counts, Petroglyph National Monument, 2001.

Common name	Grassland (n = 27)		Shrubland (n = 20)		Urban (n = 2)		All habitats (n = 49)	
	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station
American kestrel	1	0.0	1	0.1	2	1.00	4	0.08
American robin			1	0.1	1	0.50	2	0.04
Barn swallow	4	0.1	15	0.7	3	1.50	22	0.45
Black-chinned hummingbird	15	0.6	51	2.5	3	1.50	69	1.41
Black-headed grosbeak			2	0.1			2	0.04
Black-throated sparrow	14	0.5	30	1.5			44	0.90
Brown-headed cowbird	1	0.0	5	0.2			6	0.12
Bullock's oriole	1	0.0			5	2.50	6	0.12
Canyon wren	1	0.0	14	0.7			15	0.31
Cassin's kingbird	27	1.0	22	1.1	4	2.00	53	1.08
Chipping sparrow			1	0.1			1	0.02
Cliff swallow	11	0.4	46	2.3			57	1.16
Common nighthawk	5	0.2					5	0.10
Common raven	1	0.0	2	0.1			3	0.06
Cooper's hawk					1	0.50	1	0.02
Crissal thrasher	2	0.1	3	0.1			5	0.10
Eastern meadowlark	101	3.7	9	0.4			110	2.24
European starling					1	0.50	1	0.02
Greater roadrunner			3	0.1	2	1.00	5	0.10
Horned lark	250	9.3	11	0.5			261	5.3
House finch	20	0.7	69	3.4	16	8.0	105	2.1
House sparrow	9	0.3	29	1.4	59	29.5	97	2.0
Ladder-backed woodpecker	1	0.0					1	0.0
Lark sparrow	3	0.1	9	0.4			12	0.2
Lesser goldfinch	1	0.0	4	0.2	1	0.5	6	0.1
Lincoln sparrow	4	0.1					4	0.1
Long-eared owl			1	0.1			1	0.0
Mourning dove	67	2.5	89	4.4	48	24.0	204	4.2
Northern mockingbird	22	0.8	32	1.6	5	2.5	59	1.2
Northern rough-winged swallow			42	2.1			42	0.9
Red-tailed hawk			1	0.1			1	0.0
Rock dove			39	1.9	12	6.0	51	1.0
Rock wren	28	1.0	69	3.4	3	1.5	100	2.0
Rufous-crowned sparrow	2	0.1	5	0.2			7	0.1
Say's phoebe	9	0.3	14	0.7	3	1.5	26	0.5

Table 21. Bird abundance by species across habitats, based on variable circular plot point counts, PETR, 2001, cont.

Common name	Grassland (n = 27)		Shrubland (n = 20)		Urban (n = 2)		All habitats (n = 49)	
	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station
Scaled quail	30	1.1	18	0.9	8	4.0	56	1.1
Unknown species	4	0.1	6	0.3	1	0.5	11	0.2
Unknown hummingbird	2	0.1	1	0.1			3	0.1
Unknown kingbird			2	0.1			2	0.0
Unknown swallow	2	0.1					2	0.0
Unknown towhee			2	0.1			2	0.0
Unknown tyrant	2	0.1					2	0.0
Western kingbird	7	0.3	4	0.2	12	6.0	23	0.5
Western meadowlark	10	0.4	18	0.9			28	0.6
Total number of detections/habitat (relative abundance)	657		670		190		1,517	
Percent of total	43.3%		44.1%		12.5%		--	
Average no. detections/pt. ct. station	24		33		95		--	
Species richness/habitat (species distribution)	28		32		19		38	
Percent of total	73.7%		84.2%		50%		--	

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)
n = number of point-count stations in each habitat

Table 22. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, Petroglyph National Monument, 2001–2002.

Common name	Number of records
Barn swallow	16
Black-chinned hummingbird	12
Horned lark	10
Northern mockingbird	8
Scaled quail	8
Mourning dove	7
Rock wren	7
Black-throated sparrow	5
Cassin's kingbird	4
Cliff swallow	4
Gambel's quail	4
Say's phoebe	4
Common nighthawk	3
House finch	3
Violet-green swallow	3
Western kingbird	3
Greater roadrunner	2
Lark sparrow	2
Western meadowlark	2
American crow	1
American kestrel	1
American robin	1
Brown-headed cowbird	1
Bullock's oriole	1
Canyon wren	1
Common poorwill	1
Common raven	1
Green-tailed towhee	1
Swainson's hawk	1
Total number of records	117
Total number of species	29

Table 23. Bird species list and breeding evidence based on point counts, area-search surveys, and incidental observations, Petroglyph National Monument, 2001–2002.

Common name	Breeding status	Evidence code	Common name	Breeding status	Evidence code
American crow	OBSERVED	O	Violet-green swallow	OBSERVED	O
American kestrel	POSSIBLE	#	Western kingbird	POSSIBLE	X
American robin	POSSIBLE	X	Western meadowlark	POSSIBLE	X
Barn swallow	POSSIBLE	#	Breeding status and evidence codes are defined in Appendix B.		
Black-chinned hummingbird	POSSIBLE	X			
Black-headed grosbeak	OBSERVED	O			
Black-throated sparrow	CONFIRMED	NB			
Brown-headed cowbird	OBSERVED	O			
Bullock's oriole	OBSERVED	O			
Canyon wren	PROBABLE	B			
Cassin's kingbird	POSSIBLE	X			
Chipping sparrow	POSSIBLE	X			
Cliff swallow	POSSIBLE	#			
Common nighthawk	OBSERVED	O			
Common poorwill	OBSERVED	O			
Common raven	OBSERVED	O			
Cooper's hawk	OBSERVED	O			
Crissal thrasher	OBSERVED	O			
Eastern meadowlark	POSSIBLE	X			
European starling	OBSERVED	O			
Gambel's quail	OBSERVED	O			
Greater roadrunner	POSSIBLE	X			
Green-tailed towhee	OBSERVED	O			
Horned lark	POSSIBLE	X			
House finch	POSSIBLE	X			
House sparrow	POSSIBLE	X			
Ladder-backed woodpecker	OBSERVED	O			
Lark sparrow	POSSIBLE	X			
Lesser goldfinch	POSSIBLE	X			
Lincoln sparrow	POSSIBLE	X			
Long-eared owl	OBSERVED	O			
Mourning dove	CONFIRMED	NE			
Northern mockingbird	CONFIRMED	NE			
Northern rough-winged swallow	OBSERVED	O			
Red-tailed hawk	OBSERVED	O			
Rock dove	OBSERVED	O			
Rock wren	POSSIBLE	X			
Rufous-crowned sparrow	POSSIBLE	X			
Say's phoebe	POSSIBLE	X			
Scaled quail	POSSIBLE	X			
Swainson's hawk	OBSERVED	O			

Table 24. Number of bird detections and estimated densities within all habitats during point-count surveys, Petroglyph National Monument, 2001–2002.

Common name	Habitat	Truncation % distance (m)	<i>n</i>	D	CI	D CV	
Eastern meadowlark	Grassland and Shrubland	10% (189)	97	0.18	0.13	0.25	17.1
	Grassland only	None	99	0.13	0.09	0.23	22.7
Horned lark	Grassland and Shrubland	10% (118)	185	0.71	0.43	1.17	25.3
	Grassland only	None	193	0.61	0.37	0.98	24.5
Mourning dove	All	10% (168)	114	0.55	0.35	0.86	23.2
Rock wren	All	5% (234)	91	0.16	0.10	0.27	26.6

Distance (m) = maximum radius of circular plot for this species analysis

n = number of individual detections used in analysis (may be <60)

D = estimated density/hectare

CI = 95% confidence interval

D CV = percent coefficient of variation of the distance estimate

Table 25. Comparison of observed number of species with first-order jackknife estimates of the total number of species for Petroglyph National Monument, 2001–2002.

Habitat	<i>n</i>	Number of observed species	Jackknife estimate	% increase of estimate from observed	% species observed
All habitats	49	39	45.9	15.0	85.0
Grassland	27	28	36.7	23.7	76.3
Shrubland	20	33	39.7	16.7	83.1
Urban	2	19	23.0	17.4	82.6

n = sample effort (number of point counts)

Table 26. Partners in Flight priority species that occur or are probably present in and around Petroglyph National Monument, and their associated priority habitats.

Priority species	Priority habitat	Detected during this survey
Cassin's sparrow	Shrubland/Grassland	
Ferruginous hawk	Shrubland/Grassland	
Loggerhead shrike	Shrubland/Grassland	
Prairie falcon	Cliff/Cave/Rock	
Sage sparrow	Shrubland/Grassland	
Sage thrasher	Shrubland/Grassland	
Virginia's warbler	Montane shrubland	

Bolded species are also target species for The Nature Conservancy.

Table 27. Avian species detected during winter area-search surveys, Petroglyph National Monument, 2001 and 2003.

Species	Residency status	2001	2003
Canyon wren	R	X	X
Canyon towhee	R	X	
Common raven	R	X	
Crissal thrasher	R	X	
Dark-eyed junco	W, M	X	X
House finch	R	X	X
Horned lark	R	X	
Loggerhead shrike	R	X	X
Northern harrier	W	X	
Rock wren	R	X	X
Red-tailed hawk	R	X	
Sage sparrow	W, M	X	

R = year-round resident

W = winter resident

M = migrant

X = indicates whether a species was detected during a particular year

Table 28. Bird abundance by species across habitats, based on variable circular plot point counts, Salinas Pueblo Missions National Monument, 2001.

Common name	Pinyon-juniper (n = 19)		Riparian/Shrubland (n = 7)		All habitats (n = 26)	
	No. detec- tions	Avg./pt. ct. station	No. detec- tions	Avg./pt. ct. station	No. detec- tions	Avg./pt. ct. station
American crow			1	0.1	1	0.0
American robin	5	0.3			5	0.2
Ash-throated flycatcher	57	3.0	22	3.1	79	3.0
Bewick's wren	55	2.9			55	2.1
Black phoebe			3	0.4	3	0.1
Black-chinned hummingbird	4	0.2	4	0.6	8	0.3
Black-headed grosbeak	8	0.4	24	3.4	32	1.2
Black-throated sparrow	1	0.1			1	0.0
Blue-gray gnatcatcher			1	0.1	1	0.0
Brown-headed cowbird	3	0.2	7	1.0	10	0.4
Bullock's oriole			2	0.3	2	0.1
Bushtit	14	0.7	3	0.4	17	0.6
Canyon towhee			7	1.0	7	0.3
Cassin's kingbird	13	0.7	13	1.9	26	1.0
Chipping sparrow	46	2.4	9	1.3	55	2.1
Cliff swallow	26	1.4	29	4.1	55	2.1
Common nighthawk	7	0.4	1	0.1	8	0.3
Common raven	12	0.6	3	0.4	15	0.6
Cooper's hawk	1	0.1			1	0.0
Gambel's quail	1	0.1			1	0.0
Gray flycatcher	1	0.1			1	0.0
House finch	13	0.7	11	1.6	24	0.9
Juniper titmouse	84	4.4	4	0.6	88	3.4
Ladder-backed woodpecker	2	0.1	1	0.1	3	0.1
Lark sparrow	11	0.6	7	1.0	18	0.7
Lesser goldfinch	4	0.2	12	1.7	16	0.6
Mourning dove	32	1.7	11	1.6	43	1.6
Northern rough-winged swallow			1	0.1	1	0.0
Pinyon jay	11	0.6	45	6.4	56	2.1
Rock wren	12	0.6	19	2.7	31	1.2
Say's phoebe	4	0.2	7	1.0	11	0.4
Spotted towhee	51	2.7	7	1.0	58	2.2
Turkey vulture	7	0.4			7	0.3
Unknown species	3	0.2			3	0.1
Unknown woodpecker	1	0.1	1	0.1	2	0.1
Violet-green swallow	1	0.1			1	0.0

Table 28. Bird abundance by species across habitats, based on variable circular plot point counts, SAPU, 2001, cont.

Common name	Pinyon-juniper (n = 19)		Riparian/Shrubland (n = 7)		All habitats (n = 26)	
	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station	No. detections	Avg./pt. ct. station
Western bluebird	5	0.3	2	0.3	7	0.3
Western meadowlark	3	0.2			3	0.1
Western scrub jay	20	1.1	1	0.1	21	0.8
Total number of detections/ habitat (relative abundance)	518		258		776	
Percent of total	66.8%		33.2%		--	
Average no. detections/pt. ct. station	27		37		--	
Species richness/habitat (species distribution)	31		28		37	
Percent of total	83.8%		75.7%		--	

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)
n = number of point-count stations in each habitat

Table 29. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, Salinas Pueblo Missions National Monument, 2001–2002.

Common name	Number of records	Common name	Number of records
Band-tailed pigeon	146	Turkey vulture	7
House finch	102	Gambel's quail	6
Violet-green swallow	78	Great horned owl	6
Black-headed grosbeak	73	Yellow-rumped warbler	6
Spotted towhee	65	American kestrel	5
Lesser goldfinch	64	House wren	5
Juniper titmouse	53	Northern flicker	5
Northern mockingbird	52	Western meadowlark	5
Mourning dove	50	Black-throated gray warbler	4
Blue grosbeak	37	Pinyon jay	4
Yellow-breasted chat	37	Plumbeous vireo	4
Ash-throated flycatcher	36	Broad-tailed hummingbird	3
Cliff swallow	35	Common nighthawk	3
Western scrub jay	35	White-breasted nuthatch	3
Western wood-pewee	35	American crow	2
Black-chinned hummingbird	33	Blue-gray gnatcatcher	2
Brown-headed cowbird	32	Brewer's blackbird	2
Barn swallow	30	Gray catbird	2
Bushtit	27	Mallard	2
Rock wren	26	Scarlet tanager	2
Bullock's oriole	24	Scott's oriole	2
Western bluebird	24	American coot	1
Bewick's wren	19	Common poorwill	1
Cassin's kingbird	18	Gray flycatcher	1
Lark sparrow	17	Lazuli bunting	1
Say's phoebe	17	Lincoln sparrow	1
Western tanager	17	Mountain bluebird	1
Wilson's warbler	17	Mountain chickadee	1
Chipping sparrow	16	Red-naped sapsucker	1
MacGillivray's warbler	15	Red-tailed hawk	1
Phainopepla	14	Scaled quail	1
Canyon towhee	13	Yellow warbler	1
Warbling vireo	13	Total number of records	1,441
American robin	12	Total number of species	73
Common raven	12		
Ladder-backed woodpecker	12		
Red-winged blackbird	11		
Virginia's warbler	9		
White-crowned sparrow	9		
Black phoebe	8		
Cooper's hawk	7		

Table 30. Bird species list and breeding evidence based on data from bird inventory point count, incidental observation, and area-search surveys, Salinas Pueblo Missions National Monument, 2001–2002.

Common name	Breeding status	Evidence code	Common name	Breeding status	Evidence code
American coot	OBSERVED	O	Mountain bluebird	OBSERVED	O
American crow	OBSERVED	O	Mountain chickadee	OBSERVED	O
American kestrel	OBSERVED	O	Mourning dove	CONFIRMED	NE**
American robin	POSSIBLE	X	Northern flicker	OBSERVED	O
Ash-throated flycatcher	POSSIBLE	X	Northern mockingbird	CONFIRMED	NE, FL**
Band-tailed pigeon	OBSERVED	O	Northern rough-winged swallow	OBSERVED	O
Barn swallow	OBSERVED	O	Phainopepla	CONFIRMED	NB
Bewick's wren	PROBABLE	P	Pinyon jay	POSSIBLE	X
Black phoebe	PROBABLE	N	Plumbeous vireo	OBSERVED	O
Black-chinned hummingbird	PROBABLE	P	Red-naped sapsucker	OBSERVED	O
Black-headed grosbeak	PROBABLE	T	Red-tailed hawk	OBSERVED	O
Black-throated gray warbler	OBSERVED	O	Red-winged blackbird	OBSERVED	O
Black-throated sparrow	POSSIBLE	X	Rock wren	CONFIRMED	NY
Blue grosbeak	PROBABLE	P	Say's phoebe	CONFIRMED	ON**
Blue-gray gnatcatcher	OBSERVED	O	Scaled quail	OBSERVED	O
Brewer's blackbird	OBSERVED	O	Scarlet tanager	OBSERVED	O
Broad-tailed hummingbird	OBSERVED	O	Scott's oriole	OBSERVED	O
Brown-headed cowbird	OBSERVED	O	Spotted towhee	CONFIRMED	FL
Bullock's oriole	OBSERVED	O	Turkey vulture	OBSERVED	O
Bushtit	CONFIRMED	FL	Violet-green swallow	CONFIRMED	ON
Canyon towhee	OBSERVED	O	Virginia's warbler	OBSERVED	O
Cassin's kingbird	POSSIBLE	X	Warbling vireo	OBSERVED	O
Chipping sparrow	POSSIBLE	X	Western bluebird	PROBABLE	N
Cliff swallow	OBSERVED	O	Western meadowlark	POSSIBLE	X
Common nighthawk	POSSIBLE	X	Western scrub jay	PROBABLE	C
Common poorwill	OBSERVED	O	Western tanager	PROBABLE	P
Common raven	CONFIRMED	FL	Western wood-pewee	PROBABLE	P
Cooper's hawk	CONFIRMED	ON**	White-breasted nuthatch	OBSERVED	O
Gambel's quail	OBSERVED	O	White-crowned sparrow	OBSERVED	O
Gray catbird	OBSERVED	O	Wilson's warbler	OBSERVED	O
Gray flycatcher	OBSERVED	O	Yellow warbler	OBSERVED	O
Great horned owl	OBSERVED	O	Yellow-breasted chat	PROBABLE	C
House finch	CONFIRMED	CN	Yellow-rumped warbler	OBSERVED	O
House wren	OBSERVED	O			
Juniper titmouse	POSSIBLE	X			
Ladder-backed woodpecker	CONFIRMED	FL**			
Lark sparrow	CONFIRMED	FL**			
Lazuli bunting	OBSERVED	O			
Lesser goldfinch	POSSIBLE	X			
Lincoln sparrow	OBSERVED	O			
MacGillivray's warbler	OBSERVED	O			
Mallard	OBSERVED	O			

Breeding status and evidence codes are defined in Appendix B.

Table 31. Number of bird detections and estimated densities within all habitats during point-count surveys, Salinas Pueblo Missions National Monument, 2001.

Common name	Habitat	Truncation % distance (m)	<i>n</i>	D	CI	D CV	
Ash-throated flycatcher	All	5% (180)	67	0.51	0.28	0.93	30.4
	All	5% (118)	84	1.00	0.64	1.56	22.5
Juniper titmouse	Pinyon-juniper only	None	84	0.85	0.55	1.32	22.0

Distance (m) = maximum radius of circular plot for this species analysis
n = number of individual detections used in analysis (may be <60)
 D = estimated density/hectare
 CI = 95% confidence interval
 D CV = percent coefficient of variation of the distance estimate

Table 32. Comparison of observed number of species with first-order jackknife estimates of the total number of species, Salinas Pueblo Missions National Monument, 2001.

Habitat	<i>n</i>	Number of observed species	Jackknife estimate	% increase of estimate from observed	% species observed
All habitats	26	37	47.6	20.2	79.8
Pinyon-juniper	19	32	38.6	17.1	82.9
Riparian/Shrubland	7	28	36.6	23.5	76.5

n = sample effort (number of point counts)

Table 33. Partners in Flight priority species that occur or are probably present in and around Salinas Pueblo Missions National Monument, and their associated priority habitats.

Priority species	Priority habitat	Detected during this survey
Bendire's thrasher	Shrubland/Grassland	
Black-chinned sparrow	Shrubland/Grassland	
Black-throated gray warbler	Pinyon-juniper	X
Gray flycatcher	Pinyon-juniper	X
Gray vireo	Pinyon-juniper	
Hammond's flycatcher	Riparian	
Loggerhead shrike	Shrubland/Grassland	
MacGillivray's warbler	Riparian	X
Red-naped sapsucker	Riparian	X
Sage thrasher	Shrubland/Grassland	
Scott's oriole	Pinyon-juniper	X
Summer tanager	Riparian	
Virginia's warbler	Montane shrubland	X

Bolded species are also target species for The Nature Conservancy.

Table 34. Avian species detected during winter area-search surveys, Salinas Pueblo National Monument, 2001–2003.

Species	Residency status	2001	2002	2003
American crow	R	X		
American goldfinch	W	X	X	
American kestrel	R	X		
American robin	R	X	X	X
Bewick's wren	R	X		
Cooper's hawk	R	X	X	
Common raven	R	X	X	
Dark-eyed junco	W, M	X	X	X
House finch	R	X	X	
Juniper titmouse	R	X	X	
Ladderbacked woodpecker	R	X		
Mountain bluebird	R	X		
Northern flicker	R	X	X	
Northern harrier	W	X		
Pinyon jay	R	X		
Pine siskin	W, M	X		
Red crossbill	W, M	X		
Song sparrow	W, M	X	X	X
Spotted towhee	R	X	X	
Townsend's solitaire	W, M	X	X	X
White-breasted nuthatch	W, M			X
White-crowned sparrow	W, M	X	X	
Western bluebird	R	X	X	
Western scrub jay	R	X	X	
White-throated sparrow	W, M	X		

R = year-round resident

W = winter resident

M = migrant

X = indicates whether a species was detected during a particular year

Table 35. Bird abundance by species across habitats, based on variable circular plot point counts, Yucca House National Monument, 2001–2003.

Common name	Agricultural (n = 3)		Pinyon-juniper (n = 26)		Riparian-type/Upland (n = 17)		Shrubland (n = 20)		All habitats (n = 66)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
American crow			2	0.1					2	0.0
American kestrel			9	0.3	6	0.3	5	0.2	20	0.3
American robin			1	0.0	2	0.1	1	0.1	4	0.1
Ash-throated flycatcher			22	0.8	27	1.6	9	0.4	58	0.9
Barn swallow					1	0.1	1	0.1	1	0.0
Bewick's wren			33	1.3	26	1.5	15	0.7	74	1.1
Black-billed magpie	10	3.3	11	0.4	8	0.5	8	0.4	37	0.6
Black-capped chickadee	1	0.3							1	0.0
Black-chinned hummingbird			30	1.1	19	1.1	26	1.3	75	1.1
Black-headed grosbeak			10	0.4	32	1.9	10	0.5	52	0.8
Black-throated gray warbler			4	0.1	3	0.2			7	0.1
Black-throated sparrow			29	1.1	2	0.1	23	1.1	54	0.8
Blue grosbeak	4	1.3	9	0.3	1	0.1	2	0.1	16	0.2
Blue-gray gnatcatcher			29	1.1	11	0.6	18	0.9	58	0.9
Brewer's blackbird			1	0.0			3	0.1	4	0.1
Brewer's sparrow	6	2.0	1	0.0	4	0.2	6	0.3	17	0.3
Brown-headed cowbird	1	0.3	6	0.2	36	2.1	18	0.9	61	0.9
Bullock's oriole	2	0.7	16	0.6	41	2.4	13	0.6	72	1.1
Bushtit			4	0.1	30	1.8	3	0.1	37	0.6
Cassin's kingbird	6	2.0	10	0.4	2	0.1	3	0.1	21	0.3
Chipping sparrow	1	0.3	7	0.3	36	2.1	8	0.4	52	0.8
Cliff swallow			1	0.0					1	0.0
Common nighthawk			2	0.1	3	0.2			5	0.1
Common raven			6	0.2	8	0.5	9	0.4	23	0.3
Common yellowthroat			1	0.0	1	0.1			2	0.0
Dusky flycatcher							1	0.1	1	0.0
European starling	4	1.3			4	0.2	1	0.1	9	0.1
Grasshopper sparrow	1	0.3							1	0.0

Table 35. Bird abundance by species across habitats, based on variable circular plot point counts, YUHO, 2001–2003, cont.

Common name	Agricultural (n = 3)		Pinyon-juniper (n = 26)		Riparian-type/Upland (n = 17)		Shrubland (n = 20)		All habitats (n = 66)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Gray flycatcher			13	0.5	11	0.6	2	0.1	26	0.4
Gray vireo			29	1.1	5	0.3	14	0.7	48	0.7
Great blue heron					1	0.1			1	0.0
House finch			22	0.8	26	1.5	20	1.0	68	1.0
House wren							1	0.1	1	0.0
Juniper titmouse			49	1.9	28	1.6	14	0.7	91	1.4
Killdeer	1	0.3			1	0.1			2	0.0
Lark sparrow			20	0.8	37	2.2	28	1.4	85	1.3
Lazuli bunting			1	0.0					1	0.0
Lesser goldfinch			20	0.8	67	3.9	21	1.1	108	1.6
Lincoln sparrow							1	0.1	1	0.0
Loggerhead shrike			24	0.9			18	0.9	42	0.6
MacGillivray's warbler					3	0.2			3	0.1
Mallard					2	0.1			2	0.0
Mountain bluebird			1	0.0	1	0.1	2	0.1	4	0.1
Mourning dove			31	1.2	26	1.5	28	1.4	90	1.4
Northern flicker							2	0.1	2	0.0
Northern harrier	2	0.7							2	0.0
Northern mockingbird	3	1.0	5	0.2	4	0.2	5	0.2	17	0.3
Northern rough-winged swallow							1	0.1	1	0.0
Pinyon jay	1	0.3	86	3.3	1	0.1	15	0.7	103	1.6
Plumbeous vireo			1	0.0	2	0.1			3	0.1
Red-tailed hawk			3	0.1	1	0.1			4	0.1
Red-winged blackbird	4	1.3	4	0.1	9	0.5	2	0.1	19	0.3
Ring-necked pheasant	3	1.0			6	0.3	2	0.1	11	0.2
Rock wren			2	0.1					2	0.0
Rufous hummingbird					5	0.3			5	0.1
Say's phoebe					2	0.1	4	0.2	6	0.1

Table 35. Bird abundance by species across habitats, based on variable circular plot point counts, YUHO, 2001–2003, cont.

Common name	Agricultural (n = 3)		Pinyon-juniper (n = 26)		Riparian-type/Upland (n = 17)		Shrubland (n = 20)		All habitats (n = 66)	
	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station	No. de- tections	Avg./ pt. ct. station
Scaled quail			2	0.1	1	0.1	1	0.1	4	0.1
Song sparrow							1	0.1	1	0.0
Spotted towhee	2	0.7	64	2.5	76	4.5	39	1.9	181	2.7
Turkey vulture					1	0.1			1	0.0
Unknown species			11	0.4	3	0.2	14	0.7	28	0.4
Unknown flycatcher			1	0.0	1	0.1			1	0.0
Unknown hummingbird					4	0.2			5	0.1
Unknown kingbird							2	0.1	2	0.0
Unknown oriole					1	0.1			1	0.0
Unknown quail					1	0.1			1	0.0
Unknown sparrow			1	0.0	1	0.1	1	0.1	3	0.1
Unknown warbler					1	0.1			1	0.0
Unknown woodpecker			1	0.0	1	0.1			2	0.0
Vesper sparrow			2	0.1			1	0.1	3	0.1
Violet-green swallow			9	0.3			5	0.2	14	0.2
Warbling vireo					1	0.1			1	0.0
Western kingbird	1	0.3	9	0.3	33	1.9	3	0.1	46	0.7
Western meadowlark	20	6.7	26	1.0	41	2.4	26	1.3	113	1.7
Western scrub jay			19	0.7	22	1.3	7	0.3	48	0.7
Western tanager					4	0.2			4	0.1
Western wood-pewee			6	0.2	29	1.7	6	0.3	41	0.6
White-crowned sparrow							1	0.1	1	0.0
White-throated swift			10	0.4			2	0.1	12	0.2
Willow flycatcher					3	0.2			3	0.1
Yellow warbler					2	0.1	1	0.1	3	0.1
Yellow-breasted chat			2	0.1	16	0.9	2	0.1	20	0.3
Yellow-headed blackbird					1	0.1			1	0.0

Table 35. Bird abundance by species across habitats, based on variable circular plot point counts, YUHO, 2001–2003, cont.

Total number of detections/ habitat (relative abundance)	78	718	783	475	2,054
Percent of total	3.8%	35%	38.1%	23.1%	--
Average no. detections/pt. ct. station	26	28	46	23	--
Species richness/habitat (species distribution)	20	49	54	52	74
Percent of total	27%	66.2%	73%	70.3%	--

Average abundance = (total number individuals detected in each habitat)/(n = number of point-count stations in that habitat)
n = number of point-count stations in each habitat

Table 36. List of species and number of individuals recorded for all habitat types during area searches and incidental surveys, Yucca House National Monument, 2001–2003.

Common name	Number of records	Common name	Number of records
Pinyon jay	56	Mallard	3
Mourning dove	31	Northern rough-winged swallow	3
European starling	30	Red-necked phalarope	3
Brown-headed cowbird	26	Red-tailed hawk	3
Bushtit	26	Common nighthawk	2
House finch	25	Turkey vulture	2
Western meadowlark	24	Yellow-breasted chat	2
Western kingbird	20	American robin	1
Chipping sparrow	17	Bald eagle	1
Lark sparrow	17	Lazuli bunting	1
Spotted towhee	17	Lincoln sparrow	1
Ash-throated flycatcher	16	Northern harrier	1
Black-headed grosbeak	15	Olive-sided flycatcher	1
Blue-gray gnatcatcher	15	Peregrine falcon	1
Black-chinned hummingbird	14	Plumbeous vireo	1
Northern mockingbird	14	Rock wren	1
Gray vireo	13	Rufous hummingbird	1
Brewer's sparrow	12	Warbling vireo	1
Bullock's oriole	10	Western bluebird	1
Lesser goldfinch	10	Yellow warbler	1
Black-billed magpie	9	Total number of records	577
Cassin's kingbird	9	Total number of species	62
House sparrow	9		
Red-winged blackbird	9		
Western scrub jay	9		
Common raven	8		
Mountain bluebird	8		
Loggerhead shrike	7		
Bewick's wren	6		
Black-throated sparrow	6		
Juniper titmouse	6		
Violet-green swallow	6		
Western wood-pewee	6		
White-throated swift	6		
Black-throated gray warbler	5		
Brewer's blackbird	5		
Gray flycatcher	5		
Say's phoebe	5		
Barn swallow	4		
Blue grosbeak	4		
American kestrel	3		
House wren	3		

Table 37. Bird species list and breeding evidence based on data from bird inventory point count, incidental observation, and area-search surveys, Yucca House National Monument, National Monument, 2001–2003.

Common name	Breeding status	Evidence code	Common name	Breeding status	Evidence code
American crow	OBSERVED	O	Lincoln sparrow	POSSIBLE	X
American kestrel	OBSERVED	O	Loggerhead shrike	OBSERVED	O
American robin	POSSIBLE	X	MacGillivray's warbler	OBSERVED	O
Ash-throated flycatcher	POSSIBLE	X	Mallard	OBSERVED	O
Bald eagle	OBSERVED	O	Mountain bluebird	CONFIRMED	CF**
Barn swallow	OBSERVED	O	Mourning dove	POSSIBLE	X
Bewick's wren	POSSIBLE	X	Northern flicker	POSSIBLE	X
Black-billed magpie	POSSIBLE	X	Northern harrier	OBSERVED	O
Black-capped chickadee	OBSERVED	O	Northern mockingbird	POSSIBLE	X
Black-chinned hummingbird	PROBABLE	C	Northern rough-winged swallow	OBSERVED	O
Black-headed grosbeak	POSSIBLE	X	Olive-sided flycatcher	OBSERVED	O
Black-throated gray warbler	PROBABLE	C	Peregrine falcon	OBSERVED	O
Black-throated sparrow	POSSIBLE	X	Pinyon jay	POSSIBLE	X
Blue grosbeak	POSSIBLE	X	Plumbeous vireo	POSSIBLE	X
Blue-gray gnatcatcher	POSSIBLE	X	Red-necked phalarope	OBSERVED	O
Brewer's blackbird	OBSERVED	O	Red-tailed hawk	OBSERVED	O
Brewer's sparrow	POSSIBLE	X	Red-winged blackbird	POSSIBLE	X
Brown-headed cowbird	PROBABLE	P	Ring-necked pheasant	POSSIBLE	X
Bullock's oriole	OBSERVED	O	Rock wren	POSSIBLE	X
Bushtit	CONFIRMED	FY**	Rufous hummingbird	OBSERVED	O
Cassin's kingbird	POSSIBLE	X	Say's phoebe	CONFIRMED	FS*
Chipping sparrow	POSSIBLE	X	Scaled quail	POSSIBLE	X
Cliff swallow	OBSERVED	O	Song sparrow	POSSIBLE	X
Common nighthawk	OBSERVED	O	Spotted towhee	POSSIBLE	X
Common raven	POSSIBLE	#	Turkey vulture	OBSERVED	O
Common yellowthroat	POSSIBLE	X	Vesper sparrow	POSSIBLE	X
Dark-eyed junco	OBSERVED	O	Violet-green swallow	OBSERVED	O
Dusky flycatcher	OBSERVED	O	Warbling vireo	OBSERVED	O
European starling	OBSERVED	O	Western bluebird	OBSERVED	O
Grasshopper sparrow	POSSIBLE	X	Western kingbird	CONFIRMED	CF
Gray flycatcher	POSSIBLE	X	Western meadowlark	POSSIBLE	X
Gray vireo	POSSIBLE	X	Western scrub jay	POSSIBLE	X
Great blue heron	OBSERVED	O	Western tanager	POSSIBLE	X
House finch	POSSIBLE	X	Western wood-pewee	POSSIBLE	X
House sparrow	OBSERVED	O	White-crowned sparrow	POSSIBLE	X
House wren	POSSIBLE	X	White-throated swift	POSSIBLE	#
Juniper titmouse	POSSIBLE	X	Willow flycatcher	OBSERVED	O
Killdeer	POSSIBLE	X	Yellow warbler	POSSIBLE	X
Lark sparrow	POSSIBLE	X	Yellow-breasted chat	POSSIBLE	X
Lazuli bunting	OBSERVED	O	Yellow-headed blackbird	POSSIBLE	X
Lesser goldfinch	POSSIBLE	X			

* New confirmed breeding record for NPS list

** New evidence of breeding for NPS list

Breeding status and evidence codes are defined in Appendix B.

Table 38. Number of bird detections and estimated densities within all habitats during point-count surveys, Yucca House National Monument, 2001–2002.

Common name	Habitat	Truncation % distance (m)	<i>n</i>	D	CI	D CV	
Bullock's oriole	All	10% (112)	62	1.24	.69	2.23	30.1
Bewick's wren	Pinyon-juniper, Riparian/Upland & Shrubland	10% (125)	64	0.30	0.20	0.44	20.1
Gray vireo	Pinyon-juniper, Riparian/Upland & Shrubland	10% (160)	40	0.20	0.10	0.42	38.0
Juniper titmouse	Pinyon-juniper, Riparian/Upland & Shrubland	10% (76)	82	0.63	0.40	1.00	23.3
Lark sparrow	Pinyon-juniper, Riparian/Upland & Shrubland	10% (128)	71	0.28	0.17	0.46	26.0
Lesser goldfinch	Pinyon-juniper, Riparian/Upland & Shrubland	5% (152)	88	0.52	0.30	0.88	27.5
	Riparian/Upland only	5% (119)	56	0.32	0.18	0.57	29.7
Mourning dove	All	5% (152)	60	0.46	0.29	0.73	23.6
	All	10% (124)	158	0.68	0.51	0.90	14.4
Spotted towhee	Pinyon-juniper only	None	63	0.22	0.14	0.36	24.1
	Riparian/Upland only	5% (144)	66	0.61	0.33	1.13	32.2
Western meadowlark	All	20% (140)	87	0.14	0.10	0.19	17.6

Distance (m) = maximum radius of circular plot for this species analysis
n = number of individual detections used in analysis (may be <60)
D = estimated density/hectare
CI = 95% confidence interval
D CV = percent coefficient of variation of the distance estimate

Table 39. Comparison of observed number of species with first-order jackknife estimates of the total number of species, Yucca House National Monument, 2001 and 2003.

Habitat	<i>n</i>	Number of observed species	Jackknife estimate	% increase of estimate from observed	% species observed
All habitats	66	75	92.7	19.1	80.9
Agricultural	3	20	26.7	25.1	74.9
Pinyon-juniper	26	50	62.5	20.0	80.0
Riparian/Upland	17	54	68.1	20.7	79.3
Shrubland	20	52	66.2	21.5	78.5

n = sample effort (number of point counts)

Table 40. Partners in Flight priority species that occur or are probably present in and around Yucca House National Monument, and their associated priority habitats.

Priority species	Priority habitat	Detected during this survey
Black-chinned hummingbird	Pinyon-juniper	X
Black-throated gray warbler	Pinyon-juniper	X
Brewer's sparrow	Shrubland/Grassland	X
Broad-tailed hummingbird	Riparian	
Cassin's kingbird	Pinyon-juniper	X
Common poorwill	Montane shrubland	
Gray flycatcher	Pinyon-juniper	X
Gray vireo	Pinyon-juniper	X
Juniper titmouse	Pinyon-juniper	X
Lazuli bunting	Riparian	X
MacGillivray's warbler	Riparian	X
Peregrine falcon	Cliff/Cave/Rock	X
Pinyon jay	Pinyon-juniper	X
Scott's oriole	Pinyon-juniper	
Violet-green swallow	Mixed conifer	X
Western bluebird	Ponderosa pine	X
White-throated swift	Cliff/Cave/Rock	X

Bolded species are also target species for The Nature Conservancy.

Table 41. Avian species detected during winter area-search surveys, Yucca House National Monument, February 10, 2002, and February 22, 2003.

Species	Status	2002	2003
American tree sparrow	W	X	
Bald eagle	R		X
Bewick's wren	R		X
Black-billed magpie	R		X
Bushtit	R		X
Dark-eyed junco	W	X	X
European starling	R		X
House finch	R		X
House sparrow	R		X
Juniper titmouse	R	X	
Northern harrier	R	X	
Pinyon jay	R	X	X
Red-necked phalarope	M		X
Song sparrow	R	X	
Western meadowlark	R	X	X
White-crowned sparrow	R	X	X

R = year-round resident

W = winter resident

M = migrant

X = indicates whether a species was detected during a particular year

Table 42. Partners in Flight priority species that occur or are probably present in and around the SCPN parks included in this inventory.

Priority species	Parks	Priority species	Parks
Bendire's thrasher	ELMA, SAPU	Wilson's warbler	AZRU
Black-chinned hummingbird	AZRU, YUHO	Yellow-billed cuckoo	AZRU
Black-chinned sparrow	SAPU		
Black-throated gray warbler	ELMA, ELMO, SAPU, YUHO		
Blue grouse	ELMA		
Brewer's sparrow	AZRU, YUHO		
Broad-tailed hummingbird	YUHO		
Burrowing owl	ELMA		
Cassin's kingbird	AZRU, YUHO		
Cassin's sparrow	ELMA, PETR		
Common poorwill	YUHO		
Dusky flycatcher	ELMO		
Ferruginous hawk	ELMO, PETR		
Flammulated owl	ELMA, ELMA		
Gambel's quail	AZRU		
Grace's warbler	ELMA, ELMO		
Gray flycatcher	ELMA, ELMO, SAPU, YUHO		
Gray vireo	ELMA, ELMO, SAPU, YUHO		
Hammond's flycatcher	ELMO, SAPU		
Horned lark	AZRU		
Juniper titmouse	AZRU, YUHO		
Lazuli bunting	AZRU, YUHO		
Lewis's woodpecker	AZRU, ELMA, ELMO		
Loggerhead shrike	AZRU, ELMA, ELMO, PETR, SAPU		
MacGillivray's warbler	ELMO, SAPU, YUHO		
Mexican spotted owl	ELMA		
Northern goshawk	ELMA, ELMO		
Olive-sided flycatcher	ELMO		
Peregrine falcon	ELMA, ELMO, YUHO		
Pinyon jay	AZRU, YUHO		
Prairie falcon	AZRU, ELMA, ELMO, PETR		
Red-naped sapsucker	ELMA, ELMO, SAPU		
Sage sparrow	PETR		
Sage thrasher	ELMA, ELMO, PETR, SAPU		
Scott's oriole	ELMA, SAPU, YUHO		
Summer tanager	SAPU		
Violet-green swallow	AZRU, YUHO		
Virginia's warbler	ELMA, ELMO, PETR, SAPU		
Western bluebird	YUHO		
White-throated swift	YUHO		
Williamson's sapsucker	ELMO		

AZRU = Aztec Ruins National Monument
 ELMO = El Morro National Monument
 YUHO = Yucca House National Monument
 ELMA = El Malpaís National Monument
 PETR = Petroglyph National Monument
 SAPU = Salinas Pueblo Missions National Monument
 Bolded species are also target species for The Nature Conservancy.

Appendices

Appendix A. Location of point-count survey stations for the parks included in the bird inventory.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat
			Easting	Northing	
Aztec Ruins NM	AZRU-ADS-01	13	232547	4081154	Shrubland
	AZRU-ADS-02	13	232683	4081296	Shrubland
	AZRU-ADS-03	13	232767	4081115	Shrubland/Riparian
	AZRU-ADS-04	13	232618	4080973	Shrubland/Riparian
	AZRU-ADS-05	13	232463	4080727	Shrubland/Riparian
	AZRU-ADS-06	12	767355	4080727	Shrubland/Riparian
	AZRU-ADS-07	12	767166	4080537	Shrubland/Riparian
	AZRU-RIP-01	13	232784	4080396	Agricultural
	AZRU-RIP-02	13	232981	4080371	Riparian
	AZRU-RIP-03	13	233047	4080660	Riparian
	AZRU-RIP-04	13	233105	4080825	Riparian
	El Malpaís NM	ELMA-12940	13	227768	3846741
ELMA-13721		13	228707	3848856	Pinyon-juniper
ELMA-13727		13	228708	3850266	Pinyon-juniper
ELMA-13727A		13	228900	3850846	Grassland
ELMA-1373A		13	228657	3851173	Lava/Pinyon-juniper
ELMA-1373A0		13	229818	3851144	Grassland
ELMA-1373A1		13	229581	3851185	Grassland
ELMA-1373A2		13	229278	3851153	Grassland
ELMA-14110A		13	228891	3850344	Pinyon-juniper
ELMA-14112		13	229178	3850031	Pinyon-juniper
ELMA-14697		13	229883	3851441	Grassland
ELMA-15471		13	230823	3851911	Grassland
ELMA-15480		13	230823	3854026	Pinyon-juniper
ELMA-16327		13	231763	3871651	Pinyon-juniper
ELMA-16328		13	231763	3871886	Pinyon-juniper
ELMA-21714		13	238343	3867653	Lava/Ponderosa pine
ELMA-21898		13	238578	3865538	Juniper mixed shrub
ELMA-22091		13	238813	3865538	Juniper mixed shrub
ELMA-2252		12	762360	3874245	Ponderosa pine
ELMA-24434		13	241633	3871884	Pinyon-juniper
ELMA-2446		12	762580	3874494	Ponderosa pine
ELMA-25208		13	242573	3872353	Pinyon-juniper
ELMA-2637		12	762843	3874039	Ponderosa pine
ELMA-EAZ-201		13	238514	3865780	Lava/Ponderosa pine
ELMA-EAZ-202		13	238600	3866014	Lava/Ponderosa pine
ELMA-EAZ-203	13	238697	3866245	Lava/Ponderosa pine	
ELMA-EAZ-204	13	238701	3866492	Lava/Ponderosa pine	
ELMA-EAZ-205	13	238766	3866741	Lava/Ponderosa pine	

Appendix A. Location of point-count survey stations for the parks included in the bird inventory, cont.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat
			Easting	Northing	
El Malpaís NM, cont.	ELMA-EAZ-206	13	238782	3866993	Lava/Ponderosa pine
	ELMA-EAZ-207	13	238544	3867078	Lava/Ponderosa pine
	ELMA-EAZ-208	13	238442	3867305	Lava/Ponderosa pine
	ELMA-EBT-01	12	764222	3870243	Ponderosa/Pinyon-juniper
	ELMA-EBT-02	12	764385	3870029	Ponderosa/Pinyon-juniper
	ELMA-EBT-03	12	764266	3869804	Ponderosa/Pinyon-juniper
	ELMA-EBT-04	12	764163	3869531	Ponderosa pine
	ELMA-EBT-05	12	764322	3869312	Ponderosa/Pinyon-juniper
	ELMA-EBT-06	12	764240	3869088	Ponderosa pine
	ELMA-EBT-07	12	764242	3868840	Ponderosa pine
	ELMA-EBT-08	12	764114	3868606	Ponderosa pine
	ELMA-ECD03	13	231777	3871356	Ponderosa/Pinyon-juniper
	ELMA-ECD04	13	231907	3871143	Ponderosa/Pinyon-juniper
	ELMA-ECD05	13	231839	3870847	Ponderosa/Pinyon-juniper
	ELMA-ECD-06	13	231979	3870583	Ponderosa/Pinyon-juniper
	ELMA-ECD-07	13	231960	3870190	Ponderosa/Pinyon-juniper
	ELMA-ECD-08	13	231742	3870313	Ponderosa/Pinyon-juniper
	ELMA-ECD-09	13	231488	3870282	Ponderosa pine
	ELMA-ECD-10	13	231235	3870212	Ponderosa pine
	ELMA-EL-201	13	242480	3872127	Pinyon-juniper
	ELMA-EL-202	13	242219	3872353	Ponderosa pine
	ELMA-EL-203	13	241972	3872355	Ponderosa pine
	ELMA-EL-204	13	241718	3872353	Ponderosa pine
	ELMA-EL-205	13	241670	3872102	Pinyon-juniper
	ELMA-EL-206	13	241717	3871636	Pinyon-juniper
	ELMA-EL-207	13	241834	3871416	Pinyon-juniper
	ELMA-ENP01	13	230106	3851638	Grassland
	ELMA-ENP02	13	230370	3851809	Sagebrush
	ELMA-ENP04	13	230712	3852207	Sagebrush
	ELMA-ENP05	13	230947	3852467	Sagebrush
	ELMA-ENP06	13	231186	3852679	Grassland
	ELMA-ENP07	13	231343	3852937	Grassland
	ELMA-ENP08	13	231270	3853601	Pinyon-juniper
	ELMA-EP-200	12	763246	3874317	Ponderosa pine
	ELMA-EP-201	12	762564	3874143	Ponderosa pine
	ELMA-EP-202	12	763035	3874188	Ponderosa pine
	ELMA-EP-203	12	763435	3874492	Ponderosa pine
	ELMA-EP-204	12	763644	3874625	Ponderosa pine
	ELMA-EP-205	12	763852	3874767	Ponderosa pine
	ELMA-EP-206	12	764060	3874906	Ponderosa pine
	ELMA-EP-207	12	764190	3875119	Ponderosa pine

Appendix A. Location of point-count survey stations for the parks included in the bird inventory, cont.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat
			Easting	Northing	
El Morro NM	ELMO-100	12	743129	3880614	Pinyon-juniper
	ELMO-108	12	743358	3880614	Pinyon-juniper
	ELMO-109	12	743358	3880843	Pinyon-juniper
	ELMO-110	12	743358	3881073	Pinyon-juniper
	ELMO-118	12	743588	3881073	Pinyon-juniper
	ELMO-21	12	740837	3880843	Pinyon-juniper
	ELMO-30	12	741066	3881073	Pinyon-juniper
	ELMO-44	12	741524	3880614	Oak/Pinyon-juniper
	ELMO-46	12	741524	3881073	Pinyon-juniper/Grassland
	ELMO-51	12	741754	3880385	Oak/Pinyon-juniper
	ELMO-58	12	741983	3880156	Pinyon-juniper
	ELMO-59	12	741983	3880385	Pinyon-juniper
	ELMO-61	12	741983	3880843	Pinyon-juniper/Grassland
	ELMO-64	12	742212	3879697	Grassland
	ELMO-66	12	742212	3880156	Pinyon-juniper
	ELMO-67	12	742212	3880385	Pinyon-juniper/Grassland
	ELMO-77	12	742441	3880843	Pinyon-juniper/Grassland
	ELMO-83	12	742671	3880385	Grassland
	ELMO-86	12	742671	3881073	Pinyon-juniper/Grassland
	ELMO-89	12	742900	3879926	Pinyon-juniper/Grassland
	ELMO-91	12	742900	3880385	Pinyon-juniper
	ELMO-93	12	742900	3880843	Pinyon-juniper/Grassland
	ELMO-98	12	743129	3880156	Pinyon-juniper
	ELMO-99	12	743129	3880385	Pinyon-juniper
	ELMO-DPJ-01	12	741592	3880328	Oak/Pinyon-juniper
	ELMO-DPJ-04	12	741325	3880512	Oak/Pinyon-juniper
	ELMO-DPJ-05	12	741489	3880483	Oak/Pinyon-juniper
	ELMO-DPJ-06	12	741351	3880355	Oak/Pinyon-juniper
	ELMO-DPJ-07	12	741198	3880230	Oak/Pinyon-juniper
	ELMO-DPJ-08	12	741021	3880093	Oak/Pinyon-juniper
ELMO-GL-02	12	742412	3879698	Grassland	
ELMO-GL-03	12	742603	3879888	Grassland	
ELMO-R-003	12	742316	3880609	Grassland	
ELMO-RJ-001	12	740584	3880850	Pinyon-juniper	
Petroglyph NM	PETR-1385	13	338847	3887964	Grassland
	PETR-1491	13	338936	3887347	Grassland
	PETR-1942	13	339288	3887259	Grassland
	PETR-2159	13	339465	3886465	Grassland
	PETR-2611	13	339818	3886465	Shrubland
	PETR-269	13	337965	3889199	Grassland
	PETR-2837	13	339994	3886465	Shrubland

Appendix A. Location of point-count survey stations for the parks included in the bird inventory, cont.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat
			Easting	Northing	
Petroglyph NM, cont.	PETR-2842	13	339994	3886906	Shrubland
	PETR-2984	13	340082	3889464	Grassland
	PETR-3073	13	340170	3887347	Grassland
	PETR-3523	13	340523	3887171	Grassland
	PETR-3525	13	340523	3887347	Grassland
	PETR-4213	13	341052	3888229	Shrubland
	PETR-4426	13	341229	3887082	Grassland
	PETR-4774	13	341493	3887876	Shrubland
	PETR-4879	13	341582	3887171	Grassland
	PETR-5356	13	341934	3889376	Grassland
	PETR-5573	13	342111	3888582	Grassland
	PETR-5676	13	342199	3887700	Shrubland
	PETR-5786	13	342287	3887435	Grassland
	PETR-6021	13	342464	3888229	Shrubland
	PETR-6147	13	342552	3889376	Grassland
	PETR-6587	13	342905	3888317	Grassland
	PETR-6957	13	343169	3891051	Urban
	PETR-710	13	338318	3888229	Grassland
	PETR-7185	13	343346	3891228	Urban
	PETR-9491	13	345110	3895285	Shrubland
	PETR-9710	13	345286	3894668	Shrubland
	PETR-9818	13	345374	3894227	Shrubland
	PETR-PCH-201	13	342271	3888066	Shrubland
	PETR-PCH-202	13	342041	3887959	Shrubland
	PETR-PCH-203	13	341790	3887901	Shrubland
	PETR-PCH-204	13	341282	3888032	Shrubland
	PETR-PCH-205	13	341572	3888380	Grassland
	PETR-PGL-02	13	338174	3888694	Grassland
	PETR-PGL-05	13	338919	3887641	Grassland
	PETR-PGL-08	13	339397	3886849	Grassland
	PETR-PGL-201	13	342300	3889384	Grassland
	PETR-PGL-202	13	341681	3889385	Grassland
	PETR-PGL-203	13	341434	3889400	Grassland
	PETR-PGL-204	13	341185	3889416	Grassland
	PETR-PGL-205	13	340929	3889425	Grassland
	PETR-PGL-206	13	340677	3889443	Grassland
	PETR-PGL-207	13	340434	3889455	Grassland
	PETR-PUVN-02	13	345166	3895002	Shrubland
	PETR-PUVN-04	13	345469	3894512	Shrubland
	PETR-PUVS-03	13	343372	3891597	Shrubland
PETR-PUVS-04	13	343312	3892263	Shrubland	

Appendix A. Location of point-count survey stations for the parks included in the bird inventory, cont.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat	
			Easting	Northing		
Salinas Pueblo Missions NM	PETR-PUVS-05	13	343606	3892141	Shrubland	
	SAPU-SAPJ-01	13	373128	3812254	Pinyon-juniper	
	SAPU-SAPJ-02	13	373166	3812480	Pinyon-juniper	
	SAPU-SAPJ-03	13	373144	3812683	Pinyon-juniper	
	SAPU-SAPJ-04	13	373149	3812881	Pinyon-juniper	
	SAPU-SAPJ-05	13	373168	3813087	Pinyon-juniper	
	SAPU-SAPJ-06	13	373369	3813080	Pinyon-juniper	
	SAPU-SAPJ-07	13	373529	3813061	Pinyon-juniper	
	SAPU-SAR-01	13	373860	3812967	Riparian/Shrubland	
	SAPU-SAR-02	13	373835	3812756	Riparian/Shrubland	
	SAPU-SAR-03	13	373726	3812599	Riparian/Shrubland	
	SAPU-SAR-04	13	373615	3812424	Riparian/Shrubland	
	SAPU-SAR-05	13	373434	3812343	Riparian/Shrubland	
	SAPU-SAR-06	13	373248	3812259	Riparian/Shrubland	
	SAPU-SAR-07	13	373235	3812055	Riparian/Shrubland	
	SAPU-SGN-01	13	400770	3791376	Pinyon-juniper	
	SAPU-SGN-02	13	400571	3791342	Pinyon-juniper	
	SAPU-SGN-03	13	400377	3791409	Pinyon-juniper	
	SAPU-SGN-04	13	400184	3791440	Pinyon-juniper	
	SAPU-SGN-05	13	399984	3791445	Pinyon-juniper	
	SAPU-SGN-06	13	399776	3791401	Pinyon-juniper	
	SAPU-SGS-01	13	398736	3790897	Pinyon-juniper	
	SAPU-SGS-02	13	398936	3790899	Pinyon-juniper	
	SAPU-SGS-03	13	399149	3790892	Pinyon-juniper	
	SAPU-SGS-04	13	399348	3790900	Pinyon-juniper	
	SAPU-SGS-05	13	399552	3790901	Pinyon-juniper	
	SAPU-SGS-06	13	399814	3790878	Pinyon-juniper	
	Yucca House NM	YUHO-1099	12	706422	4124460	Agricultural
		YUHO-1532	12	707472	4121428	Pinyon-juniper
		YUHO-1539	12	707472	4122244	Shrubland
YUHO-1585		12	707588	4121661	Shrubland	
YUHO-1744		12	707938	4122361	Shrubland	
YUHO-1891		12	708288	4121661	Pinyon-juniper	
YUHO-1948		12	708405	4122361	Shrubland	
YUHO-195		12	704324	4126092	Pinyon-juniper	
YUHO-1994		12	708521	4121778	Pinyon-juniper	
YUHO-339		12	704673	4125043	Pinyon-juniper	
YUHO-344		12	704673	4125626	Pinyon-juniper	
YUHO-442		12	704907	4125159	Shrubland	
YUHO-495		12	705023	4125392	Riparian/Upland	
YUHO-649		12	705373	4125509	Agricultural	

Appendix A. Location of point-count survey stations for the parks included in the bird inventory, cont.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat
			Easting	Northing	
Yucca House NM, cont.	YUHO-798	12	705723	4125043	Agricultural
	YUHO-YDS-01	12	708197	4123778	Shrubland
	YUHO-YDS-02	12	708028	4123582	Shrubland
	YUHO-YDS-03	12	707829	4123500	Shrubland
	YUHO-YDS-04	12	707991	4123311	Shrubland
	YUHO-YDS-05	12	708067	4123112	Shrubland
	YUHO-YDS-06	12	708173	4122915	Shrubland
	YUHO-YDS-07	12	708233	4122715	Shrubland
	YUHO-YDS-08	12	708214	4122487	Shrubland
	YUHO-YDS-09	12	708198	4122275	Shrubland
	YUHO-YDS-10	12	708183	4122031	Shrubland
	YUHO-YE-201	12	708110	4122538	Shrubland
	YUHO-YE-202	12	708431	4122117	Shrubland
	YUHO-YE-203	12	707991	4121649	Pinyon-juniper
	YUHO-YID-01	12	707911	4121650	Pinyon-juniper
	YUHO-YID-02	12	704382	4124341	Pinyon-juniper
	YUHO-YID-03	12	704615	4124677	Shrubland
	YUHO-YID-04	12	705002	4124786	Pinyon-juniper
	YUHO-YID-05	12	704956	4125179	Pinyon-juniper
	YUHO-YID-06	12	704883	4125572	Sagebrush
	YUHO-YID-07	12	705107	4125917	Sagebrush
	YUHO-YPJ-01	12	708651	4123685	Pinyon-juniper
	YUHO-YPJ-02	12	708679	4123485	Pinyon-juniper
	YUHO-YPJ-03	12	708617	4123291	Pinyon-juniper
	YUHO-YPJ-04	12	708526	4123103	Pinyon-juniper
	YUHO-YPJ-05	12	708344	4122979	Pinyon-juniper
	YUHO-YPJ-06	12	708182	4122826	Pinyon-juniper
	YUHO-YPJ-07	12	708077	4122657	Pinyon-juniper
	YUHO-YPJ-08	12	708073	4122455	Pinyon-juniper
	YUHO-YPJ-09	12	708059	4122254	Pinyon-juniper
	YUHO-YPJ-10	12	708062	4122050	Pinyon-juniper
	YUHO-YRR-01	12	706419	4126950	Riparian/Upland
	YUHO-YRR-02	12	706144	4126653	Riparian/Upland
	YUHO-YRR-03	12	705743	4126577	Riparian/Upland
	YUHO-YRR-04	12	705491	4126263	Riparian/Upland
	YUHO-YRR-05	12	705121	4126108	Riparian/Upland
	YUHO-YRR-06	12	704962	4125738	Riparian/Upland
	YUHO-YRR-07	12	704991	4125007	Riparian/Upland
	YUHO-YRR-08	12	704670	4124765	Riparian/Upland
	YUHO-YRR-09	12	704410	4124456	Riparian/Upland
YUHO-YRR-10	12	704374	4124061	Riparian/Upland	

Appendix A. Location of point-count survey stations for the parks included in the bird inventory, cont.

National park unit	Point ID	UTM zone	UTM (NAD27)		Dominant habitat
			Easting	Northing	
Yucca House NM, cont.	YUHO-YRR-11	12	704670	4123795	Riparian/Upland
	YUHO-YW-201	12	704681	4125338	Riparian/Upland
	YUHO-YW-202	12	704504	4125863	Pinyon-juniper
	YUHO-YWPJ-01	12	704883	4126113	Pinyon-juniper
	YUHO-YWPJ-02	12	704674	4126114	Pinyon-juniper
	YUHO-YWPJ-03	12	704464	4126113	Pinyon-juniper
	YUHO-YWPJ-04	12	704245	4126169	Pinyon-juniper
	YUHO-YWW-01	12	704938	4125332	Riparian/Upland
	YUHO-YWW-02	12	704728	4125339	Riparian/Upland
	YUHO-YWW-03	12	704518	4125352	Riparian/Upland
	YUHO-YWW-04	12	704311	4125332	Riparian/Upland

Appendix B. Definition and criteria of breeding and residency status.

Observed (OB)	
Code	Description
O	Non-breeder or migrant observed during breeding season, but no indication of breeding was detected
Possible (PO)	
Code	Description
#	Species observed or identified by vocalization in suitable nesting habitat during its breeding season. Also used for species that do not have true songs (e.g., owls, woodpeckers, corvids, raptors).
X	Singing male present in suitable nesting habitat during its breeding season.
Probable (PR)	
Code	Description
P	Pair observed in suitable habitat during its breeding season.
C	Courtship behavior or copulation between a male and female. This includes courtship displays or food exchange.
N	Visiting probable nest site, but no further evidence obtained. This applies to a bird that consistently flies into the same likely nest site but provides insufficient behavior for upgrading to confirm. This is especially useful for cavity-nesters.
Confirmed (CO)	
Code	Description
CN	Bird seen carrying nesting material.
NB	Nest building seen at the actual nest site.
FL	Recently fledged young of altricial species incapable of sustained flight or downy young of precocial species restricted to the natal area by dependence on adults or by limited mobility.
ON	Occupied nest indicated by adult entering or leaving nest site in circumstances indicating an occupied nest, including those in high trees, cliffs, cavities, and burrows where the contents of the nest and incubating or brooding adult cannot be seen.
CF	Adults seen carrying food, excluding raptors, corvids, roadrunners, shrikes, and kingfishers.
FY	Adults feeding recently fledged young. Young cowbirds begging food confirm both the cowbird and the host.
FS	Adult carrying fecal sac. Many passerines keep their nests clean by carrying fecal sacs away from the nest.
NE	Nest with eggs found. Cowbird eggs confirm both the cowbird and the host.
NY	Nest with young seen or heard. A cowbird chick in the nest confirms both the cowbird and the host.

Taken from Corman and Wise-Gervais (2005), for birds detected during point count surveys, area searches, and incidental observations on six Southern Colorado Plateau Network parks, 2001–2003.

Appendix C. List of common and scientific names for bird species detected during the 2001–2003 avian inventories at AZRU, ELMA, ELMO, PETR, SAPU, and YUHO, and where they were found.

Common name	Scientific name	AZRU	ELMA	ELMO	PETR	SAPU	YUHO
Acorn woodpecker	<i>Melanerpes formicivorus</i>		X	X			
American coot	<i>Fulica americana</i>					X	
American crow	<i>Corvus brachyrhynchos</i>	X		X	X	X	X
American kestrel	<i>Falco sparverius</i>	X	X	X	X	X	X
American robin	<i>Turdus migratorius</i>	X	X	X	X	X	X
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>	X	X	X		X	X
Bald eagle	<i>Haliaeetus leucocephalus</i>						X
Band-tailed pigeon	<i>Columba fasciata</i>					X	
Barn swallow	<i>Hirundo rustica</i>	X	X		X	X	X
Bewick's wren	<i>Thryomanes bewickii</i>	X	X	X		X	X
Black phoebe	<i>Sayornis nigricans</i>					X	
Black-billed magpie	<i>Pica hudsonia</i>	X					x
Black-capped chickadee	<i>Poecile atricapillus</i>	X					X
Black-chinned hummingbird	<i>Archilochus alexandri</i>	X	X	X	X	X	X
Black-crowned night heron	<i>Nycticorax nycticorax</i>	X					
Black-headed grosbeak	<i>Pheucticus melanocephalus</i>	X	X	X	X	X	X
Black-throated gray warbler	<i>Dendroica nigrescens</i>		X			X	X
Black-throated sparrow	<i>Amphispiza bilineata</i>	X	X	X	X	X	X
Blue grosbeak	<i>Passerina caerulea</i>	X				X	X
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>		X			X	X
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	X				X	X
Brewer's sparrow	<i>Spizella breweri</i>	X					X
Broad-tailed hummingbird	<i>Selasphorus platycercus</i>		X	X		X	
Brown creeper	<i>Certhia americana</i>		X				
Brown-headed cowbird	<i>Molothrus ater</i>	X	X	X	X	X	X
Bullock's oriole	<i>Icterus bullockii</i>	X	X	X	X	X	X
Bushtit	<i>Psaltriparus minimus</i>		X	X		X	X
Canada goose	<i>Branta canadensis</i>	X					
Canyon towhee	<i>Pipilo fuscus</i>		X			X	
Canyon wren	<i>Catherpes mexicanus</i>			X	X		
Cassin's kingbird	<i>Tyrannus vociferans</i>	X	X	X	X	X	X
Chipping sparrow	<i>Spizella passerina</i>	X	X	X	X	X	X
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	X	X	X	X	X	X
Common nighthawk	<i>Chordeiles minor</i>	X	X	X	X	X	X
Common poorwill	<i>Phalaenoptilus nuttallii</i>				X	X	
Common raven	<i>Corvus corax</i>	X	X	X	X	X	X
Common yellowthroat	<i>Geothlypis trichas</i>	X					X
Cooper's hawk	<i>Accipiter cooperii</i>				X	X	
Cordilleran flycatcher	<i>Empidonax occidentalis</i>		X	X			
Crissal thrasher	<i>Toxostoma crissale</i>				X		
Curve-billed thrasher	<i>Toxostoma curvirostre</i>		X				

Appendix C. List of common and scientific names for bird species detected during the 2001–2003 avian inventories at AZRU, ELMA, ELMO, PETR, SAPU, and YUHO, and where they were found, cont.

Common name	Scientific name	AZRU	ELMA	ELMO	PETR	SAPU	YUHO
Dark-eyed junco	<i>Junco hyemalis</i>		X				X
Dusky flycatcher	<i>Empidonax oberholseri</i>		X	X			X
Eastern meadowlark	<i>Sturnella magna</i>	X	X		X		
European starling	<i>Sturnus vulgaris</i>	X			X		X
Evening grosbeak	<i>Coccothraustes vespertinus</i>	X					
Gambel's quail	<i>Callipepla gambelii</i>	X	X	X	X	X	
Grace's warbler	<i>Dendroica graciae</i>		X	X			
Grasshopper sparrow	<i>Ammodramus savannarum</i>						X
Gray catbird	<i>Dumetella carolinensis</i>					X	
Gray flycatcher	<i>Empidonax wrightii</i>		X			X	X
Gray vireo	<i>Vireo vicinior</i>		X	X			X
Great blue heron	<i>Ardea herodias</i>						X
Great horned owl	<i>Bubo virginianus</i>	X		X		X	
Greater roadrunner	<i>Geococcyx californianus</i>	X	X	X	X		
Green-tailed towhee	<i>Pipilo chlorurus</i>		X	X	X		
Hairy woodpecker	<i>Picooides villosus</i>		X				
Hepatic tanager	<i>Piranga flava</i>		X	X			
Horned lark	<i>Eremophila alpestris</i>		X	X	X		
House finch	<i>Carpodacus mexicanus</i>	X	X	X	X	X	X
House sparrow	<i>Passer domesticus</i>	X			X		X
House wren	<i>Troglodytes aedon</i>		X			X	X
Juniper titmouse	<i>Baeolophus ridgwayi</i>	X	X	X		X	X
Killdeer	<i>Charadrius vociferus</i>	X					X
Ladder-backed woodpecker	<i>Picooides scalaris</i>	X	X	X	X	X	
Lark sparrow	<i>Chondestes grammacus</i>	X	X	X	X	X	X
Lazuli bunting	<i>Passerina amoena</i>	X				X	X
Lesser goldfinch	<i>Carduelis psaltria</i>	X	X	X	X	X	X
Lewis's woodpecker	<i>Melanerpes lewis</i>			X			
Lincoln sparrow	<i>Melospiza lincolni</i>		X		X	X	X
Loggerhead shrike	<i>Lanius ludovicianus</i>			X			X
Long-eared owl	<i>Asio otus</i>				X		
Macgillivray's warbler	<i>Oporornis tolmiei</i>			X		X	X
Mallard	<i>Anas platyrhynchos</i>	X				X	X
Mountain bluebird	<i>Sialia currucoides</i>		X	X		X	X
Mountain chickadee	<i>Poecile gambeli</i>	X	X	X		X	
Mourning dove	<i>Zenaida macroura</i>	X	X	X	X	X	X
Northern flicker	<i>Colaptes auratus</i>	X	X	X		X	X
Northern harrier	<i>Circus cyaneus</i>						X
Northern mockingbird	<i>Mimus polyglottos</i>	X	X	X	X	X	X
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	X			X	X	X
Olive-sided flycatcher	<i>Contopus borealis</i>						X
Peregrine falcon	<i>Falco peregrinus</i>			X			X

Appendix C. List of common and scientific names for bird species detected during the 2001–2003 avian inventories at AZRU, ELMA, ELMO, PETR, SAPU, and YUHO, and where they were found, cont.

Common name	Scientific name	AZRU	ELMA	ELMO	PETR	SAPU	YUHO
Phainopepla	<i>Phainopepla nitens</i>					X	
Pinyon jay	<i>Gymnorhinus cyanocephalus</i>	X	X	X		X	X
Plumbeous vireo	<i>Vireo plumbeus</i>		X	X		X	X
Prairie falcon	<i>Falco mexicanus</i>	X					
Pygmy nuthatch	<i>Sitta pygmaea</i>		X	X			
Red crossbill	<i>Loxia curvirostra</i>		X				
Red-breasted nuthatch	<i>Sitta canadensis</i>		X				
Red-naped sapsucker	<i>Sphyrapicus nuchalis</i>					X	
Red-necked phalarope	<i>Phalaropus lobatus</i>	X					X
Red-tailed hawk	<i>Buteo jamaicensis</i>	X	X		X	X	X
Red-winged blackbird	<i>Agelaius phoeniceus</i>	X		X		X	X
Ring-necked pheasant	<i>Phasianus colchicus</i>	X					X
Rock dove	<i>Columba livia</i>				X		
Rock wren	<i>Salpinctes obsoletus</i>		X	X	X	X	X
Rufous hummingbird	<i>Selasphorus rufus</i>						X
Rufous-crowned sparrow	<i>Aimophila ruficeps</i>		X		X		
Say's phoebe	<i>Sayornis saya</i>	X	X	X	X	X	X
Scaled quail	<i>Callipepla squamata</i>				X	X	X
Scarlet tanager	<i>Piranga olivacea</i>					X	
Scott's oriole	<i>Icterus parisorum</i>		X			X	
Song sparrow	<i>Melospiza melodia</i>						X
Spotted sandpiper	<i>Actitis macularius</i>	X					
Spotted towhee	<i>Pipilo maculatus</i>	X	X	X		X	X
Steller's jay	<i>Cyanocitta stelleri</i>		X				
Swainson's hawk	<i>Buteo swainsoni</i>				X		
Townsend's solitaire	<i>Myadestes townsendi</i>		X				
Tree swallow	<i>Tachycineta bicolor</i>			X			
Turkey vulture	<i>Cathartes aura</i>	X	X			X	X
Vesper sparrow	<i>Poocetes gramineus</i>		X	X			X
Violet-green swallow	<i>Tachycineta thalassina</i>	X	X	X	X	X	X
Virginia's warbler	<i>Vermivora virginiae</i>	X	X			X	
Warbling vireo	<i>Vireo gilvus</i>		X	X		X	X
Western bluebird	<i>Sialia mexicana</i>	X	X	X		X	X
Western kingbird	<i>Tyrannus verticalis</i>	X	X	X	X		X
Western meadowlark	<i>Sturnella neglecta</i>	X	X	X	X	X	X
Western scrub jay	<i>Aphelocoma californica</i>	X	X	X		X	X
Western tanager	<i>Piranga ludoviciana</i>	X	X	X		X	X
Western wood-pewee	<i>Contopus sordidulus</i>	X	X	X		X	X
White-breasted nuthatch	<i>Sitta carolinensis</i>	X	X	X		X	
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	X				X	X
White-throated swift	<i>Aeronautes saxatalis</i>		X	X			X
Willow flycatcher	<i>Empidonax traillii</i>						X

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Common name	Scientific name	AZRU	ELMA	ELMO	PETR	SAPU	YUHO
Wilson's warbler	<i>Wilsonia pusilla</i>	X		X		X	
Yellow warbler	<i>Dendroica petechia</i>	X				X	X
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	X					
Yellow-breasted chat	<i>Icteria virens</i>					X	X
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>						X
Yellow-rumped warbler	<i>Dendroica coronata</i>	X	X			X	

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
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